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**DYNAMICS OF INTERPERSONAL COMPETITION AND COOPERATION:  
THE EXPERIENCE WITH COMPETITION AND  
SUBSEQUENT COOPERATION**

by

**BYUNGJUNE CHUN**

**A DISSERTATION**

**Presented to the Department of Management  
and the Graduate School of the University of Oregon  
in partial fulfillment of the requirements  
for the degree of  
Doctor of Philosophy**

**December 1998**

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"Dynamics of Interpersonal Competition and Cooperation: The Experience with Competition and Subsequent Cooperation," a dissertation prepared by Byungjune Chun in partial fulfillment of the requirements for the Doctor of Philosophy degree in the Department of Management. This dissertation has been approved and accepted by:




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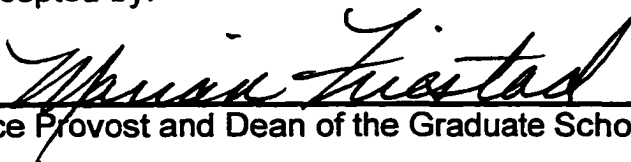



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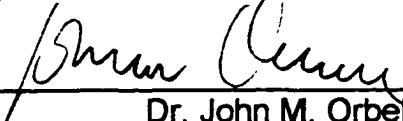
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An Abstract of the Dissertation of  
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in the Department of Management to be taken December 1998  
Title: DYNAMICS OF INTERPERSONAL COMPETITION AND COOPERATION:  
THE EXPERIENCE WITH COMPETITION AND SUBSEQUENT  
COOPERATION

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This dissertation examines the effects of prior strict competition on subsequent cooperation in mixed-motive situations and investigates whether discussion moderates the relationship between prior competition and subsequent cooperation. The experience of prior competition in a zero-sum game is hypothesized to decrease subsequent cooperation in Prisoner's Dilemma games. A laboratory experiment with a 2 (Competition versus No-Competition) \* 2 (Discussion versus No-Discussion) between-subjects factorial design using games was conducted with 254 college students. In the Competition condition, another 2 (Winner versus loser) \* 2 (Discussion versus No-Discussion) factorial design was used to examine the effect of winning versus losing in prior

competition on subsequent cooperation. Multivariate analysis of variance (MANOVA) and covariance (MANCOVA), and other statistical analyses were performed with dependent variables including subjects' choices and expectations of cooperation.

The results indicate that prior competition decreases subsequent cooperation. Particularly, losers decreased subsequent cooperation with winners if there was no discussion. The results confirm that discussion promotes subsequent cooperation and identify that discussion does not moderate the effect of prior competition but moderates the effect of winning and losing on subsequent cooperation.

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**DEDICATION**

**To my mother Sook Hee Chung and my father Pal Sib Chun  
who always love me**

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## CHAPTER I

### INTRODUCTION

#### Organizational Context of Competition and Cooperation

Organizations embody inherently conflicting elements, notably conflict between the pursuit of individual and organizational goals (Kramer, 1991, Murnighan, 1994). Referencing Scottish sociologist Tom Burns, Morgan (1986) noted that

...most modern organizations promote various kinds of politicking because they are designed as systems of simultaneous competition and collaboration. People must collaborate in pursuit of a common task, yet are often pitted against each other in competition for limited resources, status, and career advancement. These conflicting dimensions of organization are most clearly symbolized in the hierarchical chart, which is both a system of cooperation, in that it reflects a rational subdivision of tasks, and a career ladder up which people are motivated to climb. The fact that there are more jobs at the bottom than at the top means that competition for the top places is likely to be keen, and that in any career race there are likely to be far fewer winners than losers. (p.155)

Morgan (1986) contrasted two typical views of organizations: unitary and pluralist. The unitary view of organizations has emphasized “the achievement of common goals and well-integrated team work” and the pluralist view of organizations has emphasized “the diversity of individual and group interests” and “its potentially positive or functional aspects “ (p.189). Organizations bear both of these elements in their structures, practices, and culture.

An organization is a consciously coordinated social entity to achieve a common goal or set of goals (Robbins, 1987). Formal management systems that are pursuing collective goals demand strong coordination and cooperation from their members to control and harmonize interrelated behavior of members (Lawrence & Lorsch, 1969, Thompson, 1967). Management research has long recognized that cooperation is crucial to the success of organizations. Barnard (1938) defined an organization as a cooperative system that accomplishes collective goals and emphasized the critical function of cooperation for organizational effectiveness. Recently, the importance of cooperation is even more widely acknowledged. Current organizational trends such as reengineering of organizational and work structure toward team-based forms, adoption of Total Quality Management (TQM), the increase in interorganizational networking, and employee involvement are based on strong cooperation across functions, disciplinary and organizational boundary.

Organizations are also fields of competing demands from diverse people (March & Simon, 1958, Pfeffer & Salancik, 1978, Morgan, 1986). People compete with one another in the pursuit of their individual interests and goals within the organizations. They compete for pay raises, promotions, perks, opportunities, power, budget allocations and operating funds. Competition is ubiquitous in organizations, and it is induced by organizational structures and practices (March & Simon, 1958, Kramer, 1991, Murnighan, 1994, Ward, 1995). Dependence on common scarce resources such as facilities or funds (Pfeffer

and Salancik, 1978), career interdependence between one's mobility and that of another co-worker (Barnett & Miner, 1992), and performance based rewards such as tournament pay (Becker & Huselid, 1992) or rank-ordered pay system (Milkovich & Newman, 1990) generate competition among organizational members. Competition has provided important positive functions for organizational effectiveness by motivating employees to improve their performance.

Many organizations are designed to make their members compete and cooperate with one another. In the multiple webs of cooperative and competitive situations, people are involved in seemingly conflicting dual relations with others in their organizational life. They work with and against other people simultaneously. They compete for their individual interests and cooperate for collective goals.

### Research Question

The present study focuses on the behavior of those members who are the "prisoners" of organizations where they have to cooperate on the one hand and compete on the other hand with co-workers. Specifically, the study focuses on the case of individuals who face a mixed-motive interdependent situation after experiencing a strict competition against each other. A mixed –motive interdependent situation is the situation in which the interests of interacting parties are partially coincident and partially in conflict (Schelling, 1960). Many

social dilemma situations such as the Prisoner's Dilemma game or Chicken game provide mixed-motive situations that are "neither purely competitive nor purely cooperative" (Komorita & Parks, 1994, p.7). In these games, players have both incentives to cooperate and not to cooperate.

A strict competition is the situation in which the goals of the two parties are perfectly and negatively linked that their goal attainment is mutually incompatible (Deutsch, 1949). According to Schelling (1960), one's gain is diametrically related to the other's loss in "pure conflict." The zero-sum game is a typical example of a purely competitive situation where "one gains what the other must lose" (Komorita & Parks, 1994, p.7). Many face-to-face competition games such as boxing or chess have the characteristics of strict competition in the sense that they produce a necessarily opposite outcomes to two parties: winner and loser.

The relationship between competition and cooperation has been studied by some researchers but none of the studies directly addressed the relationship between strict interpersonal competition and subsequent cooperation. In particular, the reactions of winners and losers in strict competition toward subsequent cooperation in a mixed-motive situation have not been studied.

Sherif (1966) conducted a field experiment with groups of boy scouts to investigate the dynamics of competition and cooperation at the group level. He found that intergroup competition had a negative impact on the perception of the opposing group members. Competition produced hostility and biased stereotyping toward opponent group. The study provided a significant implication

for overcoming the negative impact of group competition: superior goals make people cooperate with the opponent groups. The study did not identify the influence of competition on cooperation at the individual level.

Deutsch and Krauss (1960, 1962) studied interpersonal conflict and cooperation at an individual level by conducting a “trucking game” experiment that provided a mixed-motive situation. Subjects in the game had two options for their move- to cooperate or not to cooperate- and the outcome of each move was interdependent with the other’s move. The study showed how cooperation was reached from a repeatedly conflicting interdependent situation. Studies using the “trucking game”, however, failed to distinguish a strictly competitive situation from a mixed-motive situation in their game framework. The framework provided conflicting situations between cooperation and non-cooperation to maximize individual payoffs but it did not explore the relationship between experiences in a strict competitive situation and their impact on cooperation in a different interdependent situation.

Many other studies using the iterated Prisoners’ Dilemma game also claimed to study the dynamics of competition and cooperation. The studies found that non-cooperation in the previous round negatively influences cooperation in subsequent rounds. The decisions in the PDGs are a choice between to cooperate and not to cooperate and they are not a choice between to compete and to cooperate. The experience of no cooperation from either or both parties is not a competitive experience and the studies failed to investigate the influence of

strict competitive experiences on cooperation. By having subjects play in a single interdependent situation that consists of a series of the same game, the iterated PD games showed the process to elicit cooperation in a repeated mixed-motive situation. The limitations of the PDG and the iterated PDG in studying interpersonal competition and cooperation will be discussed in detail in Chapter II.

The present study focuses on the influence of interpersonal experiences in strict competition on subsequent cooperation in mixed-motive situations. This is the case commonly observed in organizational life. For example, when two sales persons compete for the position of division head and one is promoted to the head and the other is not, will they cooperate with each other to expand sales by sharing customer information? Will candidates cooperate after head to head competition for a top position? This study will explore the relationship between prior competition and subsequent cooperation. The role of discussion after competition will be also investigated with respect to subsequent cooperation. People often reconcile their conflicts through discussion. Discussion, especially face-to-face communication, has been proven to be one of the strongest facilitators of cooperation (Ostrom, 1998, Colman, 1995). By introducing discussion after competition, the study attempts to extend the validity of the influence of prior competitive experience in different contexts and to identify possible interaction effects between discussion and prior competition. Finally, the

study will specify any differences between winners and losers in their reactions toward subsequent cooperation.

The primary research question that drives this study is: After experiencing a strictly competitive situation, how do people make decisions regarding cooperation with the same people in a mixed-motive situation? Specifically, the study seeks to answer these three questions:

(1) Does the competitive experience of a prior zero-sum game with a given individual influence cooperation with that same person in a subsequent mixed-motive game?

(2) If there is a relationship between prior competition and subsequent cooperation, does the relationship hold in other contexts? Specifically, does the opportunity for discussion after the experience of zero-sum competition but prior to the mixed-motive situation moderate the effect of prior competition?

(3) Is there any difference between the winner and the loser in prior zero-sum competition in responding to a subsequent mixed-motive situation?

#### Approach to the Research Question

The study approaches the research questions by conducting a laboratory experiment using games. Ostrom (1998) argued that laboratory experiments can adequately capture the effect of posited variables by controlling conditions and they are easily replicable in other contexts. Particularly, experimental games are a useful tool for studying interdependent social situations such as competition

and cooperation. Colman (1982) emphasized the advantages of using games by stating that

One appealing feature from the researcher's point of view is the ease and flexibility with which subjects can be placed in precisely specified states of interdependence, corresponding at a formal level to any imaginable social situation. Second, experimental games provide a means of investigating fierce competition without the ethical problems usually associated with the study of potentially antisocial forms of behavior. Third, the experiments are relatively economical and easy to perform, and they generate objective and quantitative data. Last and perhaps most important, there are many interesting phenomena associated with social interaction, including cooperation and competition, that are difficult or impossible to understand without the conceptual framework of game theory, and experimental games provide a natural and convenient method of investigating them. (p. 114)

Experimental games have also the potential to identify any gap between rational behavior prescribed by formal game theory and actual behavior. Because formal game theory is based on strong mathematical reasoning in specifically bounded domains, experimental game research makes precise testing possible (Murnighan, 1994). The use of experimental games is applicable to studying organizational phenomena. Camerer (1991) argued that most strategic decisions in business fit well within the scope of the game framework. Since organizational behavior is interwoven by many situations, experimental games are suitable for studying interpersonal dynamics in organizational life.

The focus of this study is not on the formal modeling of games but on the identification of social psychological phenomena with the aid of experimental games. The study uses a combination of two distinctively different games: The



zero-sum game and the Prisoner's dilemma game. They are structurally different in terms of payoffs and interdependence. The payoff structure of the zero-sum game is always symmetrically opposite between two players; one's gain leads to the other's loss and their sum is always zero. The PDG has the payoff structure that both players can gain with the risk of defection. The zero-sum game (ZSG) represents strictly interdependent competitive situation, and the Prisoner's Dilemma game (PDG) models a mixed-motive situation.

The use of two different games overcomes the shortcomings of the previous research that has not separated a strict competition from a mixed-motive situation. By combining zero-sum game prior to PDG, the study generates experiences of strict competition and their influence on subsequent interaction in the PDG. The use of zero-sum game excludes the experiences of defection and obscures competitiveness in the PDG that provides open and fair competitive experiences with obvious outcomes- a winner and a loser.

### The Contribution of This Study

The purpose of this study is to extend our knowledge and improve our understanding of the relationship between interpersonal competition and cooperation, specifically the effects of prior experiences of zero-sum competition on subsequent cooperation in a mixed-motive situation. The present study attempts to make theoretical, methodological and practical contributions to organizational behavior research on cooperation. Theoretically, the study

develops a conceptual model that explores the relationship between competitive experiences in zero-sum situations and subsequent cooperation. The model delineates the elements of competitive experiences and attempts to link them with the social psychological antecedents of cooperation. The model provides a social psychological rationale for the relationship between two different games, whereas formal game theory provides no logical basis for the linkage.

Methodologically, the study adopts a new research framework to study dynamics of competition and cooperation. Previous studies have used an iteration of one single game but this study uses sequence of two distinctively different games. The sequence of a strictly competitive game and a mixed-motive game clarifies the effect of competition on the subsequent interaction in a different situation. Unlike the PDG, the zero-sum game makes both parties involved in competition by clarifying that the payoff structure is symmetrically opposite. Players in the game recognize that they are competing with no way to opt out the competition during the game. This framework also distinguishes a winner and a loser in the competition, and enables researchers to investigate the differences between winners and losers in cooperation.

#### Practical Contribution to Managers

This study holds important implications for organizational design and practice. If the findings indicate a certain type of relationship between competition and subsequent cooperation, either positive or negative, careful consideration

should be given to designing organizational structures that involve competition and cooperation. For example, a work team may not obtain intended cooperation with the influence of previous competition among team members. In the composition and compensation of workers in various types of work teams, the potential competitive elements need to be considered for the maximization of cooperation. Identification of moderators after competition will improve our understanding of how to govern the effects of prior competition on subsequent cooperation. Examining any differences between winners and losers in their responses to subsequent cooperation will give us a better understanding of the aftermath of competition, and the subsequent interaction between losers and winners.

## CHAPTER II

### THEORETICAL FRAMEWORK AND HYPOTHESES

#### Previous Research in Games

##### Formal Game theory

Formal game theory has focused on theoretical modeling of social interaction in various games and the identification of rational choices in the modeling. Colman (1982) noted that

A game is a purely imaginary idealization of a social interaction. A real social interaction is too complex and transitory to be clearly perceived and perfectly understood, so it is replaced by a deliberately simplified abstract structure whose basic elements-players, strategies, and payoffs- are explicitly defined and from which other properties can be deduced by formal reasoning. (p. 113)

The primary goal of formal game theory research is to abstract and simplify a complex interdependent situation into a concise model in order to analyze rational social interaction that maximize self interests within the model. Formal game theory is analytic and normative. It seeks rational choices for players through mathematical reasoning of simplified world.

From the formal game theorists' viewpoint, the presented research question in Chapter I is, therefore, a matter of modeling and abstraction with

restrictive priori assumptions about players' behavior. To our knowledge, a formal game that models a sequence of strict competition and mixed-motive situation has not been conducted. A strictly competitive social interaction has been modeled generally in the framework of zero-sum games in which the players' interests are opposite and the prospects of mutually beneficial outcomes are not possible in the payoff structure. Mixed-motive social interactions have been modeled in various non zero-sum forms. The combination of the two different games, a zero-sum game and a PDG, sequentially, has yet to be modeled. Consequently, formal game theory does not provide any theoretical background of the linkage between zero-sum competition and behavior in a subsequent mixed-motive game.

### Experimental Games

Dynamics of cooperation have been studied within the framework of the Prisoner's Dilemma Game (PDG) and iterated PDG. Bettenhausen and Murnighan (1991) noted that

The Prisoner's Dilemma has been extensively investigated in sociology, economics, and social psychology. Prisoner's Dilemma models the structural properties inherent in many organizational conflict situations and has been used to investigate cooperation, competition, and the bargaining process. (p.22)

The PDG is a mixed motive game where players' preferences are neither opposite nor identical in the payoff structure as shown in Figure 1.

	Cooperative Choice	Defecting Choice
Cooperative Choice	1, 1,	2, -1
Defecting Choice	-1, 2	0, 0

T (The free rider's payoffs) =2

R (The reward for mutual cooperation) =1

P (The punishment for mutual defection) =0

S (The sucker's payoff) =-1

FIGURE1. Basic Structure of the Prisoner's Dilemma Game

The PDG was named by Tucker (Rasmusen, 1989) and the name derived from a social dilemma of two prisoners confronted with a choice between confessing and denying a crime in which they are accused of being jointly involved. The prisoners are prevented from communicating with each other in separate cells. They know that if both confess the crime, then both will receive an intermediate sentence and if both deny the crime, then both will receive a minor charge. If one prisoner confesses and the other denies the crime, the confessor will be acquitted, and the other will receive a long sentence.

Denying is a cooperative strategy that yields a moderately valued outcome when both cooperate but yields the worst sucker's outcome if the other

confesses. Confessing is a defecting strategy that yields the highly valued free rider's outcome if the other cooperates, and the lower mutual defector payoff if the other defects (Colman, 1982).

Figure 1. presents the structure of a basic PDG. The order of individual outcomes in the PDG is

$$T > R > P > S$$

Where T (the free rider's payoff) is the payoff from defection; R (the reward for cooperating) is the payoff from mutual cooperation; P (the punishment for defecting) is the payoff from mutual defection; and S (the sucker's payoff) is the payoff for being defected. The order of outcomes aggregated across both players is

$$CC > DC > DD$$

where CC is mutual cooperation, DC is unilateral cooperation and DD is mutual defection. The PDG has a negative Nash Equilibrium at mutual defection (DD), where aggregate payoff is lowest, but neither individual has an incentive to cooperate despite the fact that mutual cooperation (CC) maximizes joint gain. Defection is the dominant individual choice in PD games.

However, extensive experimental evidence has shown that the dominant strategies are not good predictors at the individual level and a substantial proportion of people do make cooperative choices (Ostrom, 1998). People adopt various strategies to develop cooperative relations that benefit both in the PDGs. The paradoxical nature of the conflict between the pursuit of individual gain and

joint gain in the PDGs has generated much experimental research on the conflict between cooperation and “competition” (defection).

Much PDG research, however, has used the term “competition” and “defection” (or non-cooperation) interchangeably in their research (Rapoport & Chammah, 1965, Kelley & Stahelski, 1970, Pruitt & Kimmel, 1976, and Bettenhausen & Murnighan, 1991) despite the PDG’s limitation to represent the feature of a purely competitive situation. The so-called ‘competitive’ strategy in the PDGs is, in a strict sense, a strategy to defect to pursue individual gain. The “competition” in the PDGs does not include a formal structure of competition that has negatively interdependent goals or rewards between two parties. The “competitive” choice in the PDGs does not necessarily produce a positive outcome for one person and a negative outcome for the other person at least in the symmetrical game. When both parties make a “competitive” choice, they receive equal payoffs. Pure strict competition has a negative interdependence that one’s attainment of goals or resources excludes the other’s attainment (Deutsch, 1949, Schelling, 1960, Johnson & Johnson, 1989, Komorita & Parks, 1994).

The PDG does not delineate an explicitly fair and open competition in its payoff structure. The incentive for cooperation, based on collective rationality, and the incentive for defection, based on individual rationality, make the players in the PDG experience the conflict between maximizing individual gain and joint gain (Komorita and Parks, 1994). Players in the PDG focus on maximizing gains



between two options; to cooperate or not to cooperate. To the contrary, players in a strictly competitive game focus on defeating the other party to attain target resources. Through the payoff structure and rules, players in a strict competition understand that they are in a contest of skills, knowledge and strategies. During the game, they have a clear perception that they are competing with the other person so they concentrate their efforts on winning the game. The PDG does not provide this explicit competitive atmosphere. Players in the PDG are not certain whether they are competing or cooperating.

The PD frame has another shortcoming to studying the dynamics of strict competition and cooperation. It does not contain one of the essential factors of competition in its structure; winning and losing. Winning and losing is one of the obvious experiences in competition (Johnson & Johnson, 1989), and winners and losers are determined not by the defection of one player and cooperation of the other player but by fair contests of skills and strategies to outperform the other contestants. When both players in the PDG decide to defect, there is no winner and loser in the game. The PDG does not have clear criteria and fair procedures for selecting winners.

The PDG has failed to represent a purely competitive situation: The “competitive choice” in the game does not yield mutually exclusive outcomes; competition is not explicit and clear to the players; the game does not produce winning and losing. Therefore, a new game framework that provides a purely

competitive situation is necessary to study the dynamics of interpersonal competition and cooperation.

### The Iterated PDGs

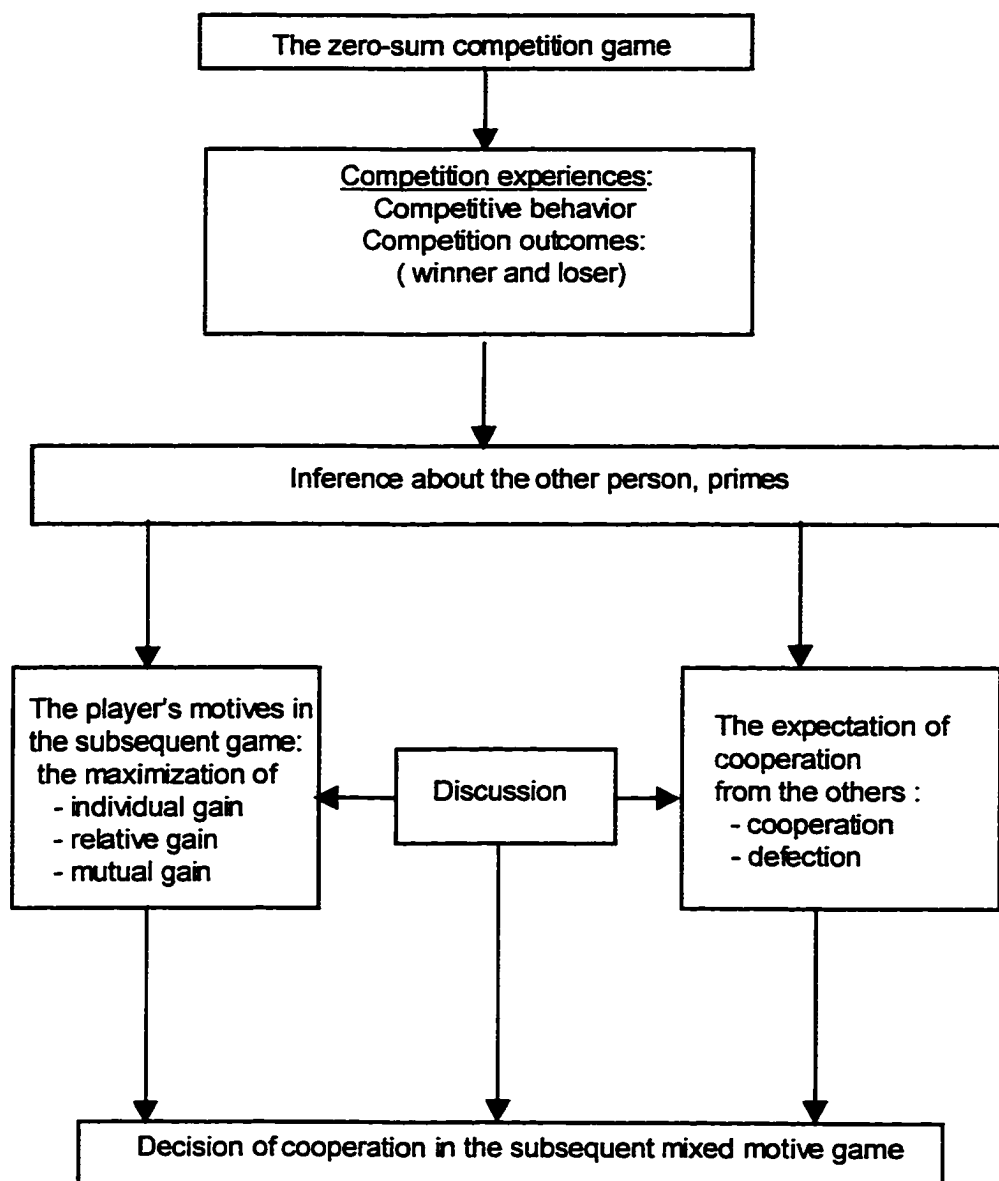
Another branch of experimental game research addressing the dynamics of “competition” and cooperation is the iterated Prisoner’s Dilemma game. Iterated PDGs are an extension of the classic PDG where two people play the same PDG repeatedly. The framework of the iterated PDG has been popular for addressing the problem in the promotion of cooperation in conflicting situations. Research has yielded interesting results such as “tit-for-tat” (Axelrod, 1984), “win-stay and lose-change” (Thibaut & Kelley, 1959), and “DD lock-in” (Rapoport & Chammah, 1965). These studies found that cooperation evolves through interactions in previous trials. For example, the “tit-for-tat” is a reciprocal strategy that imitates the other’s choice after an initial cooperation. This strategy indicates that reciprocity is an effective facilitator of cooperation in mixed-motive situations (Axelrod, 1984). Thibaut and Kelley (1959) noted that people repeat a choice that has been rewarded in the past and avoid a choice that has been punished.

The iterated PDG has limitations for studying the relationship between strict competition and subsequent cooperation in another situation. The game provides a sequence of the same situations repeatedly and players are not exposed to two different situations. The players may perceive the whole

sequence as one game situation that requires a set of interconnected decisions. Since players often consider both previous and possible future game outcomes to make present decisions on cooperation, it is difficult to argue that subsequent cooperation is influenced by prior “competition.” The iterated PDG does not have a clear beginning or ending of “competition.” The players also may not experience any kind of conflicts if both players always cooperate. Besides these shortcomings, the limitations of the PDG to generate a purely competitive situation, as I noted earlier, restrict the use of the iterated PDG in studying the influence of strict competition on subsequent cooperation. The current study attempts to overcome these limitations by proposing a new framework for addressing the research question.

### Conceptual Model

The relationship between prior experience of a strictly competitive situation and subsequent cooperation in a mixed motive situation has not yet been addressed. The proposed conceptual model synthesizes research on social psychology and experimental PDG and attempts to provide a social psychological rationale to link the competitive experience and subsequent cooperation. The model is graphically presented in Figure 2. It consists of three parts: The experiences of competition in a strictly competitive situation, the determinants of cooperation in the PDG, and the influence of competitive experiences on these determinants, particularly motives and expectations.



**FIGURE 2. The Conceptual Model of the Influence of Prior Competition on Subsequent Cooperation in a Mixed-motive Situation**

## The Experience of Competition

People in competition face negative interdependence where one's goals or rewards are negatively correlated with the other's (Johnson and Johnson, 1989). Under this situation, the interacting parties experience three properties of competition; (1) the recognition of the negatively linked goals or rewards, (2) attempts to obtain target goals, (3) the recognition of the relative identity - winning or losing.

In a competitive situation, participants perceive the scarcity of needed resources and recognize the existence of competition by understanding that their attainment of the resources is negatively related to the other's. They identify competitors, the rules and procedures of competition and the criteria for selecting winners. These perceptions trigger competitive efforts and determine the strategic direction of the efforts to outperform the other party.

Participants perceive that behavior in attempts to obtain rewards or goals is competitive because the actions decrease the possibility of the other's success. Particularly in a two-person zero-sum competition, one player's strategic decision to acquire the target resources directly hinders the other's achievement of the same goal. The players experience their efforts toward the goal as obstructing the other's efforts. One's behavior to step forward to the goal simultaneously has the other step backward from the goal (Johnson & Johnson, 1989).

In a strictly competitive situation, the participants are forced to engage in competitive behavior unless they are able simply to relax the competitive situation. Either experiences competitive behavior from the other person, that is, intentionally or unintentionally, aiming at hindering the actor's progress toward the goal.

Finally, the participants experience either winning or losing as the outcome of zero-sum competition. The experience of winning includes outperforming the other party, becoming the winner of competition and taking possession of the loser's resources-or the resources that could have been the loser's. The experience of losing is the experience of being outperformed by the other party, of becoming the loser in the competition and gaining no resources-or losing one's own resources.

### The Determinants of Cooperation in PD Games

Experimental PD research has yielded much knowledge of the determinants of cooperation. Van Lange and colleagues (1992) summarized the factors promoting cooperation. These factors include monetary payoff structure, communication, expectation of others' cooperation, and the role of individual differences, which Murnighan (1994) grouped into "structural" and "social psychological" elements. The payoff structure and rules of the game are the objective structural factors within which the players make the decision with respect to cooperation vs. defection. The social psychological elements include

the expectations and motives of the actors that transform the given payoff structure into a subjective representation. Kelley and Thibaut (1978) noted that individuals do not act directly on the objectively given payoffs but transform the given payoffs into an 'effective matrix' that reflects their attention to selected features of the situations.

Pruitt and Kimmel (1977) proposed "goal and expectation hypotheses" of games. They argue that the player's motive and his or her expectations about the other's choice are the two basic determinants of cooperation in the PDGs. Because the game outcomes depend on the other's choice, the players should have the expectation that the other person will cooperate when they choose a cooperative choice for joint gains. According to the hypotheses, two conditions are necessary for making a cooperative choice: the motive for cooperation and the expectation of cooperation from the other person.

Messick and McClintock (1968) noted that players in game situations have four motives: maximization of (1) joint outcomes, (2) one's own outcomes, (3) relative outcomes, and (4) other's outcomes. They argued that the preference of one of these motives influences the decision of cooperation. People with the motive of the maximization of one's own or relative outcome tend to be noncooperative in PD games (for a review, see Van Lange, 1992, Colman, 1995). As noted in the next section, prior experience of competition is likely to influence both expectations and motives of cooperation in subsequent interdependent situation.

## The Influence of Competitive Experience on Subsequent Cooperation

### The Inference about the Other Person in Competition

Ross and Nisbett (1991) noted that

People (1) infer dispositions from behavior that is manifestly situationally produced, (2) overlook situational context factors of substantial importance, and (3) make overly confident predictions when given a small amount of trait relevant information. (p. 126)

Erber and Fiske (1984) found that subjects pay much attention to the other person and process information about the person carefully in interdependent situations. People abstract and infer intentional and dispositional cues from their interaction parties and utilize them in predicting future behavior of those parties (Jones and Davis, 1965).

Jones and Davis (1965) noted two tendencies that affect the perceiver's attribution to the target's disposition: hedonic relevance and personalism. Hedonic relevance is the impact that the other person's behavior has on the perceiver. The hedonic relevance of the other's action for the perceiver increases as the effects to the perceiver becomes more beneficial or harmful. Personalism is the perception that the other person intended to benefit or harm the perceiver. The perception of personalism increases correspondent inference when the outcome is hedonically relevant and the perceiver believes that the action was intended. When a target's behavior has mere negative effects for the perceiver than it has positive effects, personalism becomes more important in attribution. In



competition, the other's behavior directly affects the possibility of one's success to attain the target resources or goals. Hedonic relevance and personalism of the other's behavior for the perceiver is high in negatively interdependent situations. The actors will have the tendency of perceiving a greater correspondence between the actions and the intentions or disposition of the other person in competition.

In lay psychology, people strongly believe that past behavior is generally the best indicator of what a person is likely to do in the future (Kunda and Nisbett, 1986, Ross, 1989). To this extent, therefore, one may predict an actor who experiences competitive, oppositional behavior from another player will expect similar behavior from that player in a subsequent PD game. Consistent with this, Darley and Oleson (1993) noted that when a person perceives another as having a hostile disposition, the perceiver acts in the future toward that person in ways consistent with that perception and provides hostile responses for the target. Snyder and Swann (1978) also found that subjects who had initially been labeled hostile were treated in a corresponding way in a different setting. In sum, there are grounds for predicting that actors who have experienced a co-player as competitive in an initial game will expect relatively less cooperation from that partner in a subsequent game.

### The Priming with Competition

The experience of competition may be expected to influence an actor's own motives in subsequent games through priming and escalation. Priming is "the effect of prior context on the interpretation and retrieval of information" and specifically the effect that "recently and frequently activated ideas come to mind more easily than ideas that have not been activated" (Fiske & Taylor, 1982, p.231). When people are primed with a concept, they are more likely to interpret a subsequently presented ambiguous situation through the lens of the primed concept (Wyer & Srull, 1986). Hornstein and his colleagues (1975), for example, found that subjects who heard about a generous act behaved more cooperatively toward their partners than those who heard about a brutal act. Similarly, Neuberg (1988) found that competitive primes increased the noncooperativeness of dispositionally competitive subjects' responses to their partner's moves throughout a PD game.

Players in competition are attentive to the maximization of relative gain or individual gain. In a zero-sum competition, where one player's gain leads to the other's loss, the recognition of competition is activated and players are engaged in competitive and strategic behavior toward each other if they are to win. In a subsequent mixed-motive situation with the same interacting parties, the context of which is similar to prior competition but ambiguous in the motives, the players will rely on their prior experience of competition in the choice of cooperation.

Competition escalates the actors' aspiration level in the course of exchanging oppositional behavior with competitors (Johnson and John, 1989). A spiral of competition promotes less reciprocity of goodwill and more antagonistic behavior. Bay-Hinitz and colleagues (1994) showed that competitive games among children increased aggressive behavior and decreased cooperative behavior. Once the players are primed with competitiveness and escalated to maximize relative gain and avoid loss, subsequent cooperation will be less likely.

In summary, the experience of strict competition is expected to influence subsequent cooperation in a mixed-motive situation. The experience will provide people with the bases to infer the other's future behavior and prime their motives in the subsequent situation.

#### The Role of Discussion on Subsequent Cooperation

In many designs, the participants in the Prisoner's Dilemma games are unable to communicate with each other. Making agreements, bargaining and negotiation have been impossible in the PDG without discussion. In the real world, however, people issue threats and promise, and negotiate in cooperation with others. Much research (Deutsch, 1958, Evans, 1964, Dawes, McTavish, & Shaklee, 1977, Orbell, van de Kragt, & Dawes, 1988, see Ostrom, 1988 for a review) has confirmed the positive effect of communication on cooperation in Social Dilemma games.

Face-to-face discussion substantially increases the level of cooperation. The effect of discussion is consistent and strong in many replicated studies (Ostrom, 1998). Sally (1995) conducted a meta-analysis of more than 100 experiments between 1958 to 1992 and found that face-to-face communication significantly increased the level of cooperation by more than 40 percent on average. If discussion yields such a strong effect on cooperation, will prior competitive experiences still influence subsequent cooperation when players are allowed to communicate face-to-face just after competition but prior to subsequent games? The inclusion of face-to-face discussion in the present study will extend the validity of the influence of prior competitive experiences to more cooperative mixed-motive situation.

### The Winner and the Loser in Competition

Competition divides the participants into two parties, winners and losers. Based on their performance in the competition, the participants recognize their relative identities. Winners and losers are different in the possession of resources and status. Winners take more resources than losers. As a result the losers are likely to feel relative deprivation, a resentfulness about not having desired objects Crosby (1976) proposed five necessary and sufficient conditions for feeling of egoistic relative deprivation. The conditions include that individuals must (1) see that someone else possesses the desired objects, (2) want the objects, (3) feel entitled to them, (4) think it feasible to obtain the objects, and (5) lack a sense of

personal responsibility for not having the objects. The losers in zero-sum competition seem to fit these conditions.

The reciprocity norm prescribes that we should help those who have helped us in the past and retaliate against those who have done harm to us (Gouldner, 1960). Komorita and colleagues (1992) found that people do reciprocate others' behavior in PD situations. When the loser in a competitive game faces a cooperative game with the winner who has taken the resources away from her, she may be expected to be unlikely to cooperate with the winner. For the loser, a cooperative choice in the PD games does not provide the chance of reciprocating, outperforming the other person or correcting perceived inequity between the two.

Winners may show a diversified response to cooperation with the losers. Specifically, some winners might not cooperate because of concern about preserving their gained resources and preventing losers from retaliation. Other winners might feel they are over-rewarded and uncomfortable about taking the other's resources. They might even have guilty feelings toward the losers. By cooperating, they will attempt to compensate the losers and relieve their uncomfortableness.

Winners and losers will be also different in their attribution of the outcomes of competition. Winners experience the success of their efforts while losers experience the failure. Weiner and colleagues (1972) showed that people tend to attribute successes to internal causes and failures to external causes. Thus,

winners will be more likely to attribute the success of winning to their competence, ability, and disposition. Losers will be more likely to attribute the failure of losing to bad luck or the other's behavior. In subsequent interaction with the winners, losers will perceive the winners as one of the causes of their previous failure whereas winners will not perceive the losers as the facilitators for previous successes. Because of this perceptual difference caused by an attributional bias, losers will be less likely to cooperate with the winners. Losers will expect less cooperation from the winners who, the losers believe, have prevented them from attaining the resources.

Winners and losers differ in their possession of resources, the attribution of the outcomes of competition, the perception of the other party, their motivation to reciprocate the other party, and their emotional states. These differences between winners and losers are hypothesized to lead to different expectations and motives in subsequent cooperation. Losers will cooperate less than winners in a subsequent mixed-motive situation. Losers will expect less cooperation from the winners and have less cooperative motive than winners.

### Hypotheses

Based on previous research and the preceding theoretical argument, it is expected that prior experience of zero-sum competition will decrease the level of cooperation in subsequently mixed-motive situations.

**Hypothesis 1a: Prior experiences of strict competition will decrease cooperation in subsequent Prisoner's Dilemma situations.**

**Hypothesis 1b: The prior experience of strict competition will lower expectations of cooperation from the co-player in subsequent Prisoner's Dilemma situations.**

As noted earlier, expectations and motives are core components of decisions in interdependent situations. Expecting cooperation from the other person and the players' motives in subsequently interdependent situation will, by hypothesis, both be affected by the previous experience of competition. During zero-sum competition, players interact against each other to achieve incompatible goals and limited resources. It is a head to head collision of interest and action (John and John, 1989). The negative impacts of the other person's behavior during competition will be associated with hedonic relevance and personalism. The players will correspondingly infer the other's disposition from her behavior. Players may perceive their co-players as competitive, opportunistic, strategic, or even hostile. These perceptions are less likely to lead the players toward cooperation.

The similarity of the interdependent contexts between prior competition and subsequent mixed-motive game will enable a priming process to operate. The experience of zero-sum competition will prime attributes that are competitive, mutually exclusive, aggressive, strategic, and self-interested. The primes will take the players' attention away from cooperating, mutually benefiting, and compromising motives. By hypothesis, the players' primary concern is protecting

and maximizing individual resources, and they will not give much attention to maximizing joint resources. Because the cooperative choice in the PD games provides at most equal payoffs and the risk of becoming suckers, the motive for joint gain will be less pronounced.

**Hypothesis 2a: Discussion after competition but prior to the PDG will increase cooperation and the expectation of cooperation from the co-player in subsequent Prisoner's Dilemma situations.**

**Hypotheses 2b: Discussion will increase the accuracy of the expectations of the co-player's intention in subsequent Prisoner's Dilemma situations.**

Communication is known to promote cooperation substantially and consistently in the PD game. The opportunity for a face-to-face discussion prior to the PD game after the competitive experience will increase cooperation. Discussion will enhance the subjects' understanding of the best strategies for maximizing payoffs in the subsequent game and will induce mutual promises and commitment. However, discussion may not moderate the hypothesized negative effect of prior competition. That is, discussion may not erase memories of the previous competition. The primed motives and judgements about the co-player will be operative in spite of the positive effect of discussion on cooperation.

After communicating with each other, the players will be better able to judge the other's move accurately than without any communication. Discussion will provide cues for the players to judge the other person's intention.



**Hypothesis 3a: The losers in prior zero-sum competition will be less likely to cooperate in subsequent Prisoner's Dilemma situations than the winners**

**Hypothesis 3b: The losers in prior zero-sum competition will be less likely to expect cooperation in subsequent Prisoner's Dilemma situations than the winners.**

By hypothesis, winners and losers in prior competition will show different responses to the subsequent PD games. These differences will come from the inequality of resources, different emotional states and attribution of the outcomes of competition. Winners have more resources than losers in strict competition. As a result of competition, losers are in dearth of resources and can be expected to feel deprived of resources by winners. Sequentially, winners will be satisfied with their resources, and possibly feel guilty toward the losers. On the other hand, losers will perceive winners' happiness and winners will detect losers' unhappiness. Winners will be more likely to pursue joint gain and losers relative gain in subsequent PD games. As noted earlier, losers will attribute their failure in competition to external causes but winners will attribute their success to internal causes. In subsequent interdependent situations, winners and losers will not, therefore, start the game as equal partners or opponents. These differences will generate contrasting responses between winners and losers. The experience of prior competition will influence losers more negatively than winners and losers will be less likely to cooperate in the subsequent PD game.

## CHAPTER III

### METHODOLOGY

This chapter discusses the methodology for the empirical test of the hypotheses developed in Chapter II. It begins with an overview of the research design and a description of the general procedure of the experiment. The rationale for the choice of experimental games is then described, followed by an explanation of the measurement of dependent variables.

#### Research Design

The purpose of this investigation is to examine the effect of prior competition on subsequent cooperation and to determine whether that relationship is moderated by discussion. To test the hypotheses as specified in Chapter II, an experiment with a 2 (Competition versus No-Competition)\*2 (Discussion versus No-Discussion) between-subjects factorial design was conducted. This design contrasts the effect of treatment with that of no treatment (Judd, Smith, & Kidder, 1991). The design is also advantageous in identifying the interaction effect between prior competition and discussion - which, by hypothesis, affects cooperation in opposite directions.

The competition factor had two levels- Competition (C) and No-Competition (NC). In the Competition condition, subjects experienced a series of

competitive interactions by playing an iterated two-person zero-sum game with other subjects. In the No-Competition condition, subjects experienced minimal interaction with each other by playing an estimation game. The estimation game was designed to be equivalent to the zero-sum game except for its lack of competitiveness.

The discussion factor had two levels as well Discussion (D) and No-Discussion (ND). In the Discussion condition, subjects had an opportunity to communicate with their co-player before making decisions in the subsequent PD games. In the No-Discussion condition, subjects were not allowed to communicate with each other during the subsequent game.

After playing, subjects in the Competition condition could be classified into winners and losers. I generated another 2 (Winner versus Loser) \* 2 (Discussion versus No-Discussion) factorial design to examine the effects of two distinctively different experiences of competition – winning and losing - and their interaction with discussion on subsequent cooperation. Winners and losers in competition are both inevitably produced by zero-sum games, where one's gain necessarily leads to the other's loss. Winners and losers in this experiment were determined not by the experimenters but by subjects' luck and strategic decision making based on the capability to detect the other's intention. The research design and procedure of the experiment are summarized in Figure 3.

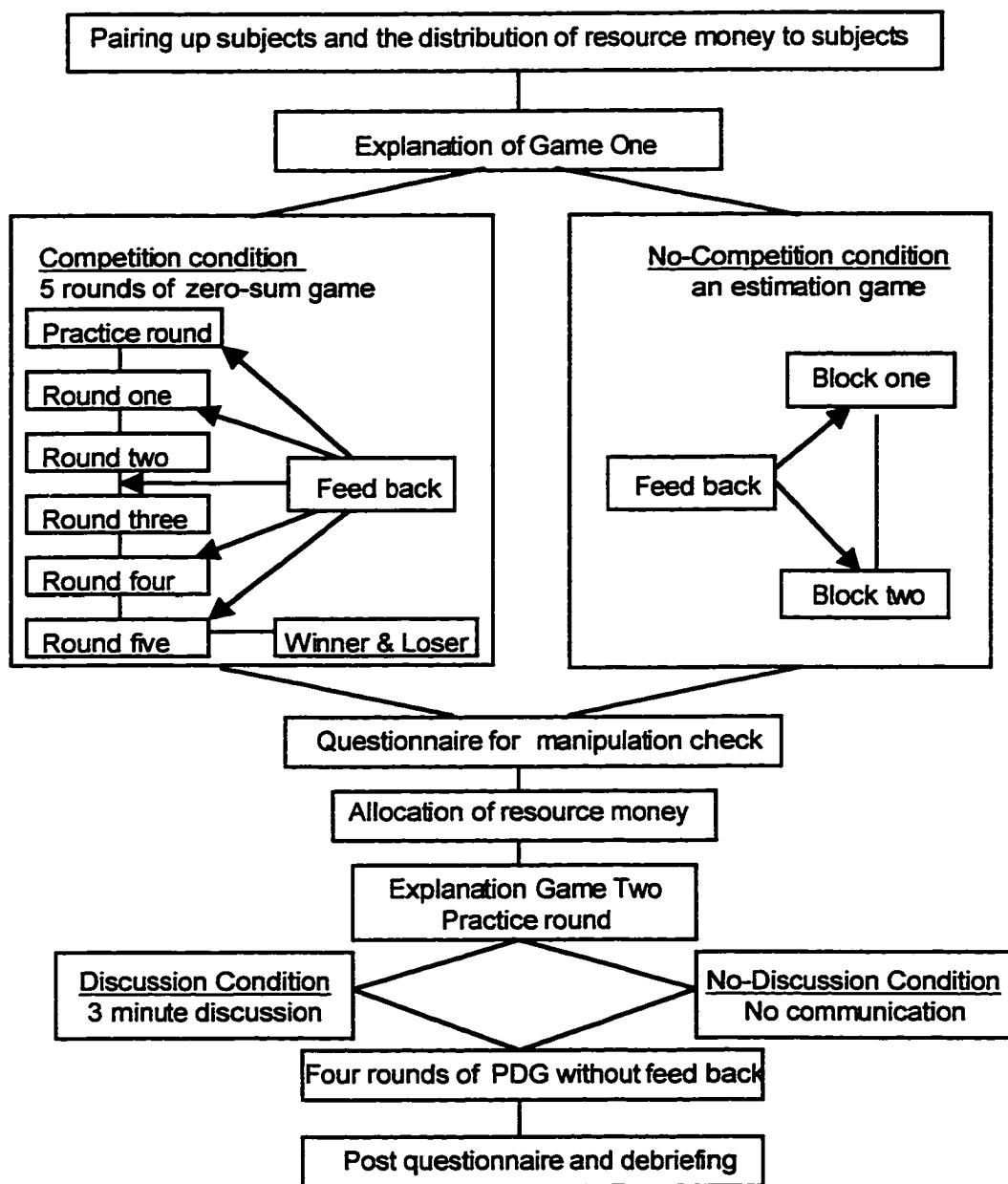


FIGURE 3. The Procedure of the Experiment

### Manipulation of Games

In the entire experiment, subjects played two sets of games, Game One and Game Two. Game One was designed to provide subjects with the experiences of zero-sum competition and to contrast the experiences of zero-sum competition with those of simple interaction in the control condition. Game Two was designed to yield responses of subjects in a mixed-motive interdependent situation. The labeling and separation of Game One and Game Two was intended to provide subjects with two distinctly different interaction situations and to decrease the likelihood of subjects seeing the whole process of the experiment as one game.

#### Game One

Game One consisted of two different games. Subjects in the Competition condition played an iterated two-person zero-sum game, and subjects in the No-Competition condition played an estimation game.

#### The Zero-Sum Game in the Competition Condition

A paper-and-pencil two-by-two matrix game with a zero-sum payoff structure was used to generate competitive interdependent situations in Game One. The payoff matrix of the zero-sum game is shown in Appendix B.

The matrix zero-sum game is a strictly competitive game in terms of its negative interdependent structure and the procedure of playing the game. The payoff structure for one player is opposite to that for the other. Since one player's gain always leads to the other's loss, the sum of payoffs of two players in this game always ends up being zero. The game structure eliminates the possibilities of optimizing or negotiating each other's interests, and players in a zero-sum game inevitably engage in strict competition (Colman, 1995).

Players in a zero-sum game typically make simultaneous choices, and the game outcome is determined by both player's choices. An accurate judgment of the other's preference, strategy, and move is advantageous to maximize individual payoffs, whereas revealing one's preference and strategy to the other player is disadvantageous.

Subjects played the game repeatedly for five times, and the experimenters provided feedback for the players in each round to ensure involvement in the process of competition and to trigger players' commitment to competition. Players were directed to record the winner and loser of each round as well as their points earned in that round before starting the next round. The experimenters also recorded the scores of each round on a board visible to players. Both players' and experimenters' recording of scores and of the winner and loser of each round was intended to ensure that subjects were aware of the competitive nature of the game and the consequences of their strategic choices.

In order to make the game more competitive and realistic, the experimenter asked participants to stake one dollar. At the beginning of the experiment, players in the Competition condition received the dollar as resource money to play Game One. This money was placed in a box for both players to see. At the end of all five rounds, participants were directed to sum the points to determine the final winner of Game One. The player who scored more in total points would become the winner of Game One and received the money (\$2) in the box.

The allocation of reward in the zero-sum game in Game One used the method of “The winner takes all”, which typically makes the competition more intense (Johnson & Johnson, 1989). Since the decision of who is the winner and the allocation of prizes are part of the experiences in competition, the experimenters announced the final winner in Game One and awarded the two dollars to the winner in front of the loser. The announcement and allocation of the money is also important for the manipulation of winner and loser, an effect which I will analyze later.

#### An Estimation Game in the No-Competition Condition

In the No-Competition condition, subjects completed estimation games in “Game One”. The game was designed to create minimal interaction between the two players and to allow only interaction that is neither competitive nor cooperative. The game consisted of two tasks. Task 1 was judging emotional

states from portrait pictures. Task 2 was estimating how other people surveyed had perceived and judged the pictures. After finishing each task, subjects received feedback from the experimenters on how they performed in the two tasks. The selection of judgment tasks and the procedure to include feedback were intended to make the No-Competition condition equivalent to the Competition condition except for the experiences of competition. Subjects in the No-Competition condition did not receive or wager any money. The length of time to complete tasks in the No-Competition condition was approximately equal to that in the Competition condition. Appendix C presents the game.

### Game Two

Game Two was designed to provide subjects with a different interdependent situation in which subjects could produce a mutual gain but had an incentive to act otherwise. Subjects played four rounds of a Prisoner's Dilemma Game (PDG) without receiving feedback. The PDG is a typical mixed-motive game that has a negative Nash Equilibrium at mutual defection, where aggregate payoff is lowest but neither individual has an incentive to cooperate. Unlike Game One, Game Two did not include any feedback to the subjects so as to ensure that decisions were based solely on prior experiences of competition and the payoff matrix of the PD game. The four-time iteration of the PD game will provide a more reliable measurement of cooperative behavior than single round PDG.



In order to make the game realistic, the payoffs in the matrix of the PD game represented the number of coins subjects could earn in the game. Each coin represented 25 cents. Subjects could earn as many as 8 coins (i.e. \$2) in the PD game. The payoff matrix used in the Prisoner's game is shown in Appendix F.

### Procedure

Subjects were randomly paired up, and pairs were randomly assigned to one of four experimental conditions. After reading and signing the consent forms (see Appendix H), subjects in the Competition condition received one dollar as their resource money to play Game One. The experimenters led each pair of subjects to a different room located in the same building. Subjects were asked not to communicate with each other during the experiment. Subjects carried the dollar with them and were seated at a table facing each other. They listened to an audio-tape that provided instructions and rules of Game One. In the audio taped instruction, subjects were informed that they would play two separate games, Game One and Game Two with each other. Subjects were then told about the rules and procedures of Game One. The instruction of Game One is presented in Appendix A. When the audio-taped instruction was finished, the experimenters asked subjects if they understood the rules of playing Game One. The experimenters ensured subjects' understanding of how to play the game before starting Game One.

In the Competition condition, subjects played five rounds of a matrix, game risking the dollar they had received. They were also instructed that the person who outscored the other player would win Game One and only the winner in Game One would receive a total of \$2, whereas the loser would receive nothing. Subjects played a practice round with their co-players to ensure their understanding of the rules of Game One. The experimenters gave feedback of the practice rounds and reminded subjects that they would start 5 rounds of game for real money.

In each round, participants made a decision and received results of that round. The game results of each round were recorded on the board so the participants could see the outcomes of their decisions. After all 5 rounds, the experimenter calculated the total score and announced the winner and the loser of Game One and awarded \$2 to the winner.

In the No-Competition condition, subjects were instructed to play an estimation game, judging emotional states of persons in 6 portrait pictures. After subjects matched each picture with a word that described the emotional state of the person in the picture, the experimenter then gave feedback on the results of their estimations. After that, subjects were asked to write down their best estimate of the percentages of people who accurately responded to judging the emotional state of each picture. The experimenters then revealed the actual survey results and asked subjects to compare their estimations with the actual results. After Game One, all subjects filled out a brief questionnaire as a

manipulation check. Game Two started after subjects had finished the questionnaire.

In Game Two, all subjects played four rounds of the PD game. Subjects received one dollar as reserve money to play Game Two. They listened to an audio tape that explained the rules and various strategies for playing Game Two. Subjects played a practice round by themselves to ensure their understanding of the game. The experimenters checked subjects' understanding of how to play Game Two. Subjects were then asked to play 4 rounds of the Prisoner's Dilemma game for real money. Subjects were informed that they would not receive any feedback on the game results during Game Two.

In the Discussion condition, subjects were asked to communicate with each other for 3 minutes just after finishing the practice round and before starting the four rounds of the PD game. Subjects could discuss any topics except what choices they had just made in the practice round. The instruction, however, encouraged subjects to discuss how to play Game Two. If both people agreed to end the discussion early, the experimenter proceeded with Game Two before the allotted 3 minutes. After discussion, no further communication was allowed until the end of the experiment. The instruction for discussion is presented in Appendix E. In the No-Discussion condition, subjects were asked not to talk with each other during the game and proceeded to play the PD game immediately after the practice round.

At the end of Game Two, subjects were asked to fill out a questionnaire about their decisions and reactions throughout Game Two. The questionnaire is presented in Appendix G. After completing the questionnaire, the subjects received a debriefing form and the game results individually. The entire experiment took approximately 50 minutes.

### Measurement

The purpose of this study is to investigate the effects of prior competition and discussion on subjects' decisions regarding cooperation in a subsequent mixed-motive game. The primary dependent variables to be investigated are cooperative choices, expectations about co-player's choices, and monetary performances in the PD game.

#### Cooperative Choices

Scores of cooperative choices were measured on two levels. For the pair-level analysis, the total number of cooperative choices made by both players in a pair over the four rounds of the PD game were calculated. The score of the cooperative choices of pairs indicates the overall degree of cooperation, ranging from 0 (pairs make no cooperative choices) to 8 (both players in the pair make cooperative choices over 4 rounds).

For the individual-level analysis, the number of cooperative choices by an individual was summed over four rounds. The score could range from 0 (subject

makes no cooperative choices at all) to 4 (subject makes cooperative choices throughout the 4 rounds).

### Expectation

Subjects' expectations of cooperation from their co-players were measured to identify the influence of prior competition and discussion on subjects' cognition about their co-players' decision. To arrive at a score, the number of expectations of one's co-player's cooperation was summed over the four rounds, ranging from 0 (no expectation of cooperation from co-player) to 4 (expectations of all cooperative choices).

### Choices in Light of One's Expectations about the Other's Intended Move

To assess what choices players made in light of their expectations about their co-players' intended moves, a categorical measure with four levels was formed: a cooperative choice expecting cooperation from co-player (Cc), a cooperative choice expecting defection from co-player (Cd), a choice to defect expecting defection from co-player (Dd), and a choice to defect expecting cooperation from co-player (Dc).

The classification of subjects' choices in light of their expectations about their co-players' intentions allows us to make cautious inferences about the motives behind the subjects' choices. When a player makes a choice in expectation of a certain choice from the co-player, the player's intention is

consistent with an intention to achieve the matched payoff when the co-player actually makes the expected choice. For example, the intention behind a choice to defect can be inferred differently depending on the expectations of cooperation. A choice to defect expecting co-player's cooperation (Dc) can be interpreted as having the intention to achieve a relative gain payoff whereas a choice to defect expecting co-players' defection (Dd) as having the intention to avoid the sucker's payoff.

The four categories can be relabeled using the possible matched payoffs in the PDG when the co-player makes the expected choices. Cc is a choice for mutual gain, Cd for altruism, Dc for relative gain, and Dd for individualistic gain. The frequencies of each category over four rounds were calculated at the individual level. The frequencies could range from 0 to 4.

#### The Accuracy of Expectation

The accuracy of the expectation was measured by comparing subjects' expectations of cooperation and actual choices of co-players at the individual level across the four rounds. When a player correctly predicts the co-player's actual choice, the expectation is an "accurate expectation" (cC or dD). When the expectation is not accurate, the inaccurate judgment would be categorized into either "optimistic error" (cD) or "pessimistic error" (dC). Optimistic error exists when a subject expects cooperation but the other person actually defects. Pessimistic error is that one predicts defection but the other chooses

cooperation. The classification of the expectations in terms of the accuracy of judgment allows us to make inferences about possible judgmental bias by prior competition and discussion. The frequencies of the three categories (accuracy, optimistic error, pessimistic error) were summed over the four rounds and could range from 0 to 4.

### The Matched Choices: Three Categories of Game Results

The actual game results were classified in terms of the matched responses of the two players; 1) mutual cooperation when both players make cooperative choices (CC), 2) mutual defection when both players make noncooperative choices (DD), and 3) unilateral cooperation when either player cooperates (DC or CD). This categorization of the outcome of the PD game is useful to see the impact of prior competition and discussion on the collective actions of two players. The frequencies of the three categories were measured at the pair level and they ranged from 0 to 4.

The individual players in unilateral cooperation can be classified as either defector or sucker. The frequencies of being a defector in each matched choices were measured for the analysis of the difference between winners and losers in their response to cooperation. They could range from 0 to 4.

### Monetary Performance: Welfare of People

Monetary performance was measured on two levels: that of the pair and that of the individual. Monetary performance of a pair is the final outcome of joint decisions in the PDG, which shows the impact of prior competition and discussion on the summed welfare of both people.

Monetary performance of a pair was measured by summing the coins earned by a pair in the four rounds of the PDG. Coincidentally, the monetary performance of a pair in this experiment happened to be identical with the total number of cooperative choices made by the pair due to the payoff matrix used in this experiment. A pair in Game Two could earn as much as eight coins through all mutual cooperation over 4 rounds which was identical with a total of 8 cooperative choices in the pair. A pair could yield no coins through all defection which is identical with a total of zero cooperative choices in the pair. However, monetary performance of an individual player was not identical with the number of cooperative choices made by the player. Monetary performance ranged from 0 to 8 at the pair level and from -4 to 8 at the individual level. Table 1 summarizes the measurement of core dependent variables.



TABLE 1. Summary of Dependent Variables

Dependent Variables	Category				Operationalization of Variables
Choices	C (Cooperation)		D (Defection)		The sum of cooperative choices over 4 rounds <sup>a,b</sup>
Expectations of the other's choices	c	d	c	d	The sum of expectations of cooperation over 4 rounds <sup>a,b</sup>
	c: cooperation, d: defection				
Choices in light of expectations	Cc	Cd	Dc	Dd	Combination of one's choice and expectation. The frequencies of each choice over 4 rounds <sup>a</sup> .
	1	-1	2	0	possible individual gains when the expectations are correct
	Cc for mutual gain Cd for altruism Dc for relative gain Dd for individualistic gain				Inferred intentions from the possible payoffs
Matched choices	CC	CD	DC	DD	Two players' choices in each round.
	1	-1	2	0	Payoffs for an individual
	2	1	1	0	Payoffs for a pair
	CC: Mutual cooperation CD or DC: Unilateral cooperation DD: Mutual defection				The frequencies of each category over 4 rounds <sup>c, d</sup>
Monetary performance	-4 to 8 for an individual				The sum of payoffs over 4 rounds
	0 to 8 for a pair				

<sup>a</sup> ranged from 0 to 4 at the individual level

<sup>b</sup> ranged from 0 to 8 at the pair level

<sup>c</sup> ranged from 0 to 4 at the pair level

<sup>d</sup> The frequency of DC (relative gain) was measured for the losers, 0 to 4

### Control Variables

Because subjects' gender (Rapoport & Chammah, 1965), ethnicity (Cox et al, 1991), and nationality (Argyle, 1991) affect their propensity to make cooperative choices, these were also measured in the questionnaire and controlled for the analysis at the individual level. Ethnicity was recoded as White versus Non-white and nationality as U.S. versus Non-U.S. due to the relatively small number of Non-White and Non-U.S. subjects.

### Subjects

Undergraduate students who were enrolled in management courses at the University of Oregon participated in this study. Participation was voluntary and all participants received five points of extra credit for the classes (total points in the classes equal to 160). Students were recruited in classrooms. Those who intended to participate in the experiments printed their names in time sheets distributed by recruiters. Two hundred and eighty five students had signed up for the extra credit. Fifteen students did not show up for the experiment. Another 16 students could not be paired up due to the no-shows. These 16 received the extra credit for completion of other tasks.

### Basic Statistics of the Sample

The total number of subjects was 254 (137 males and 117 females). One hundred and sixty seven of them had U. S. citizenship, 79 were from Asian countries and 8 were from other countries. The control group without discussion had 52 subjects; the control group with discussion had 60. The competition without discussion group had 74 and the competition with discussion had 68 subjects. One hundred and forty three subjects were Whites, 96 were Asians, 3 were Blacks, and 6 were Hispanics. The average age of the sample was 23.28. Table 2 summarizes the demographics in each experimental condition.

TABLE 2. Demographic Data in Each Condition

	NC-ND <sup>a</sup>	C-ND	NC-D	C-D	Row total
<b>Gender</b>					
Male	28	45	27	37	137
Female	24	29	33	31	117
<b>Nationality</b>					
U.S.	32	45	41	49	167
Non-U.S.	20	29	19	19	87
Asian	18	27	17	17	79
European	1	1	1	2	5
Other	1	1	1		
<b>Ethnicity</b>					
White	23	40	39	41	143
Non-White	29	34	21	27	110
Asian	28	28	18	22	96
Black		2		1	3
Hispanic		1	1	3	5
Other	1	3	2	1	6
<b>Total</b>	<b>52</b>	<b>74</b>	<b>60</b>	<b>68</b>	<b>254</b>

<sup>a</sup> NC-ND: No-Competition and No-Discussion group

C-ND: Competition and No-Discussion group

NC-D: No-Competition and Discussion group

C-D: Competition and Discussion group

## CHAPTER IV

### DATA ANALYSIS AND RESEARCH FINDINGS

#### Analysis Scheme

This chapter provides statistical analyses of the results for each variable described in the previous chapter. First, I present the manipulation check, then the analysis of the results regarding the primary research question - whether providing subjects with the experience of competition could affect subsequent cooperation. Then, the moderating effect of discussion on subsequent cooperation is analyzed. Finally, I examine the impact of prior competition and discussion on such dependent variables as cooperative choices, the expectations of cooperation, choices in light of one's expectations, the accuracy of expectations, matched choices, and welfare of subjects.

Analyses are conducted at both the pair-level and the individual-level. Additional analyses are performed at the individual level differentiating winners and losers within the Competition condition. The objective is to see the overall impact of the experiences of prior competition and discussion on collective actions of pairs as well as individual decision making and perceptions.

At the pair-level analysis, I examine the main effects for prior competition and discussion on the number of cooperative choices and expectations of

cooperation. The pair level analysis of matched choices makes it possible to classify collective actions into three categories: mutual cooperation, mutual defection and unilateral cooperation. The welfare of pairs is then presented as the outcome of prior competition and discussion on collective actions.

At the individual-level analysis, I examine the effects of prior competition and discussion on the degree of individual cooperation and expectation. Then the relations between players' choices and their expectations about the other player's choices are examined. The accuracy of expectation is analyzed to see any systematic bias caused by prior competition and cooperation. Compared with the pair-level analysis, the individual-level analysis provides more degrees of freedom and less variance of the effects. This makes it possible to identify marginal effects of the independent variables that would be overlooked in the pair-level analysis.

The individual analysis differentiating winners and losers in the Competition condition will identify the influence of winning and losing experiences on subsequent cooperation.

#### Manipulation Check

A manipulation check examined the strength of competition manipulated in Game One. A one-way between-subjects multivariate analysis of covariance (MANCOVA) was performed on three variables measuring the experiences of competition: perception of Game One itself as competitive, experiences of

competitive behavior from others, and evaluation of self-behavior as competitive in Game One. Correlations among these three variables ranged from .72 to .77. Adjustment was made for three covariates: gender, ethnicity and nationality. These demographic variables were used to control for any preexisting differences in the perception of competitive experiences.

The regression portion of the MANCOVA analysis was significant, Wilk's  $\lambda = .912$ , approximate  $F(9, 585) = 2.514$ ,  $p < .01$ , indicating that the combined covariates were significantly related to the competitive experience measures. The strength of association between covariates and variables measuring competitive experiences was weak with  $\eta^2 = .09$ . Standardized regression coefficients indicated that two of the three covariates, nationality and gender, provided marginal adjustment to the perception of Game One as competitive ( $\beta = .14$  for nationality and  $\beta = -.09$  for gender). Non-U.S. subjects perceived Game One more competitive than did U.S. subjects and female subjects perceived Game One more competitive than male subjects. Nationality provided significant adjustment to perception of competitiveness of other's behavior ( $\beta = .23$ ) and marginal adjustment to perception of self-behavior ( $\beta = .15$ ). Non-U.S. subjects perceived more competitiveness than did U.S. subjects in other's behavior and self-behavior. Ethnicity did not provide significant adjustment for the competitive experience measures.

The analysis of variance portion of the MANCOVA resulted in a significant main effect for the manipulation of competition on the competitive experiences,

Wilk's  $\lambda = .569$ ,  $F(3, 240) = 60.49$ ,  $p < .0001$ , indicating that subjects in the Competition condition perceived their experiences of Game One to be more competitive than did subjects in the No-Competition condition. Follow-up univariate  $F$ 's ( $p < .0001$ ) after adjustment for covariates indicated that the manipulation of zero-sum competition did indeed provide subjects with experiences of competition: Perceptions of the competitiveness of Game One,  $F(1, 242) = 169.07$ ,  $p < .0001$ , of their co-player's behavior,  $F(1, 242) = 92.75$ ,  $p < .0001$ , and reflections of self-behavior,  $F(1, 242) = 107.41$ ,  $p < .0001$ , as being competitive during Game One. The strength of the manipulation effect was assessed by  $\eta^2$  which accounted for approximately 43% of the variance in the experiences of competition. Table 3 presents the manipulation checks of competitive experiences in Game One.

TABLE 3. Manipulation Checks of Competitive Experiences in Game One

Competitive experiences in Game One	No-Competition	Competition	Univariate F
Game One as competitive	2.24 <sup>a</sup> (1.66) <sup>b</sup>	4.94 (1.62)	169.07*
Self-behavior as competitive	2.53 (1.83)	4.65 (1.64)	92.75*
Other's behavior as competitive	2.28 (1.63)	4.35 (1.60)	107.41*

<sup>a</sup>: mean ranged from 1 to 7.

<sup>b</sup>: S.D. (standard deviation)

\*:  $p < .0001$



Subjects in the Discussion condition were asked to talk to each other within 3 minutes prior to making decisions in Game Two. All subjects in the Discussion condition took part in discussion by communicating with each other. The precise length of time spent on discussion was not recorded, but it ranged from a brief dialogue of two sentences to a maximum of 3-minute conversation.

Winning and losing in Game One were determined by the total score earned by subjects over five rounds of zero-sum game. Five pairs were tied in total scores and they played an extra round to determine winner and loser in Game One.

### Descriptive Statistics

Two-way contingency tables of cooperative choices and expectations over four rounds of the PDGs are presented in Table 4 and 5. Table 4 summarizes the frequencies of cooperative choices and expectations by the four experimental groups, and Table 5 specifies the frequencies in the Competition condition by winners and losers.

TABLE 4. The Frequency of Cooperative Choices and Expectations by the Experiences of Prior Competition and Discussion

	NC-ND <sup>d</sup>	C-ND	NC-D	C-D	Row Total
<b>Cooperative Choices</b>					
Round1	22 <sup>a</sup> (42.3) <sup>b</sup>	24 (32.4)	49 (81.7)	44 (64.7)	139 (54.7)
Round2	27 (51.9)	29 (39.2)	46 (76.7)	44 (64.7)	146 (57.5)
Round3	17 (32.7)	25 (33.8)	46 (76.7)	47 (69.1)	135 (53.1)
Round4	19 (36.5)	20 (27.0)	45 (75.0)	41 (60.3)	125 (49.2)
Column Mean	21.3 (40.9)	24.5 (33.1)	46.5 (77.5)	44 (64.7)	105.8 (41.6)
Total Subjects	52 <sup>c</sup> (100)	74 (100)	60 (100)	68 (100)	254 (100)
<b>Expectations of Cooperation</b>					
Round1	29 (55.8)	39 (52.7)	52 (86.7)	51 (75.0)	171 (67.3)
Round2	28 (53.8)	45 (60.8)	55 (91.7)	53 (77.9)	181 (71.3)
Round3	22 (42.3)	44 (59.5)	53 (88.3)	47 (69.1)	166 (65.4)
Round4	29 (55.8)	32 (43.2)	50 (83.3)	48 (70.6)	159 (62.6)
Column Mean	27 (51.9)	40 (54.1)	52.5 (87.5)	49.8 (73.2)	169.3 (66.6)
Total Subjects	52 <sup>c</sup> (100)	74 (100)	60 (100)	68 (100)	254 (100)

<sup>a</sup>: The frequency

<sup>b</sup>: The proportion

<sup>c</sup>: Subjects in each condition

<sup>d</sup> NC-ND: No-Competition and No-Discussion group

C-ND: Competition and No-Discussion group

NC-D: No-Competition and Discussion group

C-D: Competition and Discussion group

**TABLE 5. The Frequency of Cooperative Choices and Expectations by Winners Versus Losers**

	Losers-ND <sup>d</sup>	Winners-ND	Losers-D	Winners-D	Row Total
<b>Cooperative Choices</b>					
Round1	8 <sup>a</sup> (21.6) <sup>b</sup>	18 (48.6)	21 (61.8)	23 (67.6)	70 (49.3)
Round2	10 (27.0)	17 (45.9)	23 (67.6)	21 (61.8)	71 (50.0)
Round3	10 (27.0)	15 (40.5)	22 (64.7)	25 (73.5)	72 (50.7)
Round4	8 (21.6)	14 (37.8)	20 (58.8)	21 (61.8)	63 (44.4)
Column Mean	9 (24.3)	16 (43.2)	21.5 (63.2)	22.5 (66.2)	69 (48.6)
Total Subjects	37 <sup>c</sup> (100)	37 (100)	34 (100)	34 (100)	142 (100)
<b>Expectations of Cooperation</b>					
Round1	19 (51.4)	20 (54.1)	25 (73.5)	26 (76.5)	90 (63.4)
Round2	16 (43.2)	29 (78.4)	26 (76.5)	27 (79.4)	98 (69.0)
Round3	21 (56.8)	23 (62.2)	22 (64.7)	25 (73.5)	91 (64.1)
Round4	13 (35.1)	19 (51.4)	25 (73.5)	23 (67.6)	80 (56.3)
Column Mean	17.3 (46.6)	22.8 (61.5)	24.5 (72.1)	25.3 (74.3)	89.8 (63.2)
Total Subjects	37 (100)	37 (100)	34 (100)	34 (100)	142 (100)

<sup>a</sup>: The frequency

<sup>b</sup>: The proportion

<sup>c</sup>: Subjects in each condition

<sup>d</sup> Losers-ND: Losers in No-Discussion group  
 Winners-ND: Winners in No-Discussion group  
 Losers-D: Losers in Discussion group  
 Winners-D: Winners in Discussion group

The results shown in Tables 4 and 5 are in the direction predicted by the hypotheses. Subjects in the Competition condition made fewer cooperative choices and had fewer cooperative expectations than did subjects in the No-Competition condition. Subjects in the Discussion condition made more cooperative choices and had higher expectations than did subjects in the No-Discussion condition. Losers in Game One made fewer cooperative choices in the PDGs than did winners.

The frequencies did not show any pattern that indicated the effect of time (rounds) on cooperative choices and expectations over four rounds of PDGs. A Hierarchical Log-linear analysis was performed to test a potential time (rounds) effect, and the results in the partial association tests indicated that there was no significant two-way associations between rounds and cooperative choices or between rounds and expectations. None of the higher-order association with rounds reached statistical significance (See Tables 6, 7, 8, and 9 in Appendix J). Thus, summing up the cooperative choices and expectations over four rounds is appropriate to examine the degree of cooperation and expectation of individual players.

## Pair-Level Analysis

### Cooperation in Pairs

#### Synopsis

The data showed that prior competition and discussion significantly influenced the subsequent cooperation of pairs. The mean cooperative choices in pairs decreased with prior competition but increased with discussion. The direction of the effect of discussion and of prior competition was opposite and there was no significant interaction effect between prior competition and discussion on cooperative choices in pairs.

#### Statistical Results

A two-way analysis of variance (ANOVA) of cooperative choices yielded a significant main effect for prior experiences of zero-sum competition,  $F(1, 123) = 4.09, p < .05$ , and for discussion,  $F(1, 123) = 232.36, p < .001$ . No significant interaction effect between prior competition and discussion was detected.

Subjects with prior competitive experiences made significantly fewer cooperative choices, on average, than did subjects with no competitive experiences ( $M = 3.86$  for the Competition and  $M = 4.84$  for the No-Competition condition). Discussion, however, increased the mean cooperative choices substantially ( $M = 2.91$  for the No-Discussion and  $M = 5.66$  for the Discussion

condition). A summary of the results is presented in Tables 10 and 11 in Appendix K.

### Matched Choices: The Collective Game Results

#### Synopsis

The experiences of prior competition significantly increased mutual defection (DD). Discussion decreased mutual defection (DD) and unilateral cooperation (DC or CD) but increased mutual cooperation (CC) substantially. Despite its strong effect on the matched choices, discussion does not moderate the effect of prior competition.

#### Statistical Results

A two-way MANOVA was conducted to determine whether experiences of prior competition and discussion made differences on pairs' matched choices of mutual cooperation and defection. Due to the linear dependency among three variables, unilateral cooperation was not included in the MANOVA. Correlation among three matched choices ranged from  $-.26$  to  $-.63$ .

With the use of Wilk's criterion, the combined matched choices in pairs were significantly affected by both prior experiences of competition, Wilk's  $\lambda = .949$ ,  $F(1, 123) = 3.29$ ,  $p < .05$ , and discussion, Wilk's  $\lambda = .682$ ,  $F(1, 123) = 28.4$ ,  $p < .0001$ , but not by their interaction, Wilk's  $\lambda = .990$ ,  $F(2, 122) = .632$ ,  $p = n.s.$ . The results indicated a weak association between prior competition and

matched choices of CC and DD,  $\eta^2 = .05$  and moderate association between discussion and the combined CCs and DDs,  $\eta^2 = .32$ .

For further investigation of the impact of main effect on the individual matched choices, univariate F tests were conducted. There was a significant main effect for prior zero-sum competition on mutual defection (DD),  $F(1, 123) = 6.49$ ,  $p < .05$ , and no significant main effect on mutual cooperation (CC). There was a significant main effect for discussion on mutual defection (DD),  $F(1, 123) = 16.97$ ,  $p < .0001$ , and on mutual cooperation (CC),  $F(1, 123) = 57.27$ ,  $p < .0001$ . There was no significant interaction effect for prior competition and discussion on the matched choices of CC or DD. Figures 4 and 5 graphically present the effect of prior competition and discussion respectively on the matched choices in pairs.

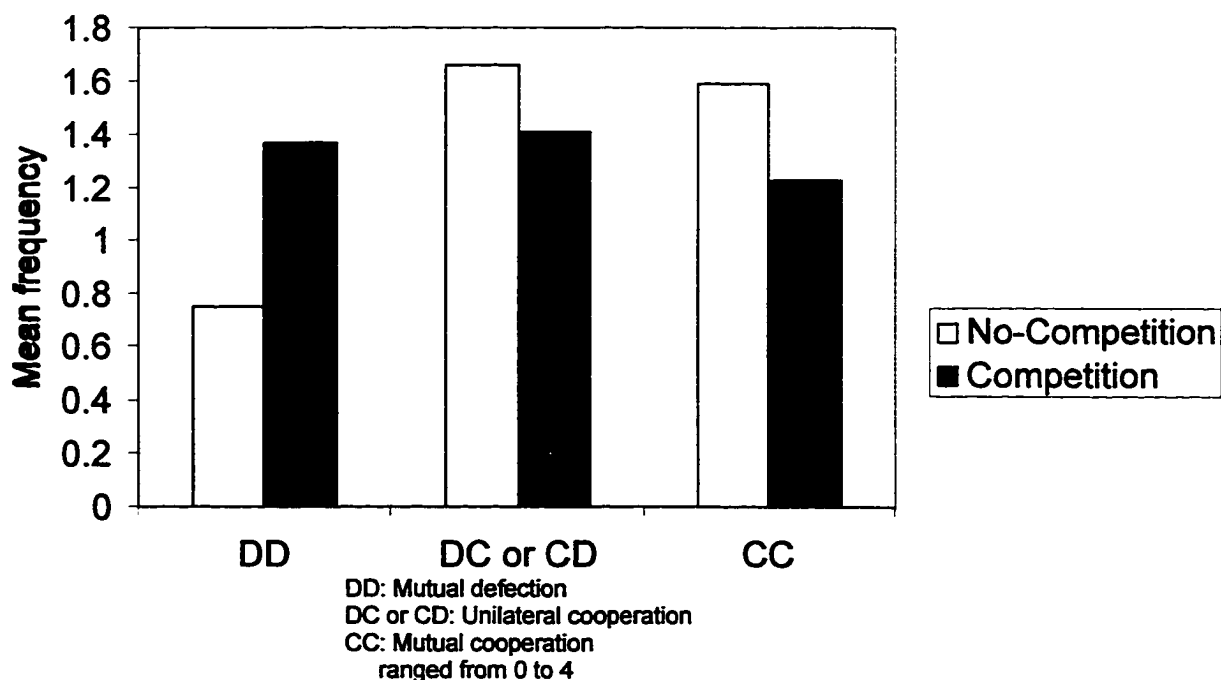


FIGURE 4. Matched Choices by Prior Competition

Figure 4 demonstrates that pairs in the Competition condition made significantly more mutual defection (DD) than did pairs in the No-Competition condition ( $M = 1.37$ ,  $S.D. = 1.43$  for the Competition and  $M = .75$ ,  $S.D. = 1.15$  for the No-Competition condition). Pairs in the No-Competition condition made more mutual cooperation (CC) and unilateral cooperation (DC or CD) than did pairs in the Competition condition but the differences are not significant.

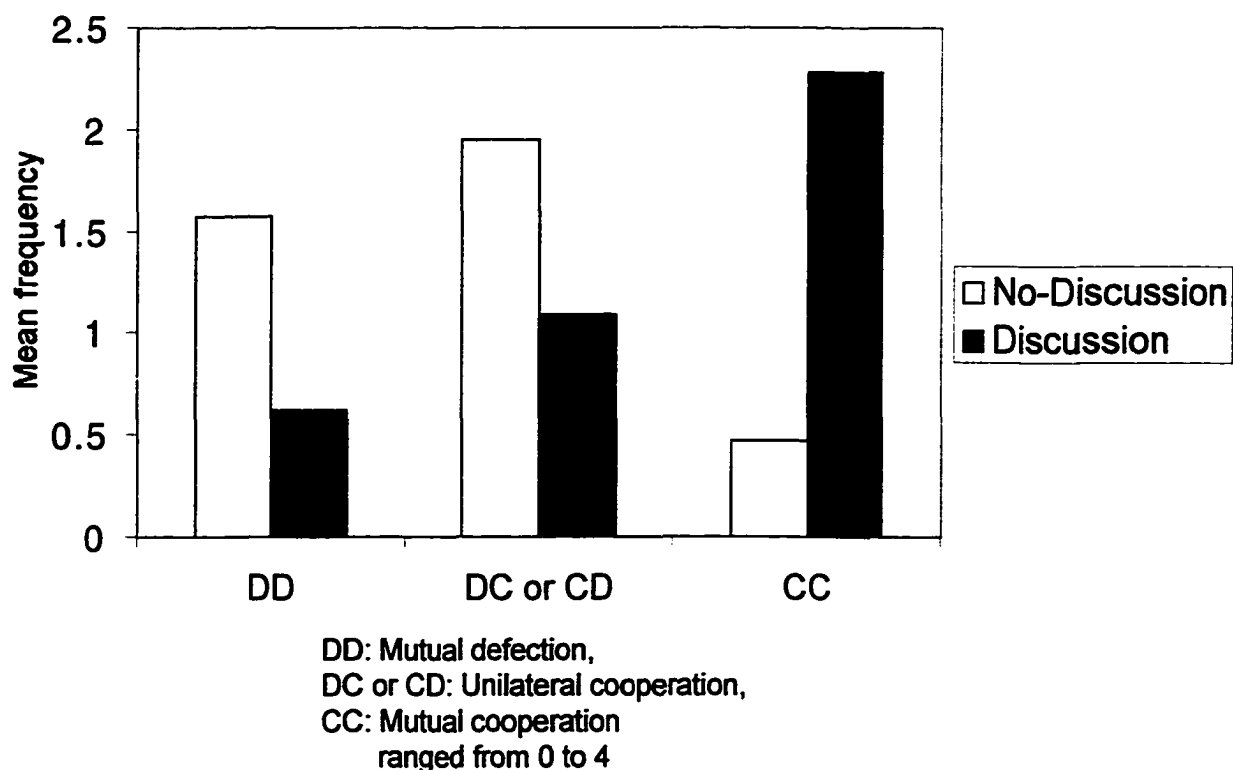


FIGURE 5. Matched Choices by Discussion

Figure 5 shows that pairs in the No-Discussion condition made more mutual defection (DD) ( $M = 1.58$ ,  $S.D. = 1.3$  and  $M = .63$ ,  $S.D. = 1.22$  for the No-Discussion and the Discussion condition respectively), more unilateral



cooperation (DC or CD) ( $M = 1.95$ ,  $S.D. = 1.1$  and  $M = 1.09$ ,  $S.D. = 1.35$  for the No-Discussion and the Discussion condition respectively), and less mutual cooperation (CC) ( $M = .48$ ,  $S.D. = .80$  and  $M = 2.28$ ,  $S.D. = 1.71$  for the No-Discussion and the Discussion condition respectively) than did pairs in the Discussion condition.

Figures 4 and 5 contrast the effects of prior competition and discussion. The experiences of prior competition increased mutual defection (DD) whereas discussion decreased DD and increased CC. Table 12 and 13 in Appendix K summarize the results.

### Expectation in Pairs

#### Synopsis

The results show that prior competition did not affect subsequent expectations of cooperation in pairs. Discussion, however, significantly increased expectations of cooperation in pairs. There was no significant interaction effect between prior competition and discussion on the expectations of cooperative choices in pairs.

#### Statistical Results

A two-way analysis of variance (ANOVA) on subjects' expectation of cooperative choices yielded a significant main effect for discussion,  $F(1, 123) =$

38.67,  $p < .001$ , but no significant main effect for prior experiences of zero-sum competition and interaction effect between prior competition and discussion.

Subjects with prior competitive experiences had a lower mean expectation of cooperative choices than did subjects with no competitive experiences ( $M = 5.20$ ,  $S.D. = 2.41$  for the Competition condition and  $M = 5.68$ ,  $S.D. = 2.23$  for the No-Competition condition). However, the difference was not statistically significant. Discussion significantly increased the mean expectation of cooperative choices substantially ( $M = 4.29$ ,  $S.D. = 2.04$  for the No-Discussion and  $M = 6.52$ ,  $S.D. = 2.07$  for the Discussion condition).

The mean expectations of cooperative choices by the four experimental groups showed that the No-Competition and Discussion (NC-D) group reported the highest mean expectation of cooperative choices ( $M = 7.00$ ,  $S.D. = 1.41$ ). The No-Competition and No-Discussion (NC-ND) group reported the lowest expectation ( $M = 4.15$ ,  $S.D. = 2.03$ ). The Competition and Discussion (C-D) group reported the second highest expectation ( $M = 6.09$ ,  $S.D. = 2.45$ ) and the Competition and No-Discussion (NC-ND) group ( $M = 4.38$ ,  $S.D. = 2.07$ ) was ranked the next. A summary of the results is presented in Table 14 and 15 in Appendix K.

## Welfare of Pairs: Monetary Performance

### Synopsis

The results show that prior competition and discussion significantly affected the welfare of pairs in the subsequent PDGs. As noted in the previous chapter, the monetary performance of pairs in this experiment happened to be identical with the number of cooperative choices made by the pairs. The effects of prior competition and discussion on monetary performance, therefore, were identical with the effects on the cooperative choices in pairs.

### Statistical Results

Pairs in the Competition (C) condition earned, on average, approximately one coin less than pairs in the No-Competition (NC) condition ( $M = 3.86$  for the Competition and  $M = 4.84$  for the No-Competition condition). Pairs in the Discussion (D) condition earned approximately twice as many coins as did pairs in the No-Discussion (ND) condition ( $M = 5.66$  for the Discussion and  $M = 2.91$  for the No-Discussion condition). Ordering the experimental groups by monetary performance of pairs was that the NC-D group earned the most coins, the C-D group the second most, the NC-ND group came in the third, and C-ND group earned the least coins.

### Individual-Level Analysis

In this analysis, I used analysis of covariance (ANCOVA) and multivariate analysis of covariance (MANCOVA) to examine the influence of prior zero-sum competition, discussion, and the interaction between the two on dependent variables after adjustment by covariates. Dependent variables consisted of individual subjects' cooperative choices, their expectations of co-players' moves, and choices in light of expectations, and the accuracy and patterns of expectations. Three demographic variables - gender, ethnicity, and nationality - were used as covariates.

#### Cooperative Choices by Individual Players

##### Synopsis

The experiences of prior zero-sum competition significantly decreased cooperative choices. Discussion after competition but before the PDGs significantly increased cooperative choices supporting the hypotheses. Discussion did not remove the negative effect of prior competition on subsequent cooperation.

##### Statistical Results

A two-way analysis of covariance (ANCOVA) on individual cooperative choices was performed. Two of the covariates, gender and nationality, were

significantly associated with cooperative choices and each uniquely adjusted the mean cooperative choices:  $F(1, 246) = 6.94, p < .01$  for gender and  $F(1, 246) = 3.80, p < .05$  for nationality. Female and U.S. subjects made more cooperative choices than did male and Non-U.S. subjects. After adjustment by covariates, there were still significant main effects for prior zero-sum competition,  $F(1, 246) = 4.38, p < .05$ , and for discussion,  $F(1, 246) = 49.04, p < .001$ , on subsequent cooperation. There was no significant interaction effect for prior competition and discussion. Figure 6 graphically shows the mean cooperative choices by the four experimental groups.

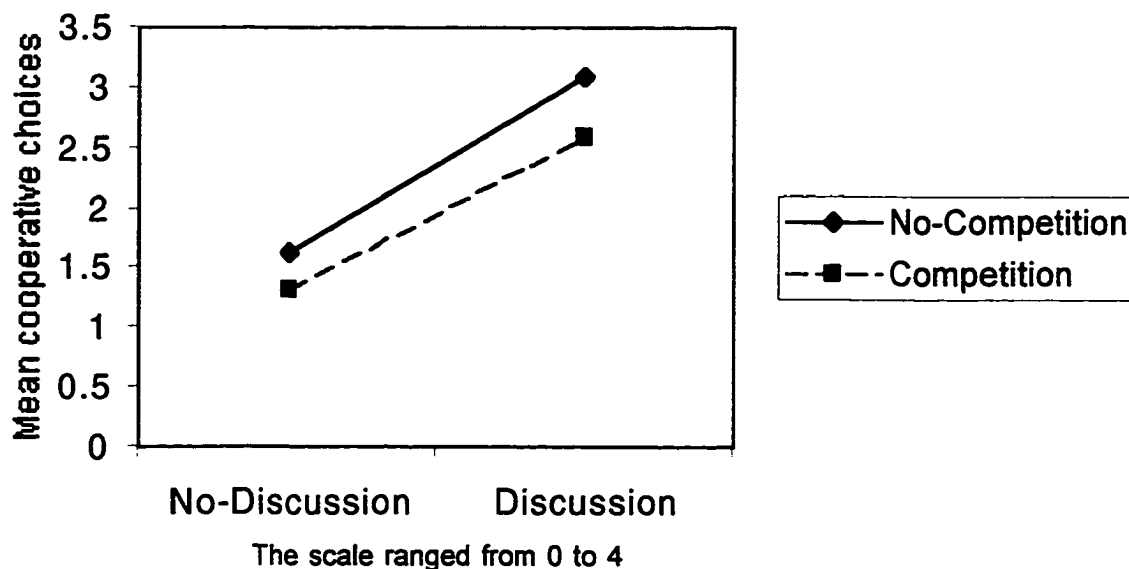


FIGURE 6. Cooperative Choices by Individuals

Subjects in the Competition condition made significantly lower mean cooperative decisions ( $M = 1.93$ ,  $S.D. = 1.60$ ) than did subjects in the No-Competition condition ( $M = 2.42$ ,  $S.D. = 1.58$ ). Subjects in the Discussion condition made significantly higher mean cooperative responses ( $M = 2.83$ ,  $S.D. = 1.55$ ) than did subjects in the No-Discussion condition ( $M = 1.45$ ,  $S.D. = 1.34$ ). The NC-D group ( $M = 3.1$ ,  $S.D. = 1.43$ ) demonstrated the most cooperative behavior and the C-ND group ( $M = 1.32$ ,  $S.D. = 1.33$ ) was the least cooperative. A summary of the results is presented in Tables 16 and 17 in Appendix K.

### Expectation of Co-Player's Intention

#### Synopsis

Prior competition did not affect subjects' expectations of cooperation, but discussion increased the expectations of cooperation significantly. A marginal interaction effect of the two emerged. In the Discussion condition, subjects' expectations of cooperation decreased due to the experiences of competition. However, in the No-Discussion condition, subjects' expectations of cooperation were not affected by prior competitive experiences.

#### Statistical Results

A two-way ANCOVA showed that there was a significant main effect for discussion,  $F(1, 253) = 43.03$ ,  $p < .001$ , but no significant main effect for zero-sum competition on the expectations. The interaction effect between prior

competition and discussion was not significant at the  $p < .05$  level,  $F(1, 253) = 3.02$ ,  $p < .10$ . Among the covariates, only gender uniquely adjusted the expectations of cooperation,  $F(1, 246) = 6.01$ ,  $p < .05$ . Female subjects expected more cooperation from their co-players. A graphic representation is presented in Figure 7.

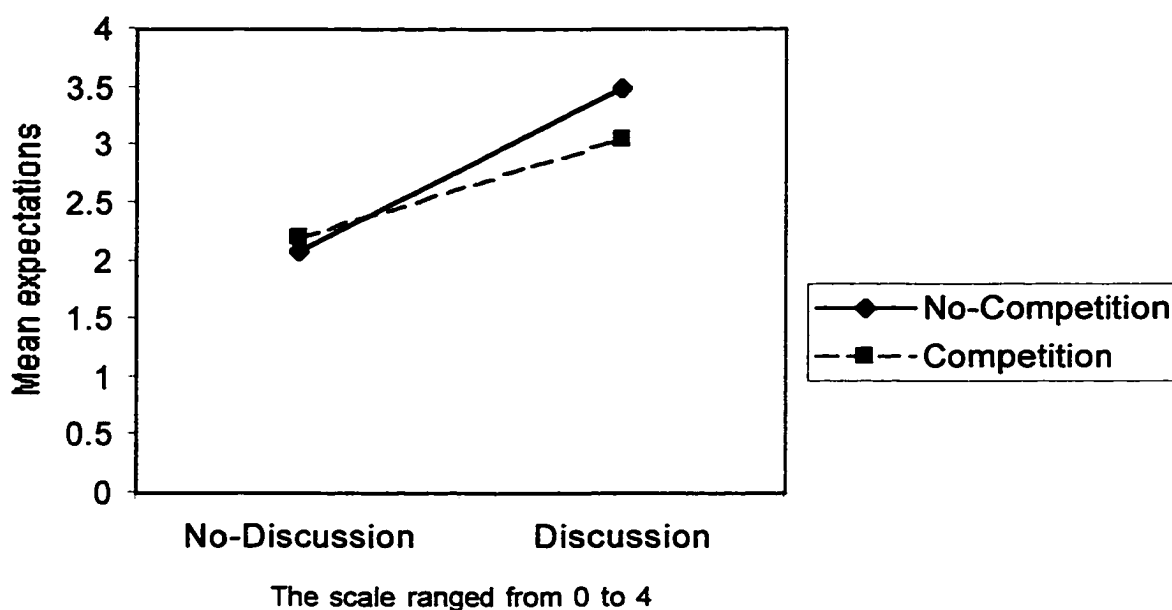


FIGURE 7. Expectation of Cooperation by Individuals

Subjects in the Discussion condition ( $M = 3.26$ ,  $S.D. = 1.16$ ) reported higher mean expectation of cooperation than did subjects in the No-Discussion condition ( $M = 2.14$ ,  $S.D. = 1.41$ ). Subjects in the Competition condition did not show a significant difference in the expectation of cooperation ( $M = 2.60$ ,  $S.D. = 1.43$  for the Competition and  $M = 2.84$ ,  $S.D. = 1.36$  for the No-Competition condition). The results are summarized in Tables 18 and 19 in Appendix K.

## Choices in Light of Expectations about Co-Player's Intentions

### Synopsis

The experiences of prior competition did not show any significant main effect on the choices in light of expectations. However, discussion significantly increased the choices for mutual gain (Cc) and decreased the choices for relative gain (Dc) and for individualistic gain (Dd). No significant interaction effect of the two emerged.

### Statistical Results

A two-way MANCOVA was conducted on three choices in light of expectations: Cc, Dc and Dd. The altruistic choices (Cd) were excluded from the analysis due to their relatively low frequency and linear dependency among the four choices in light of expectations. Correlation among the other three choices ranged from  $-.07$  to  $.68$ . Gender, ethnicity and nationality were used as covariates.

The regression portion of the analysis was significant, Wilks'  $\lambda = .897$ , approximate  $F(9, 593) = 3.01$ ,  $p < .01$  indicating that combined covariates were significantly related to three choices. Standardized regression coefficients reflected that two of the covariates, gender and nationality, provided significant adjustment to Cc choices,  $\beta = .17$ ,  $p < .01$  for gender and  $\beta = -.19$ ,  $p < .05$  for



nationality. Female and U.S. subjects made more Ccs than did Male and Non-U.S. subjects. Gender also provided a significant adjustment to Dd choices,  $\beta = -.13$ ,  $p < .05$  but no significant adjustment to Dc choices. In contrast, nationality provided a marginal adjustment to Dc choices,  $\beta = .16$ ,  $p < .10$  but no significant adjustment to Dd. Ethnicity did not provide significant adjustment to any of the three choices.

The analysis of variance portion of the analysis showed that there was a significant main effect for discussion, Wilks'  $\lambda = .793$ ,  $F(3, 244) = 21.18$ ,  $p < .001$ , but no significant main effect for prior competition, Wilks'  $\lambda = .983$ ,  $F(3, 244) = n.s.$ , and no interaction between the two, Wilks'  $\lambda = .984$ ,  $F(3, 244) = n.s.$ . The strength of the discussion effect on choices in the expectation of co-players' moves was approximately  $\eta^2 = .21$ .

Follow-up univariate F test after adjustment for covariates showed that discussion significantly increased the cooperative choices expecting cooperation (Cc),  $F(1, 246) = 62.73$ ,  $p < .001$ , and decreased the defections expecting defection from co-players (Dd),  $F(1, 246) = 31.11$ ,  $p < .001$ , and the defections expecting cooperation (Dc),  $F(1, 246) = 8.16$ ,  $p < .01$ . No significant main effect for prior competition and interaction effect for prior competition and discussion were identified in the three choices. Figure 8 graphically presents the effects of discussion on the four choices respectively. Subjects with discussion made more Ccs, fewer Dds and Dcs than did subjects without discussion. A summary of the results is presented in Tables 20, 21, and 22 in Appendix K.

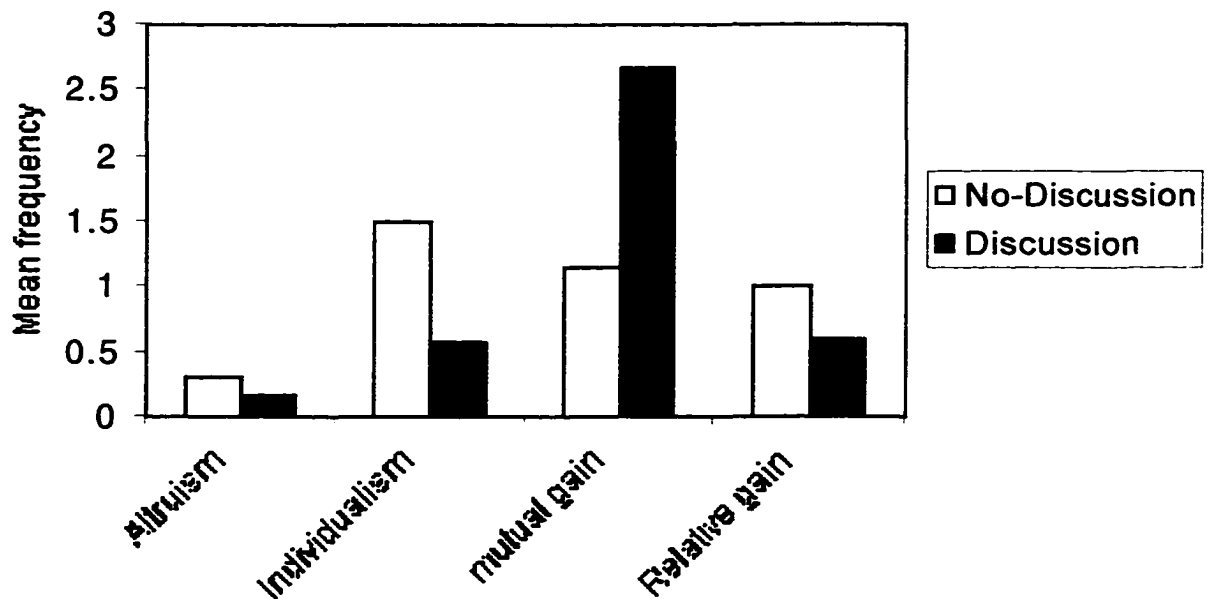


FIGURE 8. The Effect of Discussion on the Choices in Light of Expectations about Co-Player's Intentions

#### Accuracy of Expectation about Co-Player's Intention

##### Synopsis

The experience of prior competition did not significantly influence the accuracy of expectations about the co-player's choices (cC and dD). Discussion significantly increased the accuracy of predicting the other's choices.

##### Statistical Results

A two-way MANCOVA was conducted on accurate expectations (cC or dD) and pessimistic error (dC). The optimistic error (cD) was excluded from the

analysis for the degree of freedom of dependent variables because of the linear dependency among three expectations. The cD was included, however, in a separate univariate F test. Correlation among the three expectations ranged from -.23 to -.79. Gender, ethnicity and nationality were used as covariates.

The regression portion of the analysis was not significant, Wilks'  $\lambda = .987$ , approximate  $F(6, 490) = .532$ ,  $p = n.s.$ , indicating that combined covariates were not significantly related to the accuracy of expectations. The analysis of variance portion of the analysis showed that there was a significant main effect for discussion, Wilks'  $\lambda = .813$ ,  $F(2, 245) = 28.12$ ,  $p < .001$ , but no significant main effect for prior competition, Wilks'  $\lambda = .986$ ,  $F(2, 245) = n.s.$ , and no interaction between the two, Wilks'  $\lambda = .988$ ,  $F(2, 245) = n.s.$ .

A separate univariate F test showed that discussion significantly increased the accurate expectations about co-players' moves,  $F(1, 246) = 51.61$ ,  $p < .001$ , and decreased pessimistic error,  $F(1, 246) = 18.51$ ,  $p < .001$ , and optimistic error,  $F(1, 246) = 17.37$ ,  $p < .001$ . Figure 9. shows the accuracy of expectations by the four groups.

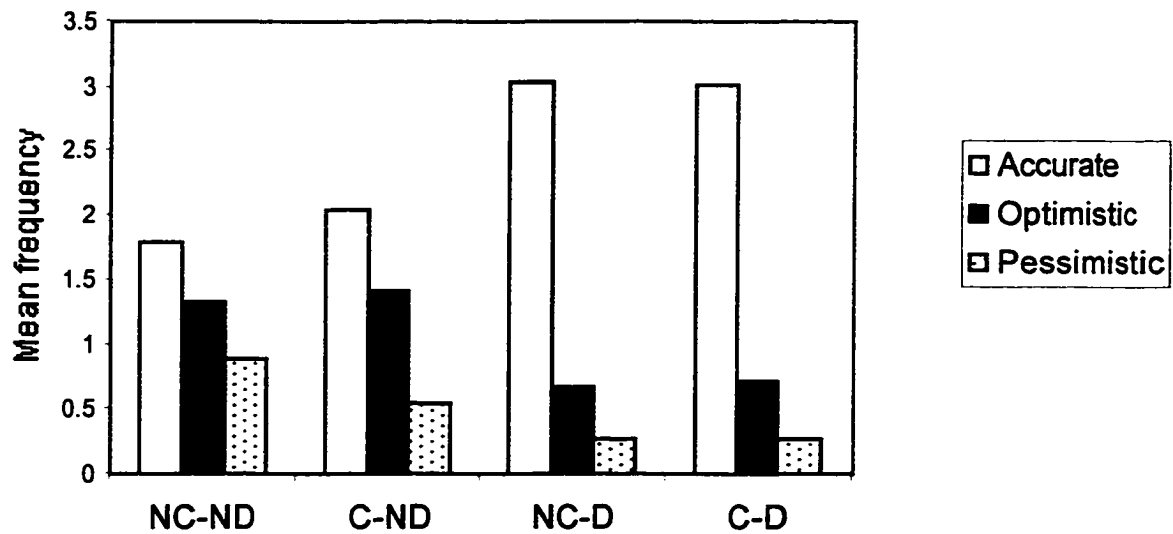


FIGURE 9. The Accuracy of Expectations by Four Groups

Subjects in the Discussion condition made significantly more accurate expectations ( $M = 3.02$ ,  $S.D. = 1.23$ ) and fewer pessimistic errors ( $M = .27$ ,  $S.D. = .60$ ) about co-players' moves than did subjects in the No-Discussion condition ( $M = 1.94$ ,  $S.D. = 1.14$  for the accuracy of expectations and  $M = .68$ ,  $S.D. = .96$  for the pessimistic errors).

In contrast, subjects in the Competition condition ( $M = 2.51$ ,  $S.D. = 1.26$ ) did not show a significant difference from subjects in the No-Competition condition ( $M = 2.46$ ,  $S.D. = 1.35$ ) in the accuracy with which they predicted their co-players' moves. A summary of the results was presented in Tables 23, 24, and 25 in Appendix K.

## Winners and Losers

This section analyzes the differential effects of prior competitive experiences on winners and losers, specifically the effects of winning and losing in Game One on subsequent cooperation, expectation, and monetary performances in the PDGs.

### Monetary Performance of Winners and Losers

#### Synopsis

The results indicate that there was a significant gap in monetary performance between prior losers and winners, particularly in the No-Discussion condition. Losers earned more coins than winners in the subsequent PDGs with No-Discussion condition. However, the monetary gap between winners and losers was eliminated by discussion.

#### Statistical Results

A two-way ANCOVA on the monetary performance scores was conducted. Ethnicity, gender and nationality did not provide significant adjustment to monetary performance. There were significant main effects for winning and losing,  $F(1, 134) = 6.15, p < .05$ , for discussion,  $F(1, 134) = 7.61, p < .01$ , and a significant interaction effect between the two,  $F(1, 134) = 8.41, p < .01$ . Losers outperformed winners in monetary performance ( $M = 2.48, S.D. = 2.73$  for losers,

$M = 1.38$ ,  $S.D. = 2.97$  for winners). Figure 10 presents both the main effects and interaction effect between discussion and winning versus losing.

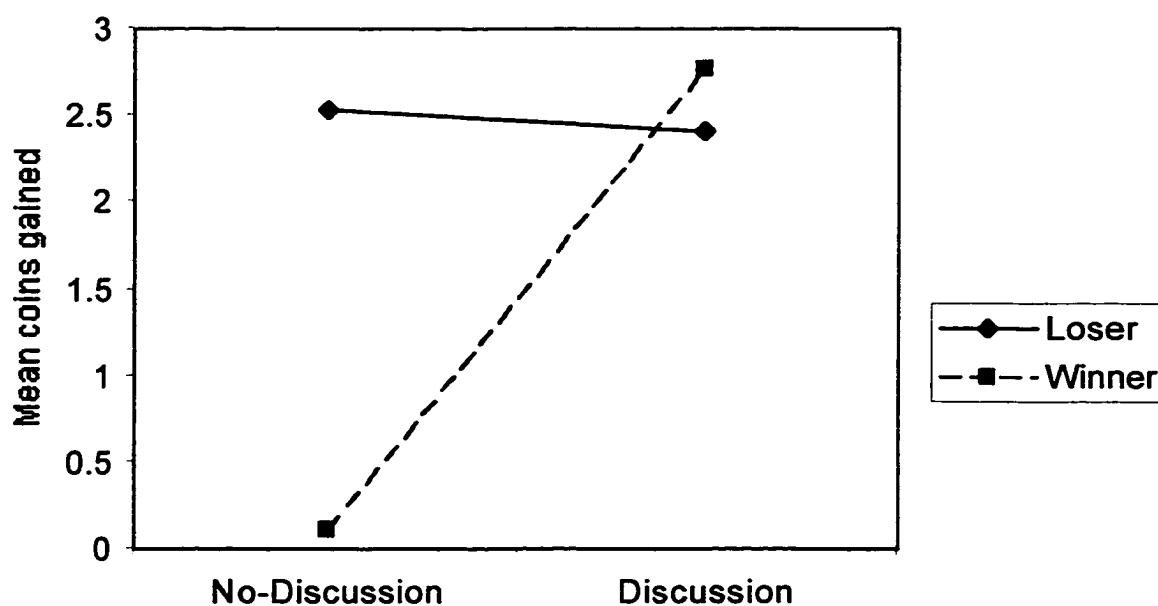


FIGURE 10. Monetary Performance by Winners and Losers

In the No-Discussion condition, losers performed better than winners ( $M = 2.54$ ,  $S.D. = 2.73$  for losers and  $M = .11$ ,  $S.D. = 2.70$  for winners respectively),  $F(1, 72) = 14.85$ ,  $p < .001$ , but the difference in monetary performance between losers and winners disappeared in the Discussion condition ( $M = 2.41$ ,  $S.D. = 2.73$  for losers and  $M = 2.76$ ,  $S.D. = 2.65$  for winners respectively),  $F(1, 66) = .29$ ,  $p = n.s.$ . A summary of the results is presented in Tables 26 and 27 in Appendix K. Next, I classified the incidence of matched choices between losers and winners in order to examine the reason for the gap in monetary performance between these two groups.

### Defection by Losers When There is no Discussion

In the PD game, as I mentioned earlier, three matched choices are possible; mutual defection (DD), mutual cooperation (CC), and unilateral cooperation (Dc or CD). Mutual cooperation (CC) and mutual defection (DD) generate equal payoffs for both losers and winners, but unilateral cooperation provides different payoffs for the players. Therefore, I focused on the occurrence of relative gain for the players in unilateral cooperation. Figure 11 shows both the main effects and the interaction between discussion and winning versus losing on defecting choices.

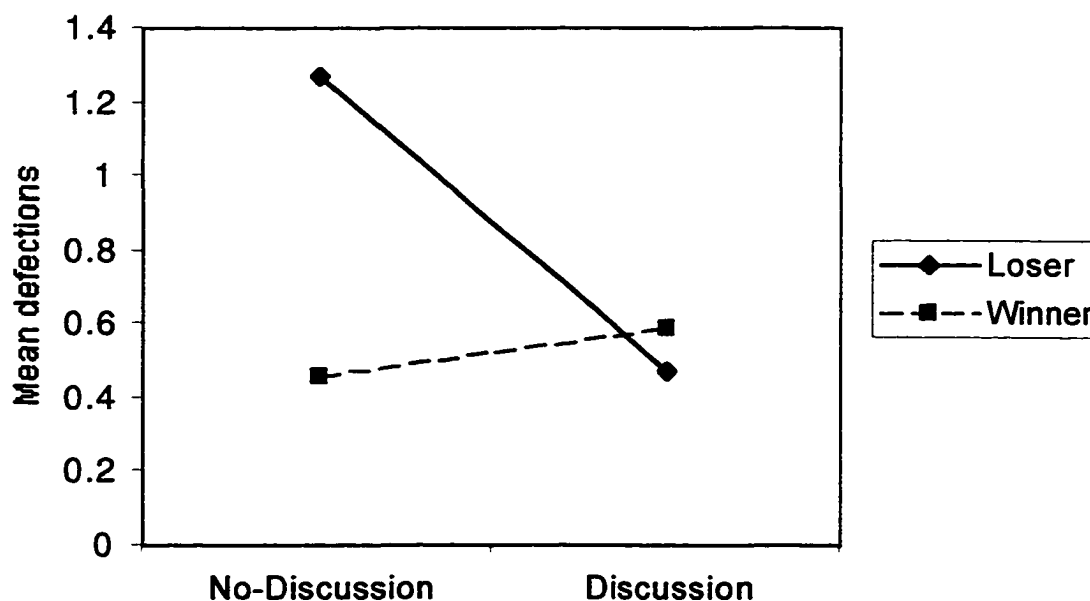


FIGURE 11. Defection by Losers

In the No-Discussion condition, more losers became defectors than did winners ( $M = 1.27$ ,  $S.D. = 1.19$  for losers and  $M = .46$ ,  $S.D. = .77$  for winners respectively),  $F(1, 72) = 12.08$ ,  $p < .001$ . In contrast, winners and losers did not show a significant difference in the number of defections after discussion ( $M = .47$ ,  $S.D. = .86$ , for losers and  $M = .59$ ,  $S.D. = 1.1$  for winners),  $F(1, 66) = .24$ ,  $p = n.s.$ . On average, the mean relative gain was higher for the losers than for the winners ( $M = .89$ ,  $S.D. = 1.12$  for the losers and  $M = .52$ ,  $S.D. = .94$  for the winners). The results are summarized in Tables 28 and 29 in Appendix K.

### Winners' Choice and Losers' Choice

#### Synopsis

The results show that, overall, being a winner or a loser did not influence subsequent cooperative choices. There was, however, a significant interaction effect between discussion and winning versus losing. A significant main effect for discussion was detected. In the No-Discussion condition, losers' mean cooperative choices were significantly lower than winners' mean cooperative choices. In the Discussion condition, losers and winners showed no significant difference in mean cooperative choices.

#### Statistical Results

A two-way ANCOVA showed that only gender provided a significant adjustment toward cooperative choices,  $F(1, 134) = 8.02$ ,  $p < .01$ . Female



subjects cooperated more than did male subjects. After adjustment by covariates, there was no significant main effect for winning and losing on the cooperative choices in the subsequent PDGs. However, a significant main effect for discussion,  $F(1, 134) = 23.00, p < .001$ , and an interaction,  $F(1, 134) = 3.86, p < .05$ , emerged on the cooperative choices. Figure 12 presents the main effects and the interaction effect between discussion and winning versus losing on cooperative choices.

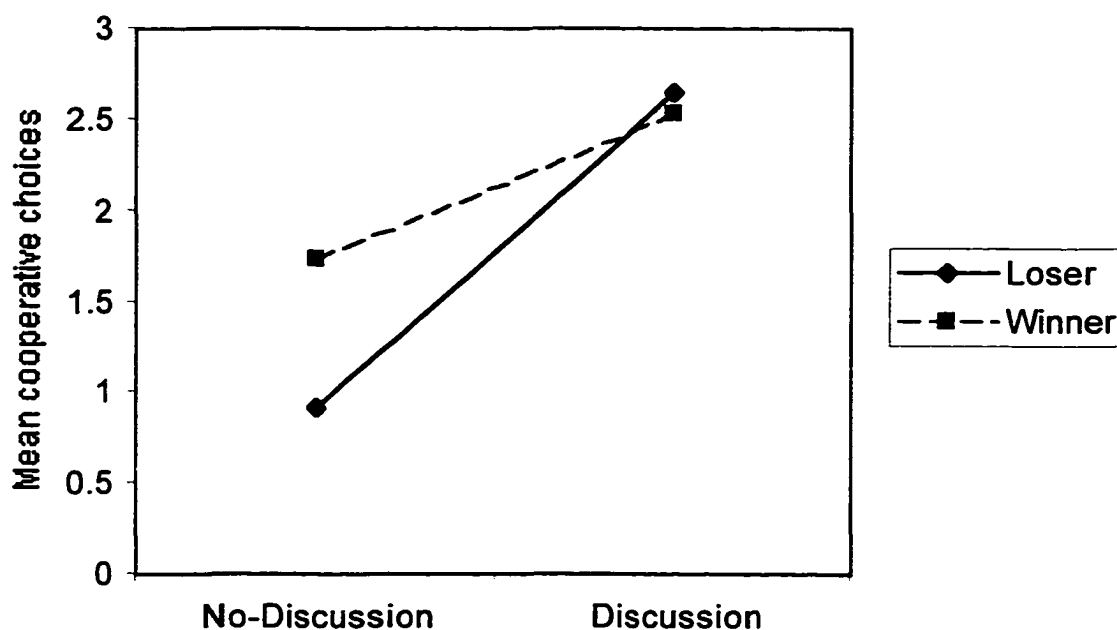


FIGURE 12. Cooperative Choices by Winners and Losers

Losers made significantly lower mean cooperative choices than did winners when there was no discussion arranged ( $M = .92, S.D. = 1.26$  for losers and  $M = 1.73, S.D. = 1.73$  for winners respectively),  $F(1, 72) = 7.55, p < .01$ . In

contrast, winners and losers showed no significant difference and similarly increased their cooperative choices with discussion ( $M = 2.65$ ,  $S.D. = 1.35$  for losers and  $M = 3.09$ ,  $S.D. = 1.24$  for winners respectively),  $F(1, 66) = 0.1$ ,  $p = n.s.$ . The results are summarized in Tables 30 and 31 in Appendix K.

### Expectation of Other's Intention by Winners and Losers

#### Synopsis

The results show that being a winner or a loser did not affect expectations of cooperation from co-players. No significant interaction between discussion and winning versus losing on expectations emerged either.

#### Statistical Results

A two-way ANCOVA yielded that only gender uniquely adjusted the expectations,  $F(1, 134) = 5.41$ ,  $p < .05$ . Female subjects expected more cooperation from their co-players than did male subjects. After adjustment by covariates, the main effect for discussion is significant,  $F(1, 134) = 11.78$ ,  $p < .001$ , but the main effect for winning and losing and the interaction effect between discussion and winning versus losing were not significant on expectations of cooperation from others. The results are summarized in Tables 32 and 33 in Appendix K.

## The Choices in Light of Expectations: Winners and Losers

### Synopsis

Losers made more choices for individualistic gain (Dd) than did winners. For the choices for relative gain (Dc), there was no significant difference between losers and winners. When there was no discussion, losers made fewer choices for mutual gain (Cc) than did winners. Discussion increased the choices for mutual gain (Cc) for both winners and losers and eliminated the difference of mean Ccs between losers and winners.

### Statistical Results

A two-way MANCOVA was conducted on three choices in light of expectations: Cc, Dc and Dd. As noted earlier, the altruistic choices (Cd) were excluded from the analysis due to linear dependency among the four choices and for the degree of freedom. Correlation among the other three choices ranged from -.17 to -.72. Gender, ethnicity and nationality were used as covariates.

The regression portion of the analysis was significant, Wilks'  $\lambda = .865$ , approximate  $F(9, 322) = 2.19$ ,  $p < .05$ , indicating that combined covariates were significantly related to the three choices. Standardized regression coefficients reflected that only gender provided significant adjustment to Cc choices,  $\beta = .22$ ,  $p < .01$  and Dd choices,  $\beta = -.18$ ,  $p < .05$ , which indicated that female subjects made more Ccs and fewer Dds than male subjects. None of the other two

covariates, ethnicity and nationality, provided a significant adjustment to Dd, Cc, and Dc choices.

The analysis of variance portion of the analysis showed that there was a significant main effect for discussion, Wilks'  $\lambda = .830$ ,  $F(3, 132) = 9.00$ ,  $p < .001$  but no significant main effect for winning and losing, Wilks'  $\lambda = .966$ ,  $F(3, 132) = n.s.$  and no interaction between the two, Wilks'  $\lambda = .970$ ,  $F(3, 132) = n.s.$ . The strength of the discussion effect on the three choices was approximately  $\eta^2 = .17$ .

A follow-up univariate F test after adjustment for covariates indicated that a significant main effect for winning versus losing on the choices for individualistic gain (Dd),  $F(1, 134) = 3.98$ ,  $p < .05$ , but no significant main effect on other choices, Dc and Cc. Discussion significantly increased the choices for joint gain (Cc),  $F(1, 134) = 26.93$ ,  $p < .001$ , and decreased the choices for individualistic gain (Dd),  $F(1, 134) = 9.11$ ,  $p < .01$ , and for relative gain (Dc),  $F(1, 134) = 7.42$ ,  $p < .01$ . There was no significant interaction effect on all four choices. Figure 13 presents the main effects of discussion and winning versus losing on the four choices.

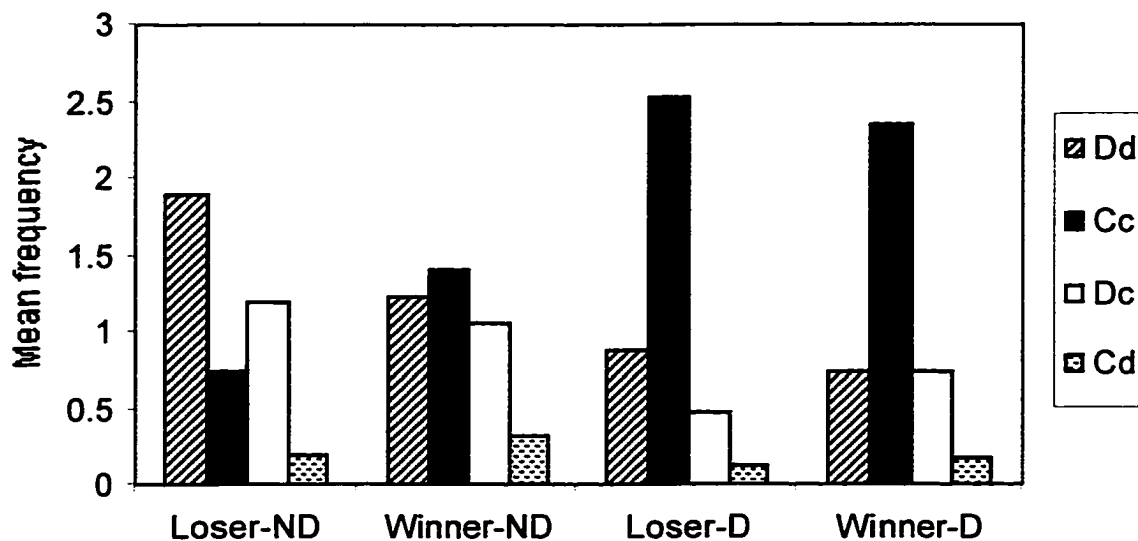


FIGURE13. Choices in Light of Expectations by Winners and Losers

Losers made more choices for individualistic gain than did winners ( $M = 1.41$ ,  $S.D. = 1.57$  for losers and  $M = .99$ ,  $S.D. = 1.22$  for winners). In No-Discussion condition, losers made more Dds ( $M = 1.89$ ,  $S.D. = 1.63$ ) than did winners ( $M = 1.22$ ,  $S.D. = 1.18$ ). Both winners and losers decreased Dds with discussion ( $M = .88$ ,  $S.D. = 1.34$  for the Loser-ND and  $M = .74$ ,  $S.D. = 1.24$  for the Winner-ND).

Figure 13 also presents the combined main and interaction effect of discussion and winning versus losing on choices for mutual gain (Cc). In the No-Discussion condition, winners made more choices for mutual gain than did losers ( $M = 1.41$ ,  $S.D. = 1.26$  for Winner-ND and  $M = .73$ ,  $S.D. = 1.22$  for Loser-ND respectively),  $F(1, 72) = 5.52$ ,  $p < .05$ . In the Discussion condition, winners and

losers showed no significant difference in the choices for mutual gain (Cc) ( $M = 2.35$ ,  $S.D. = 1.72$  for Winner-D and  $M = 2.53$ ,  $S.D. = 1.66$  for Loser-D respectively),  $F(1, 66) = .19$ ,  $p = n.s.$ . The results are presented in Tables 34, 35, and 36 in Appendix K.

### The Accuracy of Judgment by Winners and Losers

#### Synopsis

The experience of winning versus losing significantly influenced the accuracy of expectations about co-players' moves in the PDGs. Winners made significantly more optimistic errors than did losers. Discussion significantly increased the accuracy of expectations.

#### Statistical Results

A two-way MANCOVA was conducted on accurate expectations (cC or dD) and pessimistic error (dC). Correlation among the three expectations ranged from  $-.295$  to  $-.81$ . Gender, ethnicity and nationality were used as covariates.

The regression portion of the analysis was not significant, Wilks'  $\lambda = .947$ , approximate  $F(6, 266) = 1.23$ ,  $p = n.s.$ , indicating that combined covariates were not significantly related to the accuracy of expectations. The analysis of variance portion of the analysis showed that there were significant main effects for discussion, Wilks'  $\lambda = .850$ ,  $F(2, 133) = 11.76$ ,  $p < .001$ , for winning and losing, Wilks'  $\lambda = .947$ ,  $F(2, 133) = 3.71$ ,  $p < .05$  and no interaction effect between the

two, Wilks'  $\lambda = .957$ ,  $F(2, 133) = 2.96$ ,  $p = n.s.$ . The results indicated that both discussion and winning versus losing influenced the accuracy of expectations in subsequent PDGs.

A separate univariate F test showed that discussion significantly increased accurate expectations,  $F(1, 134) = 23.49$ ,  $p < .001$ , and decreased pessimistic errors,  $F(1, 134) = 4.51$ ,  $p < .05$ , as well as optimistic errors,  $F(1, 134) = 12.38$ ,  $p < .001$  about co-players' moves. The effect for winning and losing was marginal on pessimistic errors,  $F(1, 134) = 3.46$ ,  $p < .10$ . and significant on optimistic errors,  $F(1, 134) = 6.15$ ,  $p < .05$ , but not significant on accurate expectations. A significant interaction effect was found on the optimistic errors,  $F(1, 134) = 5.21$ ,  $p < .05$  but there was no significant interaction effect on accurate expectations and pessimistic errors. Figure 14 graphically presents the main effects and the interaction effect of discussion and winning versus losing on the accuracy of expectations.

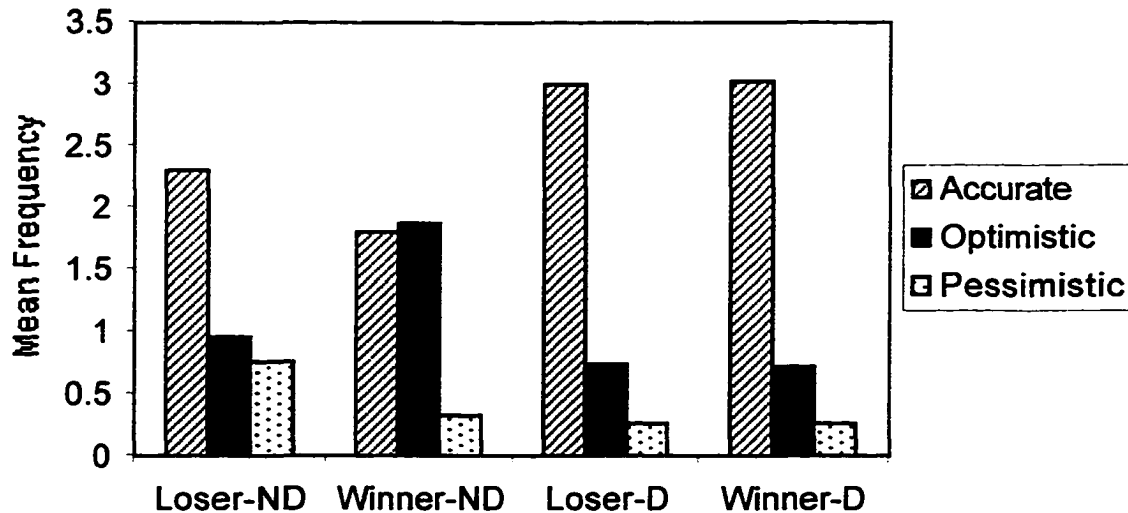


FIGURE 14. The Accuracy of Expectations by Winner and Loser

Winners made more optimistic errors (cD), on average, about co-players' (i.e. losers') choices than did losers ( $M = 1.31$ ,  $S.D. = 1.3$  for winners and  $M = .85$ ,  $S.D. = 1.14$  for losers). Winners showed marginally fewer pessimistic errors (dC) than did losers ( $M = .32$ ,  $S.D. = .78$  for winners and  $M = .76$ ,  $S.D. = .98$  for losers). Winners and losers showed no difference in accurate expectations.

In the No-Discussion condition, winners made more optimistic errors than losers ( $M = 1.86$ ,  $S.D. = 1.29$  for Winner-ND and  $M = .95$ ,  $S.D. = 1.15$  for Loser-ND respectively),  $F(1, 72) = 10.39$ ,  $p < .01$ . In the Discussion condition, winners decreased optimistic errors and the difference between winners and losers in optimistic errors disappeared ( $M = .74$ ,  $S.D. = 1.14$  for Winner-D and  $M = .71$ ,



S.D. = 1.03 for Loser-D respectively),  $F(1, 66) = .013$ ,  $p = n.s.$ . The results are presented in Tables 37, 38 and 39 in Appendix K.

### Summary of the Results

This experiment demonstrates that the experience of zero-sum competition decreases subsequent cooperation in mixed-motive PD situations at both the pair level and the individual level. Subjects in the Competition condition made fewer mean cooperative decisions than did subjects in the No-Competition condition. Discussion after competition and before the PDGs increased the cooperative choices but did not moderate the effect of prior competition.

In particular, prior zero-sum competition increased the incidence of mutual defection, but discussion decreased mutual defection and increased mutual cooperation. Discussion did not moderate the effect of prior competition on mutual defection and mutual cooperation. The analysis of choices in light of expectations showed that discussion significantly increased cooperative choices when there were such expectations and decreased defecting choices when the other was expected to defect.

Expectations of cooperation from the other person did not demonstrate the influence of prior competition but showed a marginal interaction effect for prior competition and discussion: Competition lowered the impact of discussion on expectations of cooperation.

The accuracy of expectations was not influenced by prior competition, but people who experienced competition made marginally more pessimistic errors. Discussion moderated the effect of prior competition on pessimistic errors, and the effect of prior competition on accuracy was not found when subjects had the opportunity to discuss. Discussion significantly increased the accuracy of predicting the other's choices.

Prior competition decreased while discussion increased people's welfare in the subsequent mixed-motive games. Pairs in the No-Competition condition earned significantly higher payoffs than pairs in the Competition condition. Pairs in the Discussion condition made better monetary performance than did pairs in the No-Discussion condition.

Losers cooperated significantly less than did winners in the No-Discussion condition. However, losers and winners were not different in the Discussion condition. Losers earned significantly more than winners in the No-Discussion condition, but the monetary gap between winners and losers was eliminated with discussion. There was no difference between winners and losers in their expectations of cooperation from the other person. Losers made more choices to defect given the expectation of defection from the other player, whether or not they discussed. Losers made fewer cooperative choices given the expectation of cooperation in the No-Discussion condition, but the gap between losers and winners disappeared in the Discussion condition. Winners were significantly more optimistic in their expectation of cooperation from the other person than

losers. Discussion moderated the effect of winning and losing on optimistic errors in expectation.

## CHAPTER V

### DISCUSSION

The purpose of this study was to examine the effects of prior competition and discussion on subsequent cooperation in mixed motive situations. The hypotheses predicted that the experience of competition would reduce subsequent cooperation. This chapter discusses the empirical results of this investigation. The first section discusses major findings. The second section discusses their theoretical and practical implications. The final section addresses the limitations of the research and suggests directions for future research.

#### Major Findings

The results reported in Chapter IV enhance our understanding of the effect of competition on subsequent cooperation in several ways. First, prior zero-sum competition decreases subsequent cooperation at both the pair level and the individual level. People who experienced zero-sum competition subsequently made less cooperative choices in mixed-motive situations. Second, discussion increases cooperation substantially, but it does not remove the negative effect of prior competition. After discussion, people cooperated more for mutual gains. However, in both the Discussion and the No-Discussion conditions, subjects with prior competitive experience consistently cooperated less than did

subjects with no such prior experience. The results indicate that discussion, despite its strong positive impact on cooperation, may not be able to erase the negative influence of prior competition.

Third, discussion does moderate the effect of winning versus losing on subsequent cooperation. Losers cooperate significantly less than winners when there is no discussion. After discussion, however, losers and winners showed no difference in their cooperation. That is to say, the arrangement of discussion between winners and losers eliminates the gap between the two in subsequent cooperation.

Fourth, the experience of prior winning versus losing is significantly associated with monetary performance in the subsequent PD games. Losers in the prior competition earned more than winners. Particularly in the No-Discussion condition, losers defected significantly more than winners and took advantage of the winners' cooperation. Discussion, however, removed the monetary gap between winners and losers and increased the monetary performance of both parties.

Fifth, neither the experience of prior competition nor that of winning versus losing changes the expectations of subsequent cooperation. However, discussion increases the expectation of cooperation from the other person. The results showed only a marginal interaction effect for prior competition and discussion, and for winning versus losing and discussion at the  $p < .10$  level. The statistical significance at this level is not reliable and the marginal effects could

be due to chance. Further investigation is necessary to confirm the effect of prior competition on expectations.

Sixth, discussion significantly increases the accuracy of judgment about the other's intention. Face-to-face communication might provide people with the chance to understand the other's psychological and emotional states. In many cases, discussion led to mutual promises to cooperate and most subjects seemed to be bound by these promises in their choices. Discussion seemed to provide the basis for predicting the other's behavior.

Seventh, the experience of prior competition does not bias the accuracy of judgment. But winners and losers show differences in their judgment. Winners make more optimistic errors than do losers in their expectations of cooperation when there is no discussion. More winners than losers tend to misjudge that their co-players will cooperate with them.

The results strongly support the linkage between the experience of prior competition and subsequent cooperation in mixed-motive situations. The experience of prior competition decreased subsequent cooperation, and the differences in subsequent cooperation between losers and winners were moderated by discussion.

### Theoretical and Managerial Implications

The theoretical context for this study drew on research from both experimental games and social psychology. The study begins with the notion that

the zero-sum game and the PD game are formally independent. The review of game research concluded that there is no formal basis for predicting a connection between the experience of zero-sum competition and subsequent cooperation in a PD game. This study attempted to identify any linkage between behavior in two different games. The results showed that people do not see the two different games as independent. Playing the zero-sum game decreased cooperation in the subsequent PD game. There is clearly a psychological link in people's mind, which motivates them to use their prior competitive experience in their cooperation in the different game. As proposed in the conceptual model in Chapter Two, the prior competitive experience appears to prime people with competition and the pursuit of self-interests, which suppress the motive to pursue mutual gains.

The findings imply that a strict competitive situation itself, regardless of people's intent to compete or not in the zero-sum game, affects subsequent cooperation. The study has focused on a strict competition where a third party, the experimenter, forces subjects to enter competition. A voluntary entry of competition that provides people with the option to exit if they do not want to compete was not considered here. Therefore, behavior in the zero-sum game was not mainly caused by subjects' willingness to compete but by the external forces and the game structure that had negative outcome interdependence.

Subjects in the zero-sum game, however, did perceive their behavior and co-players' behavior as competitive. What the subjects in the competition had

done was simply to make a choice between two given strategic choices that always led to opposite payoffs. Subjects might perceive the payoffs of the zero-sum game as strictly competitive. However, they did not have rational reason to perceive the other's decision-making behavior as competitive unless they were influenced by the fundamental attribution error. Even though competition was driven by external forces rather than by the subjects' willingness to compete, the experience of forced competition influenced subjects' perception of the surrounding situations and took subjects' attentions to becoming competitive and protecting their self-interests. These perceptions and motivations seemed to be carried over to the subsequent mixed-motive PD games.

The experience of competition does change people's willingness to cooperate and particularly influences losers in the prior competition the most. The decrease of cooperation in the No-Discussion condition is primarily accounted for by losers' unwillingness to cooperate. Only 25 percent of the prior losers cooperated whereas the prior winners cooperated around 40 percent, which is slightly above that of the control group in the No-Discussion condition. This implies that winners were not influenced much by prior competitive experience. To the contrary, both winners and losers equally cooperated but still less than the control group by around 13 percent when there was discussion. From this, we may infer that prior competitive experience influences losers more negatively than winners when there is no discussion.



In the subsequent PD games particularly when there was no discussion, many prior losers became defectors in their interaction with prior winners. They took advantage of winners' cooperation by choosing defection. Several explanations are possible to account for these differences between winners and losers.

The reciprocity mechanism toward the other co-player may differentiate the responses of losers from winners. Losers fail to attain resources in the zero-sum game due to the winning of their co-player. To the contrary, winners achieve their resources at the expense of their co-player's loss. As noted in the Chapter Two, the reciprocity norm tells us to reward those who did good to you and retaliate those who did harm to you. Losers have few reasons to reciprocate positively to the winners who have deprived the resources from them. In subsequent interaction with their previous competitor, losers may intend to reciprocate their co-player's blocking behavior by choosing defection even though the blocking behavior is primarily caused by the negative interdependent situation. Winners may reciprocate their co-player's previous facilitating behavior by cooperating in subsequent interaction.

The different values of gain and loss for the two parties may contribute to different responses toward subsequent cooperation. As prospect theory (Kahneman & Tversky, 1979) noted, the value of losses for the losers will be greater than the value of gains for the winners. The loss of resources that might have been avoided will greatly impact losers to compensate their losses in the

subsequent game. Winners will be affected relatively less than losers by the prior competition. The reference points for the winners and losers in the subsequent game appear to be different. In this study, both losers and winners received one dollar at the beginning of Game Two as the resource money. Many losers in the game seemed to perceive this resource money as a sure gain and made defecting choices to protect that resource. Winners might perceive the resource money as an addition to their already-earned resources, which does not provide a great value.

When choosing defection, losers did not seem to expect that they would become defectors at the expense of winners' cooperation. The analysis of choices in light of one's expectation showed that losers defected significantly more in expectation of the winners' defection while winners cooperated more in expectation of the losers' cooperation. In the post-experimental questionnaire, losers reported significantly more risk-avoiding ( $M = 5.39$ ,  $S.D. = 1.79$ ) in their choices than did winners ( $M = 4.30$ ,  $S.D. = 2.05$ ),  $F(1, 133) = 12.35$ ,  $p < .001$ . The results can be interpreted as saying that winners and losers had different beliefs about what the other person would choose. Losers seemed to choose defection in order to avoid the sucker's payoff, not for the relative gain, whereas winners seemed to choose cooperation for mutual gain.

The responses of losers and winners will vary depending on their interacting parties in subsequent games. If losers encounter new interacting parties other than winners who have defeated them, losers will show different

responses from the results of this study. Losers may be pro-social and cooperative to the new partners to make up their losses in a constructive way. Alternatively, losers may become less cooperative than other people because of their possible loss of self-esteem in the previous game. It will be interesting to conduct an experiment that untangles the response of winners and losers toward the third parties. The design should include interaction between losers and third parties who does not have competitive experiences, among losers, and among winners.

Discussion removed the barrier between losers and winners and led them to increased cooperation. Discussion seemed to work out as a peace-making mechanism to promote cooperation between losers and winners. Discussion was particularly effective on the losers' return to cooperation. I have not identified why the face-to-face communication with winners changed losers' willingness to cooperate substantially.

As noted earlier, discussion did not eliminate the negative effect of prior competitive experiences. This implies that once people experience competition the experiences are conserved in them and ex-post-facto measures to remedy the conflict may not fully overcome the effects of such experiences.

The results showed that discussion increases the accuracy of expectations. The question comes up whether people in the discussion group really become more accurate or whether they just think the same way as those in the No-Discussion group but the world changes and so they happen to become

more accurate. Data showed that subjects in the Discussion condition did cooperate more and expected more cooperation from their co-players than did those in the No-Discussion condition. The high accuracy of subjects' expectation in the Discussion condition might be caused by both behavioral and cognitive impact of discussion.

The current study supports the implication that competition that is "sound" in terms of fairness does not curtail the negative impact of competition. Subjects understood that they were competing against each other at the beginning of the zero-sum game and they perceived the game as fair. Subjects perceived the zero-sum game ( $M = 5.71$ ,  $S.D. = 1.6$ ) fairer than the PDG ( $M = 5.17$ ,  $S.D. = 1.64$ ) and the estimation game ( $M = 5.34$ ,  $S.D. = 1.58$ ). Even after such fair and explicit competition, subjects decreased cooperation in a subsequently different game with their previous competitors.

The findings share common ground with those in the iterated PDG research. As noted earlier, the iterated PDG research found that cooperation thrives from previous mutual cooperation and decreases by previous defection. (Bettenhausen & Murnighan, 1991). If we categorize both strict competition in the zero-sum game and defection in the PDG as forms of conflict, we may conclude that the experience of prior conflict from either strictly competitive or mix-motive situations decreases subsequent cooperation.

### Implication for Managers

Maximizing efficiency and effectiveness of cooperation has been one of the main concerns in designing organizational structures and managing organizational members (Smith, Carroll, & Ashford, 1995). If the findings are generally valid, the implications for the managers are clear. When adopting competition in an organizational structure to motivate members or to allocate scarce resources efficiently, managers should consider the possible negative effect of competition on cooperation in other contexts. Even if competition adopted by an organization is explicit and fair in terms of procedural and distributive justice, strict competition may decrease subsequent cooperation among co-workers.

If strict competition is inevitable, such peace-making mechanisms as discussion after competition is helpful in promoting subsequent cooperation particularly between winners and losers. Even though discussion does not eliminate the effect of competition completely, discussion will increase the overall level of cooperation among organizational members.

The implications are applicable to designing compensation systems, recruitment and selection of work teams, career development, and other human resource management practices. For example, two vice presidents competing for the president position will be motivated to outperform the other party and to improve their performance appraisals. When one becomes the president while

the other does not, this study indicates that cooperation is less likely between the two. Anecdotal evidence shows that losers after strict competition often leave the organizations rather than participate in cooperation with the winners.

A configurational approach that considers the relationship between competition and cooperation is helpful for organizations to reap advantages of competition's positive effects. The often-stated importance of communication is reinforced in this study. Practitioners are advised to arrange a face-to-face discussion between participants of competition to remedy the aftermath of competition.

#### Limitations

This study, of course, has limitations in generalizing the findings to the managerial world. Experimental games have received some criticism on the simplification of human behavior and the lack of external validity of the research (Pruitt & Kimmel, 1976). The nature of the tasks used in experimental games is highly abstract and artificial. But compared with other experimental tasks, experimental games have a relative strength in generalizability (Tedeschi et al., 1973). The games were directly adopted from formal games that have been modeled with theoretical abstraction and restrictive assumptions of behavior. The explanatory power of the zero-sum game and the PDG has been well recognized in providing a metaphoric interpretation of the real world (Colman, 1995).

Experimental games also produce a strong experimental realism that involves subjects seriously in the game situations. Compared with the real world, the competitive situation in this study may appear to be trivial: subjects wagered the money received from the experimenters, played with strangers randomly assigned to them, made choices, and became winners and losers. The results, however, showed that subjects were involved in the competition and were influenced by these competitive experiences. If the primary purpose of experimentation is to identify cause-effect relationship, as noted by Tedeschi and colleagues (1973), this study appears to fulfill that purpose.

The use of undergraduate students as subjects in this study may also limit the generalizability of the results to a managerial context. Undergraduate students generally have less organizational life experiences than employees. People have regular contact with one another in real organizations. For many subjects in this study, their first encounter was in the lab, which may not represent mundane realism of organizational contexts. However, the pool of subjects shared similarities with real organizations. Subjects had the same organizational membership - the same university - and most were taking the same class. They were engaged in similar jobs, i.e. studying, and regularly encountered colleagues at the workplace - the classroom.

The time interval between prior competition and the subsequent PD game may be too short to identify the sustaining influence of prior competition. The same reward instrument (money) in both games, and the experimental settings

may cause the subjects to perceive the two different games as one game. In order to control for this possibility, the experimenter repeatedly reminded subjects through the instructions and questionnaire that they were playing two different games and the rewards and outcomes of Game One and Two were separate.

Using one reward instrument (i.e. money) and similar tasks (i.e. strategic decision making) across two games may limit interpretation of the results. People compete and cooperate for various resources such as facilities, operating funds, services, titles, status, and physical space. Various knowledge, skill, and ability are required in competition and cooperation in real organizational contexts. Depending on the dimension of competition and cooperation, the mechanism of competition and cooperation would vary. Self-evaluation maintenance theory (Tesser, 1988) noted that people tend to bask in other's success when the successful outcome is not relevant to their self-esteem. When other's success is relevant to their self-esteem people tend to distance themselves from the successful person. If prior competition is irrelevant to losers' self-esteem and the losers gladly bask in the other's winning, the experience of prior competition may not decrease subsequent cooperation.

This study, however, did not focus on the specific dimension of competition and cooperation but examined the general relationship between prior competition and subsequent cooperation. Considering the metaphoric nature of games that simplify and abstract complex social situations, this study using



games still provides useful implications for the relationship. The use of money as a target resource also adds strength, instead of weakness, to this study. Because money is the concise form of various resources, it encapsulates the reward metaphor.

### Future Research

The current study suggests a number of directions for further research. This section focuses on developing a specific research agenda that can extend the research findings and address potential limitation this study.

### Payoff Structure

Cooperation in a PDG depends on the game's payoff structure. Rapoport and Chammah (1965) proposed an index of cooperation for the PDG defined by  $K = (R-P) / (T-S)$ , where K represents the index, and R, P, T, and S represent the payoffs of the choices as shown in Figure 1. They noted that cooperation increases when the reward for mutual cooperation (R) or the punishment for mutual defection increases (P). Murnighan and Roth (1983) also found that noncooperatively structured PD games almost invariably led to noncooperative choices and cooperative structures led to frequent cooperation.

The present study used one payoff structure that yielded low base-rate cooperation. The validity of the influence of prior competition is not tested in other PDGs with different incentives for cooperation. An examination of the effect of

prior competition on the PDGs with extremely cooperative payoff structures will extend the validity of this research.

### Domain of Competition

Modification of the domain of competition and cooperation will also extend our understanding of the dynamics of competition and cooperation. As self-evaluation maintenance theory (Tesser, 1988) implies, subsequent cooperation will depend upon the domain of prior competition and its relevance to self-esteem. The domain of competition and cooperation can be modified by the substitution of the target rewards with nonmaterial resources such as grades, prestige or positions. In the current experimental framework, the amount of rewards is relatively smaller than those in real organizations. By differentiating the amounts of target resources, the influence of prior competition may provide different impact on subsequent cooperation.

### Gender and Nationality

Such demographic variables as gender, ethnicity and nationality had a strong predictive power for cooperation. Female subjects cooperated significantly more than male subjects ( $M = 2.46$ ,  $S.D. = 1.44$  for female and  $M = 1.88$ ,  $S.D. = 1.70$  for male), which is contradictory to the results by Rapoport and Chamah (1965) that male were more cooperative in the PD Game. Prior competitive

experiences may cause this inconsistency of results. Further investigation is necessary to identify this inconsistency.

White subjects cooperated more ( $M = 2.41$ ,  $S.D. = 1.64$ ) than Non-White subjects ( $M = 1.80$ ,  $S.D. = 1.50$ ) and US subjects cooperated more ( $M = 2.38$ ,  $S.D. = 1.62$ ) than Non-US subjects ( $M = 1.69$ ,  $S.D. = 1.49$ ). The results are consistent with what Yamagichi (1986) had found that Asians are more competitive under no institutional arrangement or sanctions.

This study used those variables as control variables to clarify the main effect for competition and discussion on the dependent variables. Interaction effects between strict competition and those demographic variables on subsequent cooperation need to be examined. The identification of the interaction effects will provide useful implications for the issue of work group diversity and compensation of work teams.

### Summary and Conclusion

The purpose of this research was to improve our understanding of the effects of zero-sum competition on subsequent cooperation in mixed motive situations, and to examine whether discussion moderates the relationship between prior competition and subsequent cooperation. The relationship was identified that prior competition decreases cooperation. Particularly losers decreased subsequent cooperation with winners if there was no communication. This study confirmed that discussion promotes subsequent cooperation. It also

identified that discussion does not moderate the effect of prior competition but moderates the effect of winning and losing on subsequent cooperation.

The current study offers, I believe, valuable insights for both experimental game researchers and practitioners. The study drew our attention to the impact of pure competition that had not been studied much empirically. The methodological framework used in this study provides a more refined experimental context for studying the relationship between competition and cooperation. Implications are suggested for managers who are in need of harmonizing team efforts as well as vitalizing individual motivation to maximize the efficiency and effectiveness of their organizations. A direction for future research is suggested to clarify the deep structure of the relationship between prior competition and cooperation.

**APPENDIX A**

**INSTRUCTIONS FOR GAME ONE**

For the Competition Condition

[ ]: Instructions to the experimenters  
 Indented body text: Instructions to subjects

[WHEN SUBJECTS ARRIVE IN THE ROOM, HAND OUT ONE DOLLAR SAYING]

This is for your participation of the experiment and will be your starting money.

[DISTRIBUTE THE CONSENT FORMS AND EXPERIMENTAL MATERIALS TO THE SUBJECTS. ASK THEM TO READ AND SIGN THE CONSENT FORM FIRST AND TO FILL RESEARCH ID SECTION BY WRITING THE LAST FOUR DIGIT OF THEIR STUDENT NUMBER. ASK THEM TO COPY THEIR RESEARCH ID ON A SEPARATE CARD. THEN, PAIR SUBJECTS OFF AND ASK THEM NOT TO TALK AMONG THEMSELVES]

There are two separate studies going on here in forms of two games; You will be involved in both. You will play the two games with the other participant. Any questions?

[ANSWER ANY QUESTIONS]

Now, you are going to play Game One. Please turn to the next page. In this study, you will be making a series of decisions that involve the other person here. These decisions are like many you make in everyday life. Like many decisions in everyday life, there are risks involved—you can gain, but you can also lose.

You have received \$1 for participating in this first study: Game One. In Game One, the \$1 you received will be wagered against the other's one dollar. You can either gain \$2 in total or lose the \$1 depending on your strategic decision and the other's decision.

I will explain the rules and procedure of Game One

In Game One, you will play 5 sessions of a 2\*2 matrix game. In each session, you may gain or lose points depending on your decision and the other person's decision. At the end of 5 sessions, the scores you make in each session will be accumulated and the final scores will be compared with each other.

The person who has more points than the other person will become the winner of Game One and will win \$2 and the other person who is

outscored gains no money. In other words, only the winner in Game One will take \$2 and the loser will gain no money.

Any questions?

Please look at the exercise form.

Your choice, and the other person's choice in each session, is between what we call "A" and "B". The other person's alternatives are listed along the top, and yours are along the left side. Then there is a payoff matrix. Look first at the payoff matrix. The values in the boxes are the amount of points for you and the other person involved in each case. The circled one in each box is your points.

[INDICATING THE PAYOFFS IN THE MATRIX AND THE EXAMPLE IS LIKE THIS]

Here's how it works:

First, as you see the payoffs in each box, your payoffs and the other's payoffs are always opposite. In each game result, one's gain always lead to the other's loss exactly the same amount. When you lose points, the other person will gain as much and vice versa.

Second, depending on your choice and the other's choice, your payoffs will change. Whatever you choose between A and B, there is possibility of gain and loss in each choice.

Third, There are best outcomes for each player.

For the person who has Form A, your best game outcome is either (A, A) or (B, B). Whenever your choice matches with the other person's choice, such as (A, A) or (B, B), you will gain points and the other person will lose points. On the other hand, the other person who has Form B, your best game outcome is either (A, B), or (B, A). Whenever your choice avoids matching with the other person's choice such as (A,B) or (B, A), you will gain.

Forth, for the successful game outcome, It is important that you should accurately guess what the other person will choose. You may judge of the other's preference, strategy, and tendency of risk taking. You may also guess what the other person is anticipating from you about your preference and strategy.

The game's strategy is similar to rock, paper and scissors but has explicit values so you can predict.

Now, please play the exercise session with the other person to make sure everybody does understand payoff structure and rules of the Game One. Please fill out the question 1 and 2.

[HAVE THEM PLAY ONE PRACTICE SESSION]

Now please tell your choice to the experimenter and compare your choice with the other person and calculate your points.

[ WRITE DOWN THE CHOICES ON A BOARD SO THAT THE PLAYERS CAN SEE WHO WON AND WHO LOST. ANNOUNCE THE WINNER AND THE LOSER OF THE EXERCISE SESSION]

Please fill out the question 3 in the exercise. Who wins more points? Again, this is an exercise and the points you earned in this exercise session will not be counted. Any questions?

[ASK EACH STUDENT TO HAND IN THE ONE DOLLAR AND PUT THAT MONEY IN A PLASTIC BOTTLE FOR BOTH OF THEM TO SEE. SUBJECTS SEE \$2 IN A BOTTLE IN FRONT OF THEM. THE EXPERIMENTER INSISTS ON NO DISCUSSION AMONG THEMSELVES AT THIS STAGE. THEN SAY....]

In each session, I will record the results of the session on the paper so that both of you can see and copy them in the question 3 in each session. From now on, the points you will earn in each session will be accumulated. Please don't talk among yourselves. If you have any questions, please raise your hand. Now start the session one.

[ AFTER 1 MINUTE OF STARTING GAME ONE, ANNOUNCE]

Does anybody need more time? If not, I will give you the result of the first session. Please show your choice to me and the other person.

[ WRITE DOWN TWO PLAYERS' CHOICES AND KEEP THE SCORES ON THE BOARD. CALCULATE AND READ THE RESULT]

Player --- wins ...points and player loses ..... points in this session. Please copy the results to your questionnaire.

[AFTER 30 TO 40 SECONDS AND SAY]

Now start the session 2.

[ AFTER 1 MINUTE, ANNOUNCE]

Does anybody need more time? If not, I will give you the result of the second session. Please show your choice to me and the other person.



**[ WRITE DOWN TWO PLAYERS' CHOICES AND KEEP THE SCORES ON THE BOARD. CALCULATE AND READ THE RESULT ]**

Player — wins ...points and player loses ..... points in this session.  
Please copy the results to your questionnaire.

**[AFTER 30 TO 40 SECONDS AND SAY]**

Now start the session 3.

**[AFTER 1 MINUTE, ANNOUNCE]**

Does anybody need more time? If not, I will give you the result of the third session. Please show your choice to me and the other person.

**[ WRITE DOWN TWO PLAYERS' CHOICES AND KEEP THE SCORES ON THE BOARD. CALCULATE AND READ THE RESULT ]**

Player — wins ...points and player loses ..... points in this session.  
Please copy the results to your questionnaire.

**[AFTER 30 TO 40 SECONDS AND SAY]**

Now start the session 4.

**[AFTER 1 MINUTE, ANNOUNCE]**

Does anybody need more time? If not, I will give you the result of the fourth session. Please show your choice to me and the other person.

**[ WRITE DOWN TWO PLAYERS' CHOICES AND KEEP THE SCORES ON THE BOARD. CALCULATE AND READ THE RESULT ]**

Player — wins ...points and player loses ..... points in this session.  
Please copy the results to your questionnaire.

**[AFTER 30 TO 40 SECONDS AND SAY]**

Now start the session 5.

**[AFTER 1 MINUTE, ANNOUNCE]**

Does anybody need more time? If not, I will give you the result of the fifth session. Please show your choice to me and the other person.

[ WRITE DOWN TWO PLAYERS' CHOICES AND KEEP THE SCORES ON THE BOARD. CALCULATE AND READ THE RESULT ]

Player \_\_\_ wins ...points and player loses ..... points in this session. Please copy the results to your questionnaire.

[AFTER 30 TO 40 SECONDS AND SAY]

Now you finished all the five sessions. Please add the points you have earned in all the 5 sessions. The person who earns more points than the other person wins the \$2 in Game One.

[ IDENTIFY THE WINNER AND GIVE AWAY \$2 IN THE BOTTLE TO THE WINNER ]

Player \_\_\_ is the winner of Game One and player \_\_\_ is the loser of Game One. This is the end of Game One. In a few minutes there will be Game Two.

In the meantime, there is a questionnaire we would like you to fill out. Please turn to the next page and fill out the questionnaire. In each column, please assign a number from 1 to 7 that best describes your thoughts and feelings. For example, If you think Game One is moderately interesting, you may mark 4, or 3, or 5. If you think the game is not interesting at all, mark 1, or 2. If the game is interesting to a great extent, mark 6 or 7. Please fill in all the questions on the page and the next page. Your considerate response is important to us.

[ After 5 minutes ]

Does anyone need more time? If not, Please turn to next page and we will start Game Two.

For the No-Competition Condition

[ ]: Instructions to the experimenters  
 Indented body text: Instructions to subjects

**[WHEN SUBJECTS ARRIVE IN THE ROOM, DISTRIBUTE THE CONSENT FORM AND EXPERIMENTAL MATERIALS TO SUBJECTS. ASK THEM TO READ AND SIGN THE CONSENT FORM AND FILL RESEARCH ID SECTION BY WRITING THE LAST FOUR DIGIT OF THEIR STUDENT NUMBER. ASK THEM TO COPY THEIR RESEARCH ID ON A SEPARATE CARD. PAIR THEM OFF AND ASK THEM NOT TO TALK AMONG THEMSELVES]**

There are two separate studies going on here in forms of two games. You will be involved in both. You will play the two games with the other participant. Any questions?

**[ANSWER ANY QUESTIONS]**

Now you are going to play Game One. Please turn to the next page. I want to emphasize that what we're interested in here is how you perceive these 6 pictures and judge emotional state of the persons in the pictures. Please match the letter of each picture with one of the adjectives provided below that best describes the pictures. Do you have any questions?  
 Please fill out the question 1 and 2

**[AFTER 2-3 MINUTES AND ASK]**

Does anyone need more time? If not, I will give you the answers of Question 1. Picture a describes happiness. Picture b describes disgust. Picture c describes surprise. Picture d describes sadness. Picture e describes anger. Picture f describes fear. How many correct answers do you have?

**[CHECK THE QUESTIONNAIRE OF EACH PARTICIPANT]**

Now, turn to the next page and fill out Question 3. Your task is to write down your best estimate of the percentage of surveyed people who accurately responded to judging the emotional state of each picture presented in the question one. If you do not understand the question 3, please raise your hand and I will explain it to you. Any questions?

**[ AFTER 2-3 MINUTES]**

Do you need more time? If not, I will show you the actual survey results.

**[DISTRIBUTE SURVEY RESULTS]**

Please fill out the survey results on the right side of each column and compare them with your estimation. Is there any difference?

**[ ASK SUBJECTS TO EXPLAIN, IF ANY, DIFFERENCES BETWEEN THEIR ESTIMATION AND THE SURVEY RESULTS]**

This is the end of Game One. In a few minutes there will be Game Two. In the meantime, there is a questionnaire we would like you to fill out. Please turn to the next page and fill out the questionnaire. In each column, please assign a number from 1 to 7 that best describes your thoughts and feelings.

For example, If you think Game One is moderately interesting, you may mark 4, or 3, or 5. If you think the game is not interesting at all, mark 1, or 2. If the game is interesting to a great extent, mark 6 or 7. Please fill in all the questions on the page and the next page. Your considerate response is important to us.

**[ After 5 minutes]**

Does anyone need more time? If not, Please turn to next page and we will start Game Two.

**APPENDIX B**

**GAME ONE: FOR THE COMPETITION CONDITION**

RESEARCH ID: A \_\_\_\_\_ - \_\_\_\_\_

# GAME ONE

FORM A

## Exercise session: Form A

		If the other person chooses	
		A	B
If YOU choose	A	(2) - 2	(-2) 2
	B	(-3) 3	(3) - 3

The circled ones are the points you will earn when you choose either A or B. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
A	A	2 points	-2 points
A	B	-2 points	2 points
B	A	-3 points	3 points
B	B	3 points	-3 points

1. Please fill in your choice and the other's choice that you expect, 2. Fill in an expected outcome in the box below and show your choice to the experimenter.

Your choice is	The other's choice That you expect is	The outcome you expect	
		You	The other

3. The outcome of this session is

You earned: (     )     The other earned: (     )

4. Who won and who lost in this session? Please Circle a word below.

I am ( **the winner**,     **the loser** ) in this session.

# Session 1

		If the other person chooses	
		A	B
If you choose	A	(2) - 2	(-2) 2
	B	(-3) 3	(3) - 3

The circled ones are the points you will earn when you choose either A or B. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
A	A	2 points	-2 points
A	B	-2 points	2 points
B	A	-3 points	3 points
B	B	3 points	-3 points

1. Please fill in **your choice and the other' choice that you expect**, 2. Fill in an expected outcome in the box below and show your choice to the experimenter.

Your choice is	The other's choice That you expect is	The outcome you expect	
		You	The other

3. The outcome of this session is

You earned: (     )    The other earned: (     )

4. Who won and who lost in this session? Please Circle a word below.

I am ( **the winner**,    **the loser** ) in this session.



# Session 2

		If the other person chooses					
		<b>A</b>	<b>B</b>				
If you choose	<b>A</b>	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">2</span> </td> <td style="text-align: center; vertical-align: middle;">- 2</td> </tr> </table>	<span style="font-size: 2em;">2</span>	- 2	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">- 2</span> </td> <td style="text-align: center; vertical-align: middle;">2</td> </tr> </table>	<span style="font-size: 2em;">- 2</span>	2
	<span style="font-size: 2em;">2</span>	- 2					
<span style="font-size: 2em;">- 2</span>	2						
<b>B</b>	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">- 3</span> </td> <td style="text-align: center; vertical-align: middle;">3</td> </tr> </table>	<span style="font-size: 2em;">- 3</span>	3	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">3</span> </td> <td style="text-align: center; vertical-align: middle;">- 3</td> </tr> </table>	<span style="font-size: 2em;">3</span>	- 3	
<span style="font-size: 2em;">- 3</span>	3						
<span style="font-size: 2em;">3</span>	- 3						

The circled ones are the points you will earn when you choose either A or B. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
<b>A</b>	<b>A</b>	<b>2 points</b>	<b>-2 points</b>
<b>A</b>	<b>B</b>	<b>-2 points</b>	<b>2 points</b>
<b>B</b>	<b>A</b>	<b>-3 points</b>	<b>3 points</b>
<b>B</b>	<b>B</b>	<b>3 points</b>	<b>-3 points</b>

1. Please fill in your choice and the other's choice that you expect, 2. Fill in an expected outcome in the box below and show your choice to the experimenter.

Your choice is	The other's choice That you expect is	The outcome you expect	
		You	The other

3. The outcome of this session is  
 You earned: (     )    The other earned: (     )

4. Who won and who lost in this session? Please Circle a word below.

I am ( **the winner,**    **the loser** ) in this session.

# Session 3

		If the other person chooses	
		<b>A</b>	<b>B</b>
If YOU choose	<b>A</b>	(2) - 2	(-2) 2
	<b>B</b>	(-3) 3	(3) - 3

The circled ones are the points you will earn when you choose either A or B. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
<b>A</b>	<b>A</b>	<b>2 points</b>	<b>-2 points</b>
<b>A</b>	<b>B</b>	<b>-2 points</b>	<b>2 points</b>
<b>B</b>	<b>A</b>	<b>-3 points</b>	<b>3 points</b>
<b>B</b>	<b>B</b>	<b>3 points</b>	<b>-3 points</b>

1. Please fill in your choice and the other's choice that you expect, 2. Fill in an expected outcome in the box below and show your choice to the experimenter.

Your choice is	The other's choice That you expect is	The outcome you expect	
		You	The other

3. The outcome of this session is  
 You earned: (     )    The other earned: (     )

4. Who won and who lost in this session? Please Circle a word below.

I am ( **the winner,**    **the loser** ) in this session.

## Session 4

		If the other person chooses					
		A	B				
If YOU choose	A	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">2</span> </td> <td style="text-align: center; vertical-align: middle;">- 2</td> </tr> </table>	<span style="font-size: 2em;">2</span>	- 2	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">- 2</span> </td> <td style="text-align: center; vertical-align: middle;">2</td> </tr> </table>	<span style="font-size: 2em;">- 2</span>	2
	<span style="font-size: 2em;">2</span>	- 2					
<span style="font-size: 2em;">- 2</span>	2						
B	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">- 3</span> </td> <td style="text-align: center; vertical-align: middle;">3</td> </tr> </table>	<span style="font-size: 2em;">- 3</span>	3	<table border="1" style="width: 100px; height: 100px;"> <tr> <td style="text-align: center; vertical-align: middle;"> <span style="font-size: 2em;">3</span> </td> <td style="text-align: center; vertical-align: middle;">- 3</td> </tr> </table>	<span style="font-size: 2em;">3</span>	- 3	
<span style="font-size: 2em;">- 3</span>	3						
<span style="font-size: 2em;">3</span>	- 3						

The circled ones are the points you will earn when you choose either A or B. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
A	A	2 points	-2 points
A	B	-2 points	2 points
B	A	-3 points	3 points
B	B	3 points	-3 points

1. Please fill in your choice and the other's choice that you expect, 2. Fill in an expected outcome in the box below and show your choice to the experimenter.

Your choice is	The other's choice That you expect is	The outcome you expect	
		You	The other

3. The outcome of this session is

You earned: (     )    The other earned: (     )

4. Who won and who lost in this session? Please Circle a word below.

I am ( **the winner**,    **the loser** ) in this session.

## Session 5

		If the other person chooses	
		A	B
If you choose	A	<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">2</span> - 2	<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">- 2</span> 2
	B	<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">- 3</span> 3	<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">3</span> - 3

The circled ones are the points you will earn when you choose either A or B. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
A	A	2 points	-2 points
A	B	-2 points	2 points
B	A	-3 points	3 points
B	B	3 points	-3 points

1. Please fill in **your choice and the other' choice that you expect**, 2. Fill in an expected outcome in the box below and show your choice to the experimenter.

Your choice is	The other's choice That you expect is	The outcome you expect	
		You	The other

3. The outcome of this session is

You earned: (     )    The other earned: (     )

4. Who won and who lost in this session? Please Circle a word below.

I am ( **the winner**,    **the loser** ) in this session.

Score Board of Game One

	Player I	Player II
<b>Name</b>		
<b>Exercise session</b>		
<b>Session 1</b>		
<b>Session 2</b>		
<b>Session 3</b>		
<b>Session 4</b>		
<b>Session 5</b>		
<b>Total points</b>		

The **Winner** of Game One is

The **Loser** of Game One is

---

**APPENDIX C**

**GAME ONE: FOR THE NO-COMPETITION CONDITION**

1. Seeing these 6 pictures, please judge emotional state of each person in these pictures and assign the alphabet of each picture that best describes the adjectives below.

- 1) Anger: \_\_\_\_\_
- 2) Surprise: \_\_\_\_\_
- 3) Sadness: \_\_\_\_\_
- 4) Fear: \_\_\_\_\_
- 5) Disgust: \_\_\_\_\_
- 6) Happiness: \_\_\_\_\_

a



b



c



d



e



f



2. How much are you confident of your judgment?

	Not at all				To a great extent			
	1	2	3	4	5	6	7	
Picture a	1	2	3	4	5	6	7	
Picture b	1	2	3	4	5	6	7	
Picture c	1	2	3	4	5	6	7	
Picture d	1	2	3	4	5	6	7	
Picture e	1	2	3	4	5	6	7	
Picture f	1	2	3	4	5	6	7	

3. In a survey, a group of people in US and Japan rated the words proposed below that describe the emotional state of each person in these pictures. Your task is to estimate how many people in each country agree on this. (Write down a number between 0 and 100)

	People in US	People in Japan
Picture a as happiness:	_____	_____
Picture b as disgust:	_____	_____
Picture c as surprise:	_____	_____
Picture d as sadness:	_____	_____
Picture e as anger:	_____	_____
Picture f as fear:	_____	_____



**APPENDIX D**

**QUESTIONNAIRE AFTER GAME ONE**

I. Please assign a number from 1 to 7 to each ( ) that describes your behavior, the other person's behavior in **Game one** and the game itself.

Not at all  
1 2 3 4 5 6 7 To a great extent

**1. Game one was.....**

Interesting ( ) Cooperative ( ) Strategic ( )  
Competitive ( ) Intellectual ( ) Important to me ( )  
Serious ( ) Important to the other person ( ) Fair ( )

**2. I, Myself in Game one was.....**

Strategic ( ) Competitive ( ) Smart ( )  
Cooperative to the other person ( ) Angry ( )  
Hostile to the other person ( ) Serious ( ) Happy ( )

**3. The other person in Game one was.....**

Strategic ( ) Competitive ( ) Smart ( )  
Serious ( ) Angry ( ) Hostile ( )  
Happy ( ) Cooperative to me ( ) Nice ( )

**4. The other person's behavior in this game was influenced by .....**

The game structure ( ) My behavior ( ) The other's personality ( )

**5. The result of this game was attributed to (or caused by) .....**

The other's competence ( ) My good luck ( )  
My competence ( ) My personality ( )  
The other's personality ( ) The other's good luck ( )

Please answer the following questions by circling the appropriate letter.

**6. What is the result of Game one?**

a. I won b. The other person won c. Neither of them won d. Don't know

**7. To the other person, I, myself in Game one was .....**

a. Competitor b. Cooperator c. Neither of both d. Don't know

**8. The other person in Game one was.....**

- a. My competitor   b. My cooperator   c. Neither of both   d. Don't know

Please answer the following questions by circling the appropriate number.

9. How much are you satisfied with the result of Game one?

Not at all   1   2   3   4   5   6   7   very much

10. How much is the result of Game one important to you?

Not at all   1   2   3   4   5   6   7   very much

11. How much are you unhappy with the result of Game one?

Not at all   1   2   3   4   5   6   7   very much

12. How much do you feel deprived of by the result of Game one?

Not at all   1   2   3   4   5   6   7   very much

13. How much do you feel guilty by the result of Game one?

Not at all   1   2   3   4   5   6   7   very much

Please **STOP** here and wait for the instruction for **Game two**

**APPENDIXE**

**INSTRUCTION FOR GAME TWO**

For the Discussion and No-Discussion Conditions

[ ]: Instructions to the experimenters  
 Indented body text: Instructions to subjects

[DISTRIBUTE A \$1 TO EACH PLAYER]

In this study, you received another \$1 for the work of Game Two and the \$1 will go to your "reserve" account. This is your starting money here. We will add any gains you make from this Game Two to that account, but we will also subtract any losses you make from it. Not like Game One, as you will see, it is possible to keep your \$1 exactly that sum, or you can more than double your \$1, or you may lose the \$1.

This time, your decisions will be private. Please don't show your decision to the other person. After games, we will pay you what you have earned in a way that preserves your privacy. Any questions? Please turn to the next page.

[INDICATING THE PAYOFFS IN THE MATRIX AND THE EXAMPLE IS LIKE THIS]

Please look at the exercise form

Your choice, and the other person's choice in each session, is between what we call "X" and "Y". The other person's alternatives are listed along the top, and yours are along the left side. Then there is a payoff matrix. Look first at the payoff matrix. The values in the boxes are the amount of coins (quarters) for you and the other person can earn in each case.

Here's how it works:

[THE TOP LEFT HAND CELL]

First: When both people choose X, both gain 1 coin worth of 25 cents, that is one quarter.

[YOU CAN RUN YOUR FINGER ALONG FROM THE LEFT-HAND PERSON'S X AND DOWN FROM THE TOP ONE'S X];

Second: When one person chooses X and the other chooses Y

[THE TOP RIGHT HAND, AND THE BOTTOM LEFT HAND CELLS]

the Y-chooser gains 2 quarters, 50 cents; that's more than either person can make in any other way. But the X chooser loses 1 quarter, –which is more than either person can lose in any other way.

Third: When both people choose Y

[THE BOTTOM RIGHT HAND CELL]

both gains nothing and lose nothing. Do you understand this structure? In each session, we will ask you to write either the "X" or the "Y" in the blank. That will be your decision for that session.

Before we begin, remember that, unlike Game One, if BOTH people choose Y, both end up with no gain, nothing; while if both people choose X, both end up with 1 gain in Game Two.

Below the payoff matrix, a summary of possible outcomes is proposed. If both choose X, both gains one quarter. If you choose X but the other person chooses Y, you lose one quarter and the other person gain two quarters. If you choose Y but the other person chooses X, you gain two quarters and the other person loses one quarter. If both choose Y both gain no quarters.

Now look at the place for recording your expectations—your best judgement—about what the other person is going to do. This will record your judgment of what the other person will choose between X and Y. Write down either "X" or "Y" depending on your expectation of the other's choice. Then write down numbers in the range from 0 to 100 in percentage that describes your confidence level of your expectation.

Just to be sure everyone does understand the payoff structure, please complete the exercise in front of you.

[AFTER ONE MINUTE, GO TO EACH PLAYER AND REVIEW HIS OR HER CHOICE. MAKE SURE SUBJECTS UNDERSTAND THE PAYOFF STRUCTURE. DO NOT REVEAL SUBJECTS' CHOICES TO EACH OTHER. IF EVERYONE GETS THEM ALL RIGHT]

OK, Everyone seems to understand what is going on.

Just a few additional points to remember:

First, in each case, your choice along with the other person's choice will determine how much money each of you makes in that case. Gains will be added to your \$1, and losses will be subtracted from it. Unlike Game One, we will not give you any feedback of the game result in each session. Your choice in each session will be private. We will give your game results in Game Two privately after this experiment. Any question?

[ANSWER ANY QUESTIONS]

**[ATTENTION FOR THE EXPERIMENTERS]  
[READ THIS PART IF SUBJECTS ARE IN "THE DISCUSSION CONDITION",  
BUT DON'T READ THIS IF SUBJECTS ARE IN "THE NO-DISCUSSION  
CONDITION"]**

Before starting Game Two, I would like you to discuss Game One and Two with each other for 3 minutes. You can talk about whatever you want to with the other person except for your choice in the exercise session. For example, you may talk about your thoughts and feelings of Game One you have just played. You may also talk about how to play Game Two for the best outcomes for both of you. You may even make an agreement on what to choose in Game Two. Any topic is fine. If you don't want, you may not talk to each other. I will give you three minutes and please start discussion with each other now.

**[AFTER 3 MINUTES]**

Please stop the discussion.

**[FROM NOW ON, THE INSTRUCTIONS FOR BOTH CONDITIONS ARE THE SAME. THE EXPERIMENTER INSISTS ON NO TALK AMONG SUBJECTS IN BOTH CONDITIONS AT THIS POINT. THEN, ASK]**

Please turn to the next page and begin session one, two, three, and four. Please finish all the sessions and don't show and talk about your choices to the other person. Please keep playing all the sessions.

**[AFTER 3-5 MINUTES]**

When you finish all sessions, Game Two is over. But there is a questionnaire we would like you to fill out. After you finish all sessions, turn to the next page and keep going on the questionnaire. Until you complete the questionnaire, please don't talk to each other.

**[WHEN SUBJECTS COMPLETE THE QUESTIONNAIRE]**

After you completed this questionnaire, the experiment is finished. Please submit the experimental materials. But remember: we promised you that your decisions would be private, so please don't reveal them to anyone else, and please don't ask anyone to reveal theirs. For the same reason, we will let you know of the monetary result on Monday of "Finals' week". Please keep the card bearing your research ID number carefully. I strongly recommend you to write down your research ID number on a separate sheet. Since we will only record your research ID number on

the card, we can not trace your name in the questionnaires when you lost your research ID number. To claim your monetary reward, simply present the card or your research ID number to B.J. Chun at Gilbert 209F anytime on "Finals' week" and he will give you monetary reward in your reserve account. You may gain money in the range between \$3 and zero depending on game result.

Be sure to sign " the extra credit sign sheet" for receiving the extra credit from your instructor and take a debriefing form when you leave.

**[ASK THEM TO WRITE INITIALS OF THEIR NAME ON THE EXTRA CREDIT SHEET AND GIVE THE DEBRIFING FORMS]**



**APPENDIX**

**GAME TWO: THE PDG**

# GAME TWO

## Exercise session

	<b>If the other person chooses</b>					
	<b>X</b>	<b>Y</b>				
If YOU choose	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; padding: 10px; text-align: center;"> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">1</div> <div>1</div> </div> </td> <td style="border: 1px solid black; padding: 10px; text-align: center;"> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">-1</div> <div>2</div> </div> </td> </tr> <tr> <td style="border: 1px solid black; padding: 10px; text-align: center;"> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">2</div> <div>-1</div> </div> </td> <td style="border: 1px solid black; padding: 10px; text-align: center;"> <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">0</div> <div>0</div> </div> </td> </tr> </table>		<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">1</div> <div>1</div> </div>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">-1</div> <div>2</div> </div>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">2</div> <div>-1</div> </div>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">0</div> <div>0</div> </div>
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">1</div> <div>1</div> </div>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">-1</div> <div>2</div> </div>					
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">2</div> <div>-1</div> </div>	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; border-radius: 50%; width: 30px; height: 30px; display: flex; align-items: center; justify-content: center; margin-right: 10px;">0</div> <div>0</div> </div>					
X						
Y						

The **circled ones** are the **payoffs** you will earn when you choose either X or Y. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
X	X	2 coin	-2 coin
X	Y	-2 coin	2 coin
Y	X	-3 coin	3 coin
Y	Y	3 coin	-3 coin

1. Your choice between X and Y in this game is : (      )
2. Your best estimate of the other person's choice between X and Y is : (      )  
 To what extent are you confident of the other's decision of X?  
 Write down from ) to 100 %: (      )

3. Why do you make your decision of X or Y?

(      )

# Session 1

		If the other person chooses	
		X	Y
If YOU choose	X	<span style="font-size: 1.5em;">1</span> 1	<span style="font-size: 1.5em;">-1</span> 2
	Y	<span style="font-size: 1.5em;">2</span> -1	<span style="font-size: 1.5em;">0</span> 0

The **circled ones** are the **payoffs** you will earn when you choose either X or Y. The payoffs will vary by both your decision and the other's decision.

If you choose	& The other person chooses	You earn	& The other person earns
X	X	2 coin	-2 coin
X	Y	-2 coin	2 coin
Y	X	-3 coin	3 coin
Y	Y	3 coin	-3 coin

1. Your choice between X and Y in this game is : (      )
2. Your best estimate of the other person's choice between X and Y is : (      )  
 To what extent are you confident of the other's decision of X?  
 Write down from ) to 100 %: (      )
3. Why do you make your decision of X or Y?  
 (      )

## Session 2

		<b>If the other person chooses</b>	
		<b>X</b>	<b>Y</b>
<b>If YOU choose</b>	<b>X</b>	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">1</span> 1	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">-1</span> 2
	<b>Y</b>	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">2</span> -1	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">0</span> 0

The **circled ones** are the **payoffs you will earn** when you choose either X or Y. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
X	X	2 coin	-2 coin
X	Y	-2 coin	2 coin
Y	X	-3 coin	3 coin
Y	Y	3 coin	-3 coin

1. Your choice between X and Y in this game is : (      )
  
2. Your best estimate of the other person's choice between X and Y is : (      )  
 To what extent are you confident of the other's decision of X?  
 Write down from ) to 100 %: (      )
  
3. Why do you make your decision of X or Y?  
 (      )

## Session 3

		If the other person chooses	
		<b>X</b>	<b>Y</b>
If YOU choose	<b>X</b>	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">1</span> 1	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">-1</span> 2
	<b>Y</b>	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">2</span> -1	<span style="font-size: 1.5em; border: 1px solid black; border-radius: 50%; padding: 2px 5px;">0</span> 0

The **circled ones** are the **payoffs** you will earn when you choose either X or Y. The payoffs will vary by both your decision and the other's decision.

IF you choose	& The other person chooses	You earn	& The other person earns
X	X	2 coin	-2 coin
X	Y	-2 coin	2 coin
Y	X	-3 coin	3 coin
Y	Y	3 coin	-3 coin

1. Your choice between X and Y in this game is : (      )
2. Your best estimate of the other person's choice between X and Y is : (      )  
 To what extent are you confident of the other's decision of X?  
 Write down from ) to 100 %: (      )
3. Why do you make your decision of X or Y?  
  
 (      )



APPENDIX G

QUESTIONNAIRE AFTER GAME TWO





Please assign a number from 1 to 7 to each ( ) that describes your behavior, the other person's behavior in **Game Two**.

Not at all							To a great extent
1	2	3	4	5	6	7	

**8. MY decision in Game two was.....**

Rational ( )	Emotional ( )	Conservative ( )
Aggressive ( )	Defensive ( )	Competitive ( )
Cooperative ( )	For mutual benefit ( )	Opportunistic ( )
Risk seeking ( )	Risk avoiding ( )	Compassionate ( )

**9. My decisions in Game two are caused by .....**

The payoff structure of Game two ( )

My expectation of the other's move in Game two ( )

The other person's behavior before Game two ( )

The result of previous Game one ( )

Experience with the other person in Game one ( )

My motive to win the other person ( )

My motive to compensate the other person ( )

My motive to maintain the 1dollar in the reserve account ( )

My motive to earn as many coins as possible ( )

Other reasons: \_\_\_\_\_

**10. The other person in Game two will be.....**

Rational ( )	Emotional ( )	Conservative ( )
Aggressive ( )	Compassionate ( )	Competitive ( )
Cooperative ( )	Opportunistic ( )	Risk seeking ( )
Risk Avoiding ( )	Defensive ( )	For mutual benefit ( )

**11. The other's decision in Game two will be caused by .....**

- The payoff structure of Game two (     )  
 His/her guess of my move in Game two (     )  
 The result of previous Game one (     )  
 Experience with me in Game one (     )  
 My behavior before Game two (     )  
 His/her motive to win me (     )  
 His/her motive to compensate me (     )  
 His/her motive to maintain the 1 dollar in the reserve account (     )  
 His/her motive to earn as many coins as possible (     )  
 Other reasons: \_\_\_\_\_

**12. Game two is.....**

- Fair (     )    Competitive (     )    Serious (     )    Cooperative (     )  
 Important to me (     )    Important to the other person (     )

**13. To what extent do you see yourself in everyday life as....**

	Not at all					To a great extent	
1) emotional in general	1	2	3	4	5	6	7
2) smart in general	1	2	3	4	5	6	7
3) competitive in general	1	2	3	4	5	6	7
4) cooperative in general	1	2	3	4	5	6	7
5) rational in general	1	2	3	4	5	6	7





**APPENDIX H**

**INFORMED CONSENT FORMS**

For the Competition Condition

Informed consent form

I understand that I will be participating in a dissertation research project conducted by Byungjune Chun from the Department of Management, Lundquist College of Business, University of Oregon. The purpose of this study is to increase our understanding of the choices people make with respect to others. My participation in these studies will last no longer than one hour. I understand there will be several questionnaires to complete at different times throughout the study.

I understand that I will receive an extra credit (5 bonus points) in MGMT 321 by participating in this experiment. The extra credit is a bonus and will not affect the "curve" or grade cut-offs for the class. My participation is voluntary; I recognize that I have the right to withdraw or refuse to participate at any time without penalty. If I decide not to participate in the experiment, I will have the opportunity to earn the same amount of extra credit by completing a short research paper, details of which are available on request from my instructor.

I understand that I will take part in two sets of games with other participants dealing with human cognition and decision making. I understand that I will be paid \$1 for my work in game one. At the beginning of game one, I understand that I will place that \$1 in a "reserve account" on the first study; depending on the choices I make and the simultaneous choices of the other person in the study, I might make more money ( \$2 in total); or I might lose money (the \$1 in my reserve account); I also understand that I will be paid another \$1 for my work in the game two. On completing that work, I understand that I will place that \$1 in a "reserve account" for the second study; depending on the choices I make and the simultaneous choices of others in the study, I might make more money (perhaps as much as \$ 3) ; or I might lose money ( perhaps as much as the \$1 in my reserve account); or I might just keep the \$1— or a range of sums between those extremes. I understand there will be several questionnaires to complete at different times throughout the study.

I understand that there is no deception in either study, and that all judgment expressed and decisions are anonymous. I also understand that people sometimes can be happy or annoyed at the outcome of the studies; monetary pay can be dependent on what others decide, as well as what I decide personally. I understand that all information gathered in the two studies is coded anonymously, and that my identity and privacy will be protected at all times.

The principal investigator is Byungjune Chun at (541) 346-3301, Gilbert Hall, Room 209F. I may contact him or his advisor Dr. John Orbell at (541) 346-5061 at the University of Oregon for answers to questions about any problems that might arise during the experiment. There are no anticipated risks associated with this experiment beyond those typically encountered in decision making in everyday life. But should I have questions about my rights as a subject, I should contact Human Subjects Compliance at (541) 346-2510 at the University of Oregon. If I want a copy of this form, I may get one from B.J. Chun, or from the person administering the experiment.

Signature:

Date:

### For the No-Competition Condition

#### Informed consent form

I understand that I will be participating in a dissertation research project conducted by Byungjune Chun from the Department of Management, Lundquist College of Business, University of Oregon. The purpose of this study is to increase our understanding of the choices people make with respect to others. My participation in these studies will last no longer than one hour. I understand there will be several questionnaires to complete at different times throughout the study.

I understand that I will receive an extra credit (5 bonus points) in MGMT 321 by participating in this experiment. The extra credit is a bonus and will not affect the "curve" or grade cut-offs for the class. My participation is voluntary; I recognize that I have the right to withdraw or refuse to participate at any time without penalty. If I decide not to participate in the experiment, I will have the opportunity to earn the same amount of extra credit by completing a short research paper, details of which are available on request from my instructor.

I understand that I will take part in two sets of games dealing with human cognition and decision making. I understand that I will be paid \$1 for my work in the Game two. On completing that work, I understand that I will place that \$1 in a "reserve account" for the second study; depending on the choices I make and the simultaneous choices of others in the study, I might make more money (perhaps as much as \$2) ; or I might lose money (perhaps as much as the \$1 in my reserve account); or I might just keep the \$1-- or a range of sums between those extremes. I understand there will be several questionnaires to complete at different times throughout the study.

I understand that there is no deception in either study, and that all judgment expressed and decisions are anonymous. I also understand that people sometimes can be happy or annoyed at the outcome of the studies; monetary pay can be dependent on what others decide, as well as what I decide personally. I understand that all information gathered in the two studies is coded anonymously, and that my identity and privacy will be protected at all times.

The principal investigator is Byungjune Chun at (541) 346-3301, Gilbert Hall, Room 209F. I may contact him or his advisor Dr. John Orbell at (541) 346-5061 at the University of Oregon for answers to questions about any problems that might arise during the experiment. There are no anticipated risks associated with this experiment beyond those typically encountered in decision making in everyday life. But should I have questions about my rights as a subject, I should contact Human Subjects Compliance at (541) 346-2510 at the University of Oregon. If I want a copy of this form, I may get one from B.J. Chun, or from the person administering the experiment.

Signature:

Date:



**APPENDIX I**

**DEBRIEFING FORM**

My dissertation investigates whether previous interaction in zero-sum competition will influence subsequent cooperation in mixed motive games. Zero-sum competition is that what one player gains, the other must lose and the sum of payoffs adds up to zero. Examples from spheres of life similar to the zero-sum competition are such as two persons competing for votes, two companies competing for market shares, two armies competing for a territory, and most two-person sport games. Mixed-motive games represent the situations where players are motivated partly to cooperate and partly to compete with one another. For examples, siblings cooperate to help parents in house keeping, but they also compete with one another to receive recognition from their parents.

In everyday life, we work with and work against other people. In classrooms, you may experience competition with other colleague students for better grades but you may also experience with cooperation in preparation for group projects or tests. Likewise, people compete and cooperate at work place.

The data you have provided will be used in identifying the relationship between interpersonal competition and subsequent cooperation. Game One you have played is the "Zero-sum game" for the treatment group or a simple task for the control group. Game Two is the "Prisoner Dilemma Game" that models an interdependent mixed motive situation. As you learned from the instruction, this is the case where attempts to maximize one's own benefit happen to end up with mutually the second worst outcome.

My study examines how people respond to each other in a mixed motive situation, after experiencing competition in zero-sum game. I will explain the research design in more detail when I return to your class to report my results before the end of this term.

## APPENDIX J. HIERARCHICAL LOG-LINEAR REGRESSIONS

TABLE 6. Tests of Partial Association with Generating Class of Rounds \*  
Discussion \* Competition \* Choice

Effect Name	DF	Partial Chi-Square	Probability
Rounds * Discussion * Competition	3	0.161	0.98
Rounds * Discussion * Choice	3	1.857	0.60 <sup>a</sup>
Rounds * Competition * Choice	3	1.696	0.64 <sup>a</sup>
Discussion * Competition * Choice	1	1.453	0.23
Rounds * Discussion	3	0.349	0.95
Rounds * Competition	3	0.034	1
Discussion * Competition	1	0.296	0.59
Rounds * Choice	3	3.059	0.38 <sup>a</sup>
Discussion * Choice	1	117.954	0
Competition * Choice	1	11.422	0.001
Rounds	3	0	1
Discussion	1	0.063	0.80
Competition	1	14.206	0
Choice	1	5.994	0.01

#### Variables in the Final Model

Discussion \* Choice

Competition \* Choice<sup>b</sup>

#### Goodness of Fit Tests

Likelihood Ratio Chi-Square	26	9.145 <sup>c</sup>	.999
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<sup>a</sup> indicated no time (rounds) effect on choices over four rounds of PDGs

<sup>b</sup> reflected the effects of discussion and competition on cooperative choices

<sup>c</sup> indicated a good fit between observed frequencies and expected frequencies generated by the model

TABLE 7. Tests of Partial Association with Generating Class of Rounds \*  
Discussion \* Competition \* Expectation

Effect Name	DF	Partial Chi-Square	Probability
Competition * Rounds * Discussion	3	0.179	0.981
Competition * Rounds * Expectation	3	1.946	0.584 <sup>a</sup>
Competition * Discussion * Expectation	1	12.148	0.000
Rounds * Discussion * Expectation	3	0.256	0.968 <sup>a</sup>
Competition * Rounds	3	0.024	0.999
Competition * Discussion	1	1.22	0.269
Rounds * Discussion	3	0.391	0.942
Competition * Expectation	1	4.87	0.027
Rounds * Expectation	3	4.996	0.172 <sup>a</sup>
Discussion * Expectation	1	81.507	0
Competition	1	14.207	0.000
Rounds	3	0	1
Discussion	1	0.063	0.802
Expectation	1	114.617	0
<b>Variables in the Final Model</b>			
Competition * Discussion * Expectation <sup>b</sup>			
<b>Goodness-of-Fit</b>			
Likelihood Ratio Chi-Square	24	12.13 <sup>c</sup>	.978

<sup>a</sup> indicated no time (rounds) effect on expectations over four rounds of PDGs

<sup>b</sup> reflected the interaction effects of discussion and competition on expectations of cooperative choices

<sup>c</sup> indicated a good fit between observed frequencies and expected frequencies generated by the model

TABLE 8. Tests of Partial Association with Generating Class of Rounds \*  
Discussion \* Winning \* Choice

Effect Name	DF	Partial Chi-Square	Probability
Rounds * Discussion * Winning	3	0.092	0.99
Rounds * Discussion * Choice	3	0.461	0.93 <sup>a</sup>
Rounds * Winning * Choice	3	0.823	0.84 <sup>a</sup>
Discussion * Winning * Choice	1	4.217	0.04
Rounds * Discussion	3	0.153	0.98
Rounds * Winning	3	0.022	1
Discussion * Winning	1	0.778	0.38
Rounds * Choice	3	1.584	0.66 <sup>a</sup>
Discussion * Choice	1	56.063	0
Winning * Choice	1	8.028	0.005
Rounds	3	0	1
Discussion	1	1.014	0.31
Winning	1	0	1
Choice	1	0.451	0.50

Variables in the Final Model

Discussion \* Winning \* Choice<sup>b</sup>

Goodness of Fit Tests

Likelihood Chi-Square	24	3.794	1
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<sup>a</sup> indicated no time (rounds) effect on choices over four rounds of PDGs

<sup>b</sup> reflected an interaction effect of discussion and winning on cooperative choices

<sup>c</sup> indicated a good fit between observed frequencies and expected frequencies generated by the model

TABLE 9. Tests of Partial Association with Generating Class of Rounds \*  
Discussion \* Winning \* Expectations

Effect Name	DF	Partial Chi-Square	Probability
Winner * Discussion * Rounds	3	0.071	0.995
Winner * Discussion * Expectation	1	1.805	0.179
Winner * Rounds * Expectation	3	3.071	0.381 <sup>a</sup>
Discussion * Rounds * Expectation	3	2.359	0.501 <sup>a</sup>
Winner * Discussion	1	0.198	0.656
Winner * Rounds	3	0.046	0.997
Discussion * Rounds	3	0.209	0.976
Winner * Expectation	1	4.98	0.026
Discussion * Expectation	1	22.923	0
Rounds * Expectation	3	5.229	0.156 <sup>a</sup>
Winner	1	0	1
Discussion	1	1.014	0.314
Rounds	3	0	1
Expectation	1	40.086	0

Variables in the Final Model

Winner \* Expectation

Discussion \* Expectation<sup>b</sup>

Goodness of Fit Test

Likelihood Chi-Square	26	15.943 <sup>c</sup>	.938
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<sup>a</sup> indicated no time (rounds) effect on choices over four rounds of PDGs

<sup>b</sup> reflected effects of discussion and winning on expectations of cooperative choices

<sup>c</sup> indicated a good fit between observed frequencies and expected frequencies generated by the model

**APPENDIX K**

**ADDITIONAL RESULTS**



TABLE 10. ANOVA of Cooperative Choices in Pairs

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Main Effects</b>	262.540	2	131.270	25.496	0
Competition	21.080	1	21.080	4.094	.045
Discussion	232.369	1	232.359	45.13	0
<b>2-Way Interactions</b>					
Competition * Discussion	1.266	1	1.266	.246	.621
<b>Explained</b>	262.931	3	87.644	17.023	0
<b>Residual</b>	633.289	123	5.149		
<b>Total</b>	896.220	126	7.113		

TABLE 11. Mean Cooperative Choices in Pairs

	No-Discussion	Discussion	Row total
No-Competition	1.23 <sup>a</sup> (1.8) <sup>b</sup>	6.2 (2.25)	4.84 (2.51)
Competition	2.65 (1.89)	5.18 (2.9)	3.86 (2.72)
Column total	2.91 (1.86)	5.66 (2.64)	4.29 (2.67)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 12. Univariate Fs of Matched Choices

IV	DV	Univariate F	DF	Sig of F
Discussion	Mutual defection	13.65	1/123	0
	Mutual cooperation	51.16	1/123	0
Competition	Mutual defection	6.00	1/123	.02
	Mutual cooperation	.83	1/123	n.s.
Discussion *Competition	Mutual defection	.60	1/123	n.s.
	Mutual cooperation	.74	1/123	n.s.

TABLE 13. Mean of Matched Choices

	No-Discussion	Discussion	Row total
	Mutual defection (DD)		
No-Competition	1.23 <sup>a</sup> (1.24) <sup>b</sup>	.33 (.88)	.75 (1.15)
Competition	1.81 (1.31)	.88 (1.41)	1.37 (1.43)
Column total	1.57 (1.3)	.63 (1.22)	1.1 (1.34)
	Mutual cooperation (CC)		
No-Competition	.5 (.81)	2.53 (1.68)	1.59 (1.68)
Competition	.46 (.8)	2.06 (1.74)	1.23 (1.55)
Column total	0.48 (.8)	2.28 (1.71)	1.39 (1.61)
	Unilateral cooperation (DC or CD)		
No-Competition	2.27 (1.08)	1.13 (1.46)	1.67 (1.41)
Competition	1.73 (1.07)	1.06 (1.28)	1.41 (1.21)
Column total	1.95 (1.1)	1.09 (1.35)	1.52 (1.3)

<sup>a</sup> Mean, <sup>b</sup> S.D. (Standard Deviation)

TABLE 14. Expectations of Cooperation in Pairs

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	168.995	2	84.497	20.188	0
Competition	3.683	1	3.683	0.88	0.35
Discussion	161.87	1	161.87	38.674	0
2-Way Interactions	10.069	1	10.069	2.406	0.123
Competition *	10.069	1	10.069	2.406	0.123
Discussion					
Explained	171.886	3	57.295	13.689	0
Residual	514.823	123	4.186		
Total	686.709	126	5.45		

TABLE 15. Mean Expectation of Cooperative Choices in Pairs

	No-Discussion	Discussion	Row total
No-Competition	4.15 <sup>a</sup> (2.03) <sup>b</sup>	7.00 (1.41)	5.68 (2.23)
Competition	4.38 (2.07)	6.09 (2.45)	5.20 (2.41)
Column total	4.29 (2.04)	6.52 (2.07)	5.41 (2.33)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 16. ANCOVA of Cooperative Choices by Individuals

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	32.576	3	10.859	5.458	0.001
Ethnicity	0.031	1	0.031	0.016	0.9
Gender	13.8	1	13.8	6.936	0.009
Nationality	7.556	1	7.556	3.798	0.052
Main Effects	109.614	2	54.807	27.546	0
Competition	8.712	1	8.712	4.379	0.037
Discussion	97.58	1	97.58	49.043	0
2-Way Interactions	0.743	1	0.743	0.374	0.542
Competition * Discussion	0.743	1	0.743	0.374	0.542
Explained	162.831	6	27.139	13.64	0
Residual	489.461	246	1.99		
Total	652.292	252	2.588		

TABLE 17. Mean Cooperative Choices by Individuals

	No-Discussion	Discussion	Row total
No-Competition	1.63 (1.37)	3.1 (1.43)	2.42 (1.58)
Competition	1.32 (1.33)	2.59 (1.62)	1.93 (1.6)
Column total	1.45 (1.35)	2.83 (1.55)	2.15 (1.61)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 18. ANCOVA of Expectation of Cooperative Choices by Individuals

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	18.458	3	6.153	3.857	0.01
Ethnicity	0.301	1	0.301	0.189	0.664
Gender	9.586	1	9.586	6.009	0.015
Nationality	2.293	1	2.293	1.437	0.232
Main Effects	71.062	2	35.531	22.274	0
Competition	1.269	1	1.269	0.796	0.373
Discussion	68.633	1	68.633	43.025	0
2-Way Interactions	4.823	1	4.823	3.024	0.083
Competition * Discussion	4.823	1	4.823	3.024	0.083
Explained	103.939	6	17.323	10.86	0
Residual	392.417	246	1.595		
Total	496.356	252	1.97		

TABLE 19. Mean Expectations of Cooperative Choices by Individuals

	No-Discussion	Discussion	Row total
No-Competition	2.08 <sup>a</sup> (1.37) <sup>b</sup>	3.5 (.95)	2.84 (1.36)
Competition	2.19 (1.44)	3.04 (1.29)	2.6 (1.43)
Column total	2.14 (1.41)	3.26 (1.16)	2.7 (1.4)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 20. Univariate F's of Choices in Light of Expectations

IV	DV	Univariate F	DF	Sig of F
Covariates	Choice for individualistic gain	2.13	3/246	0.097
	Choice for mutual gain	8.38	3/246	0
	Choice for relative gain	2.27	3/246	0.081
Discussion	Choice for individualistic gain	31.11	1/246	0
	Choice for mutual gain	62.73	1/246	0
	Choice for relative gain	8.16	1/246	0
Competition	Choice for individualistic gain	1.77	1/246	n.s.
	Choice for mutual gain	2.56	1/246	n.s.
	Choice for relative gain	1.37	1/246	n.s.
Competition * Discussion	Choice for individualistic gain	1.97	1/246	n.s.
	Choice for mutual gain	1.17	1/246	n.s.
	Choice for relative gain	0.76	1/246	n.s.

TABLE 21. ANCOVAs of Choices in Light of Expectations

## Choices for Individualistic Gain (Dd)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	10.971	3	3.657	2.331	0.075
Ethnicity	0.138	1	0.138	0.088	0.767
Gender	6.583	1	6.583	4.196	0.042
Nationality	1.171	1	1.171	0.747	0.388
<b>Main Effects</b>	54.555	2	27.278	17.387	0
Competition	3.227	1	3.227	2.057	0.153
Discussion	49.865	1	49.865	31.784	0
<b>2-Way Interactions</b>	2.961	1	2.961	1.888	0.171
Competition * Discussion	2.961	1	2.961	1.888	0.171
<b>Explained</b>	75.286	6	12.548	7.998	0
<b>Residual</b>	385.94	246	1.569		
<b>Total</b>	461.225	252	1.83		

TABLE 21. (Continued)  
 Choices for Mutual Gain (Cc)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	<b>45.17</b>	<b>3</b>	<b>15.057</b>	<b>7.729</b>	<b>0</b>
Ethnicity	0.125	1	0.125	0.064	0.8
Gender	18.023	1	18.023	9.252	0.003
Nationality	10.117	1	10.117	5.193	0.024
<b>Main Effects</b>	<b>131.427</b>	<b>2</b>	<b>65.714</b>	<b>33.733</b>	<b>0</b>
Competition	5.207	1	5.207	2.673	0.103
Discussion	123.237	1	123.237	63.262	0
<b>2-Way Interactions</b>	<b>1.789</b>	<b>1</b>	<b>1.789</b>	<b>0.918</b>	<b>0.339</b>
Competition * Discussion	1.789	1	1.789	0.918	0.339
<b>Explained</b>	<b>202.871</b>	<b>6</b>	<b>33.812</b>	<b>17.357</b>	<b>0</b>
<b>Residual</b>	<b>479.216</b>	<b>246</b>	<b>1.948</b>		
<b>Total</b>	<b>682.087</b>	<b>252</b>	<b>2.707</b>		



TABLE 21. (Continued)  
 Choices for Relative Gain (Dc)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	6.615	3	2.205	2.269	0.081
Ethnicity	0.038	1	0.038	0.039	0.844
Gender	1.321	1	1.321	1.359	0.245
Nationality	2.777	1	2.777	2.858	0.092
Main Effects	9.633	2	4.816	4.956	0.008
Competition	1.335	1	1.335	1.374	0.242
Discussion	7.934	1	7.934	8.164	0.005
2-Way Interactions	0.737	1	0.737	0.759	0.385
Competition * Discussion	0.737	1	0.737	0.759	0.385
Explained	20.255	6	3.376	3.474	0.003
Residual	239.057	246	0.972		
Total	259.312	252	1.029		

TABLE 22. Mean Choices in Light of Expectations

	No-Discussion	Discussion	Row total
Choices for individualistic gain (Dd)			
No-Competition	1.52 <sup>a</sup> (1.41) <sup>b</sup>	.33 (.73)	.88 (1.24)
Competition	1.55 (1.45)	.81 (1.28)	1.2 (1.42)
Column total	1.54 (1.43)	.59 (1.08)	1.06(1.35)
Choices for mutual gain (Cc)			
No-Competition	1.23 (1.25)	2.93 (1.53)	2.14 (1.64)
Competition	1.07 (1.28)	2.44 (1.68)	1.73 (1.63)
Column total	1.13 (1.26)	2.67 (1.62)	1.91 (1.64)
Choice for relative gain (Dc)			
No-Competition	0.85 (0.83)	0.57 (1.11)	0.7 (0.99)
Competition	1.12 (1.12)	0.6 (0.83)	0.87 (1.02)
Column total	1.01 (1.02)	0.59 (0.97)	0.8 (1.01)
Choices for altruism (Cd)			
No-Competition	0.4 (0.89)	0.17 (0.59)	0.28 (0.75)
Competition	0.26 (0.55)	0.15 (0.43)	0.2 (0.5)
Column total	0.32 (0.71)	0.16 (0.51)	0.24 (0.62)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 23. Univariate Fs of the Accuracy of Expectations

IV	DV	Univariate F	DF	Sig of F
Discussion	Accurate expectations	51.61	1/246	0
	Optimistic errors	17.37	1/246	0
	Pessimistic errors	18.51	1/246	0
Competition	Accurate expectations	0.56	1/246	n.s.
	Optimistic errors	0.26	1/246	n.s.
	Pessimistic errors	3.49	1/246	0.063
Discussion *Competition	Accurate expectations	0.86	1/246	n.s.
	Optimistic errors	0.05	1/246	n.s.
	Pessimistic errors	2.94	1/246	0.088

TABLE 24. ANCOVAs of the Accuracy of Expectations

Accurate Expectations (cC or dD)					
Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	1.07	3	0.357	0.25	0.861
Ethnicity	0.038	1	0.038	0.026	0.871
Gender	0.563	1	0.563	0.395	0.53
Nationality	0.082	1	0.082	0.057	0.811
Main Effects	73.69	2	36.845	25.874	0
Competition	0.798	1	0.798	0.56	0.455
Discussion	73.488	1	73.488	51.607	0
2-Way Interactions	1.222	1	1.222	0.858	0.355
Competition * Discussion	1.222	1	1.222	0.858	0.355
Explained	76.922	6	12.82	9.003	0
Residual	350.303	246	1.424		
Total	427.225	252	1.695		

TABLE 24. (Continued)

## Optimistic Errors (cD)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	<b>3.784</b>	<b>3</b>	<b>1.261</b>	<b>0.848</b>	<b>0.469</b>
Ethnicity	0.94	1	0.94	0.632	0.428
Gender	1.317	1	1.317	0.885	0.348
Nationality	0.007	1	0.007	0.004	0.947
<b>Main Effects</b>	<b>26.622</b>	<b>2</b>	<b>13.311</b>	<b>8.947</b>	<b>0</b>
Competition	0.386	1	0.386	0.259	0.611
Discussion	25.836	1	25.836	17.365	0
<b>2-Way Interactions</b>	<b>0.081</b>	<b>1</b>	<b>0.081</b>	<b>0.054</b>	<b>0.816</b>
Competition * Discussion	0.081	1	0.081	0.054	0.816
<b>Explained</b>	<b>32.676</b>	<b>6</b>	<b>5.446</b>	<b>3.66</b>	<b>0.002</b>
<b>Residual</b>	<b>366.004</b>	<b>246</b>	<b>1.488</b>		
<b>Total</b>	<b>398.68</b>	<b>252</b>	<b>1.582</b>		

TABLE 24. (Continued)

## Pessimistic Errors (dC)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	<b>1.081</b>	<b>3</b>	<b>0.36</b>	<b>0.548</b>	<b>0.65</b>
Ethnicity	0.602	1	0.602	0.915	0.34
Gender	0.158	1	0.158	0.24	0.625
Nationality	0.042	1	0.042	0.064	0.801
<b>Main Effects</b>	<b>13.959</b>	<b>2</b>	<b>6.98</b>	<b>10.611</b>	<b>0</b>
Competition	2.293	1	2.293	3.486	0.063
Discussion	12.177	1	12.177	18.513	0
<b>2-Way Interactions</b>	<b>1.932</b>	<b>1</b>	<b>1.932</b>	<b>2.937</b>	<b>0.088</b>
Competition * Discussion	1.932	1	1.932	2.937	0.088
<b>Explained</b>	<b>15.273</b>	<b>6</b>	<b>2.545</b>	<b>3.87</b>	<b>0.001</b>
<b>Residual</b>	<b>161.81</b>	<b>246</b>	<b>0.658</b>		
<b>Total</b>	<b>177.083</b>	<b>252</b>	<b>0.703</b>		

TABLE 25. Mean of the Accuracy of Expectations

	No-Discussion	Discussion	Row total
<b>Accurate expectations (cC or dD)</b>			
No-Competition	1.79 <sup>a</sup> (1.16) <sup>b</sup>	3.03 (1.25)	2.46 (1.35)
Competition	2.05 (1.12)	3.01((1.22)	2.51 (1.26)
Column total	1.94 (1.14)	3.02 (1.23)	2.49 (1.3)
<b>Optimistic errors (cD)</b>			
No-Competition	1.33 (1.23)	0.68 (1.24)	0.98 (1.27)
Competition	1.41 (1.3)	0.72 (1.08)	1.08 (1.24)
Column total	1.37 (1.27)	0.7 (1.15)	1.04 (1.26)
<b>Pessimistic errors (dC)</b>			
No-Competition	0.88 (1.06)	0.28 (0.61)	0.56 (0.9)
Competition	0.54 (0.91)	0.26 (0.56)	0.41 (0.78)
Column total	0.68 (0.96)	0.27 (0.6)	0.48 (0.84)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 26. ANCOVA of Monetary Performance by Winners and Losers

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	58.038	3	19.346	2.726	0.047
Ethnicity	25.22	1	25.22	3.554	0.062
Gender	9.792	1	9.792	1.38	0.242
Nationality	0.305	1	0.305	0.043	0.836
Main Effects	98.931	2	49.466	6.971	0.001
Winning vs. losing	43.637	1	43.637	6.15	0.014
Discussion	54.011	1	54.011	7.612	0.007
2-Way Interactions	59.671	1	59.671	8.409	0.004
Winning * Discussion	59.671	1	59.671	8.409	0.004
Explained	225.287	6	37.548	5.291	0
Residual	950.855	134	7.096		
Total	1176.142	140	8.401		

TABLE 27. Mean Monetary Performance by Winners and Losers

	No-Discussion	Discussion	Row total
Losers	2.54 <sup>a</sup> (2.73) <sup>b</sup>	2.41 (2.73)	2.48 (2.71)
Winners	0.11 (2.7)	2.76 (2.65)	1.38 (2.97)
Column total	1.32 (2.96)	2.59 (2.68)	1.93 (2.89)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 28. ANCOVA of Relative Gain by Winners and Losers

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	3.175	3	1.058	1.059	0.369
Ethnicity	0.598	1	0.598	0.599	0.44
Gender	1.488	1	1.488	1.489	0.225
Nationality	0.007	1	0.007	0.007	0.931
Main Effects	8.831	2	4.416	4.417	0.014
Winning vs. losing	5.045	1	5.045	5.048	0.026
Discussion	3.9	1	3.9	3.902	0.05
2-Way Interactions	7.019	1	7.019	7.022	0.009
Winning * Discussion	7.019	1	7.019	7.022	0.009
Explained	19.547	6	3.258	3.259	0.005
Residual	133.942	134	1		
Total	153.489	140	1.096		

TABLE 29. Mean Relative Gains by Winners and Losers

	No-Discussion	Discussion	Row total
Losers	1.27 <sup>a</sup> (1.19) <sup>b</sup>	0.47(0.86)	0.89 (1.12)
Winners	0.46 (0.77)	0.59 (1.1)	0.52 (0.94)
Column total	0.86 (1.08)	0.53 (0.98)	0.7 (1.04)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)



TABLE 30. ANCOVA of Cooperative Choices by Winners and Losers

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	24.971	3	8.324	4.173	0.007
Ethnicity	0.831	1	0.831	0.417	0.52
Gender	15.993	1	15.993	8.017	0.005
Nationality	1.831	1	1.831	0.918	0.34
Main Effects	50.447	2	25.223	12.644	0
Winning vs. losing	4.955	1	4.955	2.484	0.117
Discussion	45.876	1	45.876	22.997	0
2-Way Interactions	7.706	1	7.706	3.863	0.051
Winning * Discussion	7.706	1	7.706	3.863	0.051
Explained	93.114	6	15.519	7.78	0
Residual	267.311	134	1.995		
Total	360.426	140	2.574		

TABLE 31. Mean Cooperative Choices by Winners and Losers

	No-Discussion	Discussion	Row total
Losers	0.92 <sup>a</sup> (1.26) <sup>b</sup>	2.65 (1.61)	1.75 (1.67)
Winners	1.73 (1.28)	2.53 (1.66)	2.11 (1.52)
Column total	1.32 (1.33)	2.59 (1.62)	1.93 (1.6)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 32. ANCOVA of Expectations of Cooperative Choices by Winners and Losers

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	13.11	3	4.37	2.404	0.07
Ethnicity	0.773	1	0.773	0.425	0.516
Gender	9.837	1	9.837	5.412	0.021
Nationality	0.163	1	0.163	0.09	0.765
Main Effects	25.513	2	12.756	7.018	0.001
Winning vs. losing	4.352	1	4.352	2.394	0.124
Discussion	21.408	1	21.408	11.778	0.001
2-Way Interactions	1.735	1	1.735	0.955	0.33
Winning * Discussion	1.735	1	1.735	0.955	0.33
Explained	44.194	6	7.366	4.052	0.001
Residual	243.564	134	1.818		
Total	287.759	140	2.055		

TABLE 33. Mean Expectations of Cooperative Choices by Winners and Losers

	No-Discussion	Discussion	Row total
Losers	1.92 <sup>a</sup> (1.57) <sup>b</sup>	3.0 (1.35)	2.44 (1.56)
Winners	2.46 (1.26)	3.09 (1.24)	2.76 (1.28)
Column total	2.19 (1.44)	3.04 (1.29)	2.6 (1.43)

<sup>a</sup> Mean

<sup>b</sup> S.D. (Standard Deviation)

TABLE 34. Univariate F's of Choices in Light of Expectations by Winning

IV	DV	Univariate F	DF	Sig of F
Covariates	Choice for individualistic gain	1.86	3/134	n.s.
	Choice for mutual gain	5.43	3/134	0.001
	Choice for relative gain	2.16	3/134	0.096
Discussion	Choice for individualistic gain	9.11	1/134	0.01
	Choice for mutual gain	26.93	1/134	0
	Choice for relative gain	7.42	1/134	0.01
Winning	Choice for individualistic gain	3.98	1/134	0.05
	Choice for mutual gain	1.31	1/134	n.s.
	Choice for relative gain	0.23	1/134	n.s.
Winning * Discussion	Choice for individualistic gain	1.2	1/134	n.s.
	Choice for mutual gain	3.44	1/134	0.07
	Choice for relative gain	1.73	1/134	n.s.

TABLE 35. ANCOVA s of Choices in Light of Expectations by Winning  
 Choices for Individualistic Gain (Dd)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	10.225	3	3.408	1.858	0.14
Ethnicity	0.545	1	0.545	0.297	0.587
Gender	8.754	1	8.754	4.773	0.031
Nationality	0.007	1	0.007	0.004	0.949
Main Effects	23.723	2	11.862	6.468	0.002
Winning vs. losing	7.299	1	7.299	3.98	0.048
Discussion	16.708	1	16.708	9.11	0.003
2-Way Interactions	2.192	1	2.192	1.195	0.276
Winning * Discussion	2.192	1	2.192	1.195	0.276
Explained	38.082	6	6.347	3.461	0.003
Residual	245.748	134	1.834		
Total	283.83	140	2.027		

TABLE 35. (Continued)  
 Choices for Mutual Gain (Cc)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	<b>32.321</b>	<b>3</b>	<b>10.774</b>	<b>5.426</b>	<b>0.001</b>
Ethnicity	1.107	1	1.107	0.558	0.456
Gender	17.447	1	17.447	8.787	0.004
Nationality	3.398	1	3.398	1.711	0.193
<b>Main Effects</b>	<b>55.77</b>	<b>2</b>	<b>27.885</b>	<b>14.044</b>	<b>0</b>
Winning vs. losing	2.594	1	2.594	1.306	0.255
Discussion	53.474	1	53.474	26.932	0
<b>2-Way Interactions</b>	<b>6.826</b>	<b>1</b>	<b>6.826</b>	<b>3.438</b>	<b>0.066</b>
Winning * Discussion	6.826	1	6.826	3.438	0.066
<b>Explained</b>	<b>107.704</b>	<b>6</b>	<b>17.951</b>	<b>9.041</b>	<b>0</b>
<b>Residual</b>	<b>266.055</b>	<b>134</b>	<b>1.985</b>		
<b>Total</b>	<b>373.759</b>	<b>140</b>	<b>2.67</b>		

TABLE 35. (Continued)  
 Choices for Relative Gain (Dc)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	6.29	3	2.097	2.156	0.096
Ethnicity	0.03	1	0.03	0.031	0.861
Gender	1.083	1	1.083	1.113	0.293
Nationality	2.071	1	2.071	2.129	0.147
<b>Main Effects</b>	7.474	2	3.737	3.842	0.024
Winning vs. losing	0.226	1	0.226	0.233	0.63
Discussion	7.213	1	7.213	7.416	0.007
<b>2-Way Interactions</b>	1.678	1	1.678	1.725	0.191
Winning * Discussion	1.678	1	1.678	1.725	0.191
<b>Explained</b>	17.373	6	2.895	2.977	0.009
<b>Residual</b>	130.329	134	0.973		
<b>Total</b>	147.702	140	1.055		

TABLE 36. Mean Choices in Light of Expectations by Winners and Losers

	No-Discussion	Discussion	Row total
Choices for individualistic gain (Dd)			
Losers	1.89 <sup>a</sup> (1.63) <sup>b</sup>	0.88 (1.34)	1.41 (1.57)
Winners	1.22 (1.18)	0.74 (1.24)	0.99 (1.22)
Column total	1.55 (1.45)	0.81 (1.28)	1.2(1.42)
Choices for mutual gain (Cc)			
Losers	.73 (1.22)	2.53 (1.66)	1.59 (1.7)
Winners	1.41 (1.26)	2.35 (1.72)	1.86 (1.56)
Column total	1.07 (1.28)	2.44 (1.68)	1.73 (1.63)
Choice for relative gain (Dc)			
Losers	1.19 (1.22)	0.47 (0.71)	0.85 (1.06)
Winners	1.05 (1.03)	0.74 (0.93)	0.9 (0.99)
Column total	1.12 (1.12)	0.6 (0.83)	0.87 (1.02)
Choices for altruism (Cd)			
Losers	0.19 (0.46)	0.12 (0.33)	0.15 (0.4)
Winners	0.32 (0.63)	0.18 (0.52)	0.25 (0.58)
Column total	0.26 (0.55)	0.15 (0.43)	0.2 (0.5)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

TABLE 37. Univariate Fs of the Accuracy of Expectations by Winning

IV	DV	Univariate F	DF	Sig of F
Discussion	Accurate expectations	23.49	1/134	0
	Optimistic errors	12.38	1/134	0
	Pessimistic errors	4.51	1/134	0.036
Winning	Accurate expectations	1.51	1/134	n.s.
	Optimistic errors	6.15	1/134	0.014
	Pessimistic errors	3.46	1/134	0.065
Discussion *Winning	Accurate expectations	1.57	1/134	n.s.
	Optimistic errors	5.21	1/134	0.024
	Pessimistic errors	2.31	1/134	n.s.

TABLE 38. ANCOVAs of the Accuracy of Expectations by Winning

## Accurate Expectations (cC or dD)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	2.467	3	0.822	0.599	0.616
Ethnicity	1.636	1	1.636	1.193	0.277
Gender	0.786	1	0.786	0.573	0.451
Nationality	0.413	1	0.413	0.301	0.584
Main Effects	34.505	2	17.252	12.577	0
Winning vs. losing	2.068	1	2.068	1.508	0.222
Discussion	32.218	1	32.218	23.486	0
2-Way Interactions	2.159	1	2.159	1.574	0.212
Winning * Discussion	2.159	1	2.159	1.574	0.212
Explained	39.388	6	6.565	4.785	0
Residual	183.818	134	1.372		
Total	223.206	140	1.594		



TABLE 38. (Continued)

## Optimistic Errors (cD)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	7.921	3	2.64	1.988	0.119
Ethnicity	2.834	1	2.834	2.134	0.146
Gender	3.218	1	3.218	2.423	0.122
Nationality	0.104	1	0.104	0.079	0.78
<b>Main Effects</b>	24.914	2	12.457	9.379	0
Winning vs. losing	8.163	1	8.163	6.146	0.014
Discussion	16.445	1	16.445	12.382	0.001
<b>2-Way Interactions</b>	6.919	1	6.919	5.21	0.024
Winning * Discussion	6.919	1	6.919	5.21	0.024
<b>Explained</b>	40.173	6	6.695	5.041	0
<b>Residual</b>	177.969	134	1.328		
<b>Total</b>	218.142	140	1.558		

TABLE 38. (Continued)

## Pessimistic Errors (dC)

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
<b>Covariates</b>	<b>2.003</b>	<b>3</b>	<b>0.668</b>	<b>1.146</b>	<b>0.333</b>
Ethnicity	0.164	1	0.164	0.281	0.597
Gender	0.824	1	0.824	1.413	0.237
Nationality	0.102	1	0.102	0.175	0.676
<b>Main Effects</b>	<b>4.582</b>	<b>2</b>	<b>2.291</b>	<b>3.931</b>	<b>0.022</b>
Winning vs. losing	2.013	1	2.013	3.455	0.065
Discussion	2.627	1	2.627	4.508	0.036
<b>2-Way Interactions</b>	<b>1.348</b>	<b>1</b>	<b>1.348</b>	<b>2.313</b>	<b>0.131</b>
Winning * Discussion	1.348	1	1.348	2.313	0.131
<b>Explained</b>	<b>7.867</b>	<b>6</b>	<b>1.311</b>	<b>2.25</b>	<b>0.042</b>
<b>Residual</b>	<b>78.091</b>	<b>134</b>	<b>0.583</b>		
<b>Total</b>	<b>85.957</b>	<b>140</b>	<b>0.614</b>		

TABLE 39. Mean of the Accuracy of Expectations by Winner and Loser

	No-Discussion	Discussion	Row total
Accurate expectations (cC or dD)			
Losers	2.3 <sup>a</sup> (1.05) <sup>b</sup>	3. (1.26)	2.63 (1.2)
Winners	1.81 (1.15)	3.03((1.19)	2.39 (1.31)
Column total	2.05 (1.12)	3.01 (1.22)	2.51 (1.26)
Optimistic errors (cD)			
Losers	0.95 (1.15)	0.74 (1.14)	0.85 (1.14)
Winners	1.86 (1.29)	0.71 (1.03)	1.31 (1.3)
Column total	1.41 (1.3)	0.72 (1.08)	1.08 (1.24)
Pessimistic errors (dC)			
Losers	0.76 (0.98)	0.26 (0.57)	0.52 (0.84)
Winners	0.32 (0.78)	0.26 (0.62)	0.3 (0.71)
Column total	0.54 (0.91)	0.26 (0.59)	0.41 (0.78)

<sup>a</sup> Mean<sup>b</sup> S.D. (Standard Deviation)

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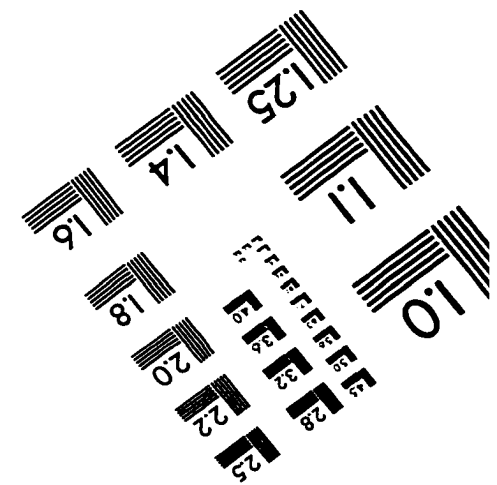
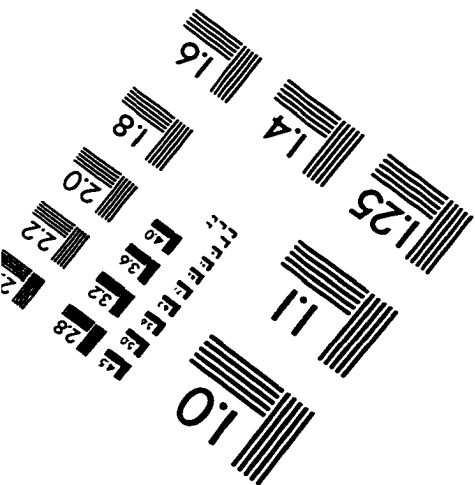
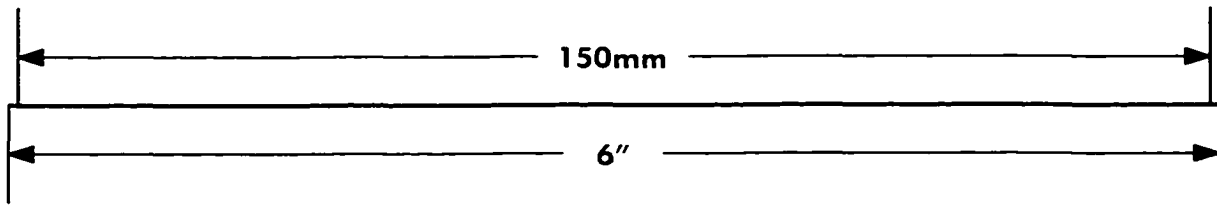
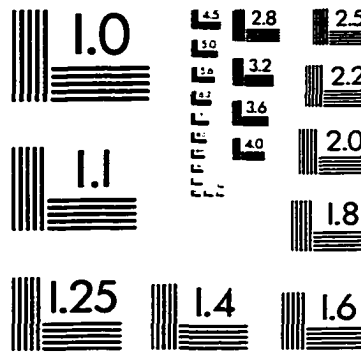
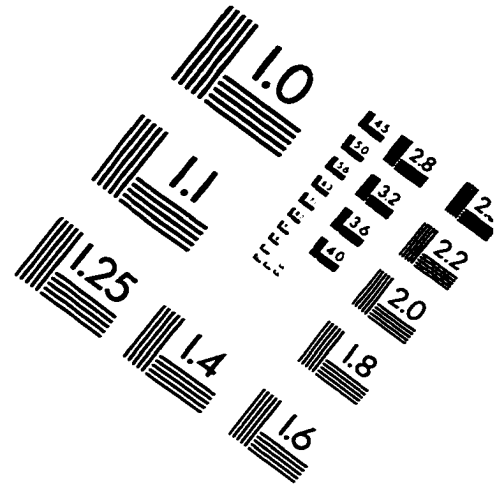
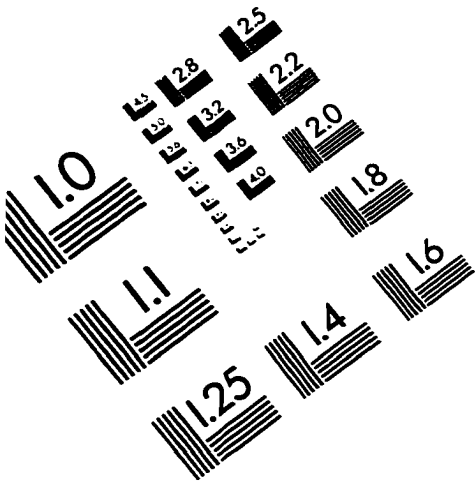
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