NETWORKS, INSTITUTIONS AND INDIVIDUALS: THE INTERACTION OF STRUCTURE AND TRUST IN COOPERATION AND COORDINATION GAMES

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Social capital theory integrates both individual and institutional perspectives in studies of governance, but interactions between individual and institutional components are underdeveloped with regard to strategies tailored to specific populations of actors. Until this point, the discussion of social capital has been developed in terms of observable outputs, with a specific focus on analyzing self-organizing collaboration. The experimental literature on collective behavior tends to focus on cooperation in the prisoner's dilemma game, in either single shot or repeated interactions. In these two papers, I utilize a combination of experimental and survey data to ask what drives collective behavior in four separate economic games, the prisoner's dilemma, a simple matching game, the battle of the sexes and the stag hunt. Each game has a unique set of strategies and incentives to mimic four distinct challenges associated with collective behavior. The first paper focuses on the prisoner's dilemma, one of the most widely studied networked games in the literature, where the risk of defection poses a threat to cooperation.

It is not just the traditional social sciences that recognize a heavy attention paid to cooperation in the prisoner's dilemma when analyzing social capital (Snidal 1985). Law scholars also push for the inclusion of a broader set of collective action problems, suggesting that equal if not more attention should be paid to coordination problems, the more common dilemma playing out in America's legal system (McAdams 2008). Enemark, McCubbins and Weller (2011) discuss coordination problems as likely the most common type of interaction for most political, economic and social situations, yet this class of games is remarkably understudied. The second paper's contribution to the literature comes from expanding the analysis beyond the prisoner's dilemma to three coordination games, alleviating almost all risks of defection; a simple matching game, the introduction of conflict decisions (battle of the sexes) and a game of assurance problems (stag hunt). Both papers link successful networking strategies, represented by two structure treatments, to subject trust dispositions in each of the four games.

COOPERATION IN EXPERIMENTAL NETWORKS: THE EFFECTS OF TRUST & STRUCTURE

The social capital literature suggests that network structure and individual-level trust affect cooperation in exchange relationships. These two elements may work together or separately to encourage cooperation. Using the most basic network format, open and closed triads, cooperative choices in a series of experimental prisoner's dilemma games are analyzed. This paper develops two specific research questions: First, are closed networks necessary for cooperation, or can more modern, open networks be just as effective? Second, does trust play a more significant role in open networks than in closed networks? The models of cooperation show that levels of trust interact with the structure of a network to significantly increase subject cooperation. Ego and partner trust also have a positive effect on cooperation. Consequently the findings indicate that both individual and network characteristics drive cooperation, in particular as an individual's trust increases so too does the effectiveness of closed networks.

The conceptualization of social capital, in one form or another, has been a part of the social science literature for over a century. Over time the definition of social capital has evolved becoming both more concise and broad. While measurement and operationalization varies with context, the basic definition of social capital still holds; actors invest in relationships with others to extract some expected returns. Studying the networks formed by these interactions has become a focus for capital scholars of late. Studies of who these actors are, who they interact with and the benefits they receive span disciplines such as sociology with studies of interpersonal networks and their influence on our lives; from the prevalence of obesity (Christakis & Fowler 2008) and happiness (Christakis & Fowler 2009) to the strength and prevalence of human social networks on the basis of homophily, or commonality among personal ties. In educational psychology, studies look at the relationship between interpersonal ties among students and retention rates in secondary education (Eckles & Stradley 2011). One segment of political science in particular explores relationships between and among groups of voters with the expected return of turnout and mobilization (Mutz 2006), while others look at the complex role of government actors in the American political system; the classic institutional approach championed by March and Olsen (1989) as well as governance models of policymaking (Edelenbos et al 2008, Sørensen & Torfing 2005, 2003, Berardo 2009, Berardo & Scholz 2010, see also Feiock & Scholz 2009)

Networks survive and grow primarily if they increase returns (benefits) to their members. Social capital returns are typically discussed as the result of two separate elements (Lin 1999), structural and positional variations within the network of actors (Coleman 1988, Putnam 1993, 2000) -- how and who is linked in decision making-- and individual-level attributes and assets such as norms and trust (Brehm and Rhan 1997, Gachter et al 2003, Hardin 2006, Holm & Danielson 2005, Tadelis 2007). Unfortunately, the literature is also criticized for equating structures and norms with social capital, often times using the various terms and measurements interchangeably or as substitutes (Yamagishi et al 1998). Lin (1999) comments on the need to not only separate discussions of social capital from those of trust and structure, but also derive causal theories that link instances of trust or specific structures to increases or decreases in social capital outputs.

Experimentation provides a vehicle to develop a causal theory in the simplest and most sterile of settings. The analysis presented here quantifies social capital with observations of subject cooperation is a series of experimentally iterated prisoner's dilemma games. Treatments within the experiment control for the two most common social capital substitutes, individual trust attributes and

structural variations. In addition, the analysis considers two dimensions of trust, attitudes and behavior, and uses a common dimension of network structure; strong and weak ties. In the experimental setting, an open and closed triad captures this dimension in its simplest form (Ahn & Scholz 2009).

Once trust, structure and cooperation are distinguishable, I ask "What drives cooperation in experimental networks? Is it individual-level attributes, such as trust, or is it something about the network structures themselves?" I test independent and conditional hypotheses of trust and network structures' effects on cooperation. Furthermore, I ask what is it about trust and/or structure that provide this medium for increased cooperation?

1.1 Social Capital and Cooperation

Putnam (2000) cites social capital as one feature that increases the ability of network participants to act together more effectively. Hardin (2006) agrees, describing social capital as something gained through close and frequent interactions with other members of a group. Putnam goes further to argue that it is "social capital" that facilitates coordination for mutual benefits (166) with the caveat that past successes in interactions positively influence future cooperation (167).

Political science has expanded a biological and evolutionary approach with Nowak's (2006) five rules for the evolution of cooperation[1] - kin selection, direct reciprocity, indirect reciprocity, network reciprocity and group selection. It is wise to think about the inclusive nature of these terms, group-level interactions provide the opportunity for sanctions and punishment if in-group members or out-group members act inappropriately. Network, direct and indirect reciprocity provide actors the opportunity to accumulate resources with direct person-to-person contacts or contacts through individuals, i.e. the friend of a friend. These relationships are further enhanced with proximity and repeated interactions.

Social capital then is the by-product of these person-to-person interactions, the benefits or costs extracted from the exchange. Separating the gains from trade from the mechanisms that facilitate the exchange is generally one of the most difficult tasks for scholars studying real world phenomena. The experimental setting is one where distinctions between the outcome and the mechanisms that get you there can be made much clearer.

This paper conceptualizes social capital as cooperation in a series of prisoner's dilemma games, but the level of cooperation for any one subject hinges on existing group norms as well as their ability to incorporate and build on them through the structure of their relationships. I now discuss the two mediating effects on cooperation, one a key dimension of structural variation, bridging and bonding, and the other an individual attribute, trust.

1.2 Bridging and Bonding Triads

Networks connect both individuals and organizations in an infinitely possible number of configurations. Historically and in some of today's small towns, close kin and extended family were the extent of a person's connections. In these cases people had very few, but very strong links and ties

[1] For a more in depth discussion of social capital, see Ostrom (1990), Ostrom and Ahn (2003), Putnam (2000) and Coleman (1988).

to others. In more modern, western cultures this net of communication has drastically expanded.[2] Being an active member in society requires interactions with both close family and friends, but also with those at the far reaches of one's social circle. Going to the pharmacy, maneuvering the bureaucratic red tape of your health insurance, even shopping at the local grocery store will likely put the modern citizen in contact with someone totally unfamiliar. These weak links may be greater in number but they lack a certain amount of depth that our historical counterparts experienced.

The strength of our ties is important because they impact our ability to maintain and enforce group norms, those standards of behavior based on widely shared beliefs of how individual group members should behave in a given situation (Fehr and Fischbacher 2004). Group members must uphold these norms for continued and efficient action. To quantify "strong and weak-tie" relationships, Putnam (2000) distinguishes two paths by which people facilitate social capital; bridging and bonding relationships. The first, bonding capital can be thought of like Hardin's (2006) village where people have strong, direct ties to one another and very little interaction with outsiders. This situation is very typical of modern day small towns where everyone knows everyone and word travels fast. Generally composed of close-knit, overlapping and homogenous populations, members of these networks tend to be inward looking and are very good at enforcing existing in-group norms (Putnam 1993, 2000, Coleman 1988, Granovetter 1973). Qualities favored by the group are more easily maintained and those not favored by the group are more easily ignored or eradicated, meaning there is also the potential for developing strong, out-group biases (Coleman 1988). Xavier deSouza Briggs has referred to bonding relationships as "getting by" or maintaining a way of life (Putnam 2000).

Conversely, Briggs discusses bridging relationships as "getting ahead." Bridging is exemplified by the relationships in the modern day example. Bonds and links are created across broad social groups and heterogeneous populations. Generally bridging relationships can be thought of as outward looking with the ability to gather distant information and link to far reaching assets. On average, these actors bring novel information and resources to their partners. Unlike bonding situations where every actor knows every other actor, it is typical in bridging structures that one's partners do not have contact with each other. Bridging capital has also been associated with increases in out-group tolerance (Mutz 2006), but by the same token can create difficulties for mobilization (Huckfeldt et al 2004).

As many as ten years prior to Putnam's discussion of bridging and bonding capital, Coleman (1988) conceptualized a defining structural characteristic by simplifying relationships into the categories of "open" and "closed." Coleman's closed structures correspond to Putnam's bonding capital and similarly, open structures correspond to bridging capital. Both of these authors spotlight the value of networks, specifically that certain structures facilitate certain types of capital. This discussion is not meant imply that one type of structure is any better than the other, simply that certain populations may benefit from one form or the other because they are better equipped to extract its benefits. Therefore, I focus my discussion on the benefits of two network structures, in particular a dimension of network closure.

Coleman (1988) cites norms as one of the most powerful elements of social capital and a key component for discussing the benefits of network closure.[3] Group norms help to limit negative

[2] Fowler and Christakis (2011) argue that although our contacts may be greater in number, the core of our social networks and the reach of our influence are very similar to the limits of earlier civilizations. The authors suggest an evolutionary tie to the 3 step reach of influence seen for many network effects.

[3] Ostrom (1990) provides an appropriate conceptualization of norms when she says, "Norms of behavior reflect valuations that individuals place on actions or strategies in and of themselves, not as they are connected to immediate consequences. When an individual has strongly internalized a norm related to keeping promises, for example, the individual suffers shame and guilt when a personal promise is broken. If the norm is shared with

external effects while they simultaneously encourage positive effects from both inside and outside of the network (Coleman 1988). Closure creates an environment for existing norms to develop and prevail. Repetition, overlapping relationships and increased opportunities for reciprocity help to maintain the existing norms within the closed community as well as provide a first line of defense from the intrusion of outsiders. A lack of closure in a network-- when there is at least one actor not connected to everyone-- can explain why norms fail to develop even if they are initially present; lending further evidence to Putnam's (2000) discussion of bonding relationships and how they benefit existing in-group norms.

Looking at Figure 1.1 the bridging/bonding distinction is captured in its simplest form, the open and closed triad. Each lettered node represents a subject in the experiment to be described later in this chapter. The lines, or links, between two subjects represent an interaction between them. For this experiment the interaction takes the form of a prisoner's dilemma game. In open structures (Figure 1.1 open), the *leader*, actor E, can impose sanctions on both *followers*, actors D and F. Since D and F have no direct relationship they are unable to join forces and meaningfully sanction E. Among *members* of the closed triad (Figure 1.1 closed), A and C do have a relationship and joining together in order to collectively sanction B is possible. The possibility of meaningful sanctions in closed structures makes the development of effective norms possible (Coleman 1988). In the case of defection in a prisoner's dilemma game, a form of negative externality, open structures allow only for sanctions by the actor that was defected upon (D on E or F on E). Coleman (1988) reminds us that "Reputation cannot arise in an open structure, and collective sanctions… cannot be applied." Fehr and Fischenbacher (2004) discuss the long term benefits to sanctions and the enforcement of norms. Specifically that cooperation can be conditioned on norms which work with emotions and rational behavior.

A discussion of reputation and visibility is also relevant when analyzing norms and closure. Baumeister (1982) observes, "If public awareness makes people change their behavior, it is because they are concerned with what their behavior communicates to others." Observation alone is not sufficient for cooperation. Tadelis (2007) finds that cooperation increases in a trust game if defection is made public, but actors must be able to act upon the observations they encounter with sanctions or positive reciprocity.[4] The experimental application of these arguments insures that subjects have complete information about the actions of all other subjects in their triad. Here, all subjects see a four period history of their group even if they themselves did not have any direct interactions with the group member.

Ostrom and Ahn (2003) find that the more connections made within a network over time the more efficient the network is at facilitating and maintaining social capital, or stated simply, increasing the number interactions increases a network's efficiency. In addition to increasing the number of connections, repeated games also produce incentives for cooperation (Axelrod 1984), and "it is quite reasonable to assume that trust as a subjective belief cannot be sustained in the long run unless it is verified frequently by the behavior of the [opponent]" (Ostrom and Ahn 2003). With more

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others, the individual is also subject to considerable social censure for taking an action considered to be wrong by others...Actions that are strongly proscribed among a set of individuals will occur less frequently (even though they promise to yield high payoffs to individuals) than will those same actions in a community that does not censure such actions."

[4] The experiment presented here did not explicitly define a punishment mechanism, nor was one explained to the subjects. They did however have the opportunity to defect on their partners if they so desired, as punishment for defecting against any other group member. Based on exit interviews most subjects did not take advantage of this fact. This could be the result of the independent payoff structure. The results of interactions between two Alters even inside Ego's own triad had no effect on Ego's payoffs. Only direct Ego/Alter interactions affected the payoffs for Ego.

opportunities to play other actors, the cost of defecting early in the game is greater than the benefit of many cooperative relationships throughout. Compared to open triads, closed triads increase the total number of interactions an actor has and thus the potential for efficiency. At any one time in a closed triad six decisions are made, three subjects who have a decision with each of two partners. In open structures this number is reduced by one third, leader make two decisions and followers one each for a total of four decisions. More connections in a network also allow for more reciprocity and per Hardin (2006), we know that with increased reciprocity comes increased cooperation.

The effects Coleman (1988) presents for closed networks, can be tested on the experimental closed triad. With six interactions and more opportunities for reciprocity and the use of meaningful sanctions, less defection should occur in the closed structures. In an exploration of 10 U.S. estuary policy networks Berardo and Scholz (2010) argue that when the risk of defection is high among actors, they benefit from the strong, overlapping, bonding ties. When exchange poses little risk of defection, weak, bridging ties are just as effective.

Therefore, I argue that when playing a series of prisoner's dilemma games, where the risk of defection is relatively high, closed or bonding triads will see more cooperation compared to the less encouraging environment of an open or bridging triad. This is not to say that open triads will not see cooperation, but that the amount observed will fall short of cooperation levels in the closed triads. This leads to the hypothesis that closed triads are better able to increase and maintain existing cooperation. Formally stated,

H1: Closed triads increase cooperation.

Closed triads provide an environment where like-minded individuals can re-enforce existing norms. It logically follows that structures with more interactions and more opportunities for reciprocity can produce higher levels of cooperation. That being said, closed triads positively affect cooperation, more so than open triads. In some estimates reported here, when the analysis is broken down further from open and closed triads into position, leader is used as the reference category. Therefore estimations draw a distinction between not only open and closed but additionally, the difference between one and two ego links (leader (2)/follower (1)) within a network and the difference between networks with the same number of ego links (member (2)/leader (2)).

1.3 Trust and Cooperation

Current discussions of trust in the literature provide little in the way of concise conceptualizations or definitions, with even less emphasis on distinguishing between trust cooperation and social capital. Hardin voices this frustration in the following quote,

> In much of the experimental literature, cooperation is taken to entail or be trust. Unfortunately, this means that trust is often identified with (or merely inferred from) cooperation and, because it is not independently measured, it yields no explanation of anything (2006, 36).

Seven years earlier, Lin (1999) had expressed similar sentiments. In the interim, Ostrom and Ahn (2003) formally explore trust as the core link between social capital and collective action stating, "Trust is enhanced when individuals are trustworthy, are networked with one another in multiple ways, and are

within institutions that facilitate the growth of trust" (xvi). This statement first recognizes the effects of structure on creating trusting relationships by referring to both a network and institutional element. Second their quote also recognizes the impact of individual attributes; actors must be both trustworthy and part of an institution that enables them to build on their dispositions. In hopes of distinguishing between cooperation and eventually two dimensions of trust, attitudes and behavior, this section outlines some of the most recent and influential studies. From these studies and definitions I develop measures of trust on both an attitudinal and behavioral dimension.

Attitudinal trust represents a subject's feelings and attitudes about trust in the general population. In the past these notions have been used in hopes of predicting how subjects will act in the laboratory setting (Holm & Danielson 2004, 2005, Gachter et al 2003). National surveys such as the GSS (General Social Survey) and ANES/NES use a specific battery of questions to gage the feelings and attitudes of the country.

The attitudinal dimension of trust can be explained simply as people's attitudes about trust in the general population. The battery of questions in the GSS is one of the most widely used measures of trust in the social sciences. These questions include such statements as; "In general, do you believe most people are out to get you or are they generally pretty honest, In general would you say that most people can be trusted." This measure is not ideal, as people's answers are not tied to any specific time, place or action; rather the aim is to gauge how people view the trustworthiness of a generic population. Relating generalized trust questions to the experimental setting has usually incorporated Orbell and Dawes (1991) use of 'projection', those subjects who feel that the public is generally honest should themselves be more trusting and therefore trustworthy.

An alternate approach to measuring trust in the experimental setting utilizes a set of questions that ask subjects about their past behavior in several situations. Most often these measures of trust relate to trust*ing* and trust*worthy* behavior. The former, trust*ing* behavior, involves the willingness of ego, or one's self, to trust another person or subject, called alter. The latter, trust*worthy* behavior represents the degree to which ego feels she can trust alter. More to the point, alter's trustworthiness is ego's belief that their interaction will produce some positive return from alter. Both of these definitions rely on the existence of two actors, an ego and an alter, and a discourse between them.

One can think of behavioral trust as the actions one takes in the face of some choice. Actions can be as simple as lending money to a friend, trusting that they will pay you back, or something with life threatening consequences such as finding a worthy climbing partner. Trusting behaviors require an acknowledgement on behalf of ego that the risk of performing the action is outweighed by the expected return. Ego's friend may not pay him back or he might drop him to his death but by agreeing to lend or climb ego's behavior shows a degree of trust in alter.

Glaeser et al. (2000) created a survey originally believed to test for trusting behavior, but the authors found the survey to be a good predictor of trustworthiness, or how trustworthy a subject (ego) was viewed by his/her opponents (alters). In other words how a subject answered the questionnaire was a predictor, on average, of how trustworthy they were perceived to be by others. Examples of behavior questions included on the survey: "When you leave your dorm/apartment do you leave it unlocked?," "How often do you lend CDs, DVDs or money to friends?," "Have you ever benefited from someone else's honesty such as getting a wallet returned?." The authors found, at least for socially related subjects, where common social connections mitigate problems of collective action trusting and trustworthy behaviors rose during experimentation; when subjects were theoretically more trusting of one another they sent more money to their partners, more so than experiments whose subjects were socially unrelated. Given these results cooperation in iterated prisoner's dilemma games, trusting and

trustworthy behavior, should increase as the level of trusting or trustworthy behavior a subject enters the experiment with increases.

Since cooperation deals with how trusting a subject is as well as the trustworthiness of their opponent, some would argue a survey such as Glaeser et al.'s, found to measure simple trustworthiness is not satisfactory to the core question of cooperation, reciprocal trusting behavior. On the other hand, if you are viewed as a trustworthy person, others will be more inclined to cooperate with you. Now, since your opponent is cooperating, you also have the incentive to reciprocate their cooperation. Orbell and Dawes (1991) make a similar assumption about projection: "whatever their cooperate-defect choice, people are biased toward expecting others to do the same as themselves" (p. 518). Thus, a score for a dimension of trustworthiness still reflects the probability that you will be prone to cooperate, and are, therefore, more prone to trustworthy and trusting behaviors.

Holm and Danielson (2005) use trust and dictator games in Sweden and Tanzania to test the determinants of sending credits to other subjects. In their trust game the authors do not find the GSS questions to be very good predictors of trusting behavior. In fact the single GSS question is not at all significant in either Sweden or Tanzania and the index of GSS questions is significant at the .05 level in Sweden only.[5] The authors do not mention the inclusion of survey questions measuring past trusting behavior which may have made it difficult to accurately predict current behavior in their trust and dictator games.

In experiments of one-shot public goods games**,** Gachter et al (2003) analyze both attitudinal and behavior trust questions in their comparison of several heterogeneous populations; their Russian subjects as well as American (Glaeser et al 2000) and South African (Ashraf 2003) subjects from outside studies. The authors evaluate each of three GSS questions separately, as well as an indexed measure, and utilize an index for the behavioral questions.[6] With their Russian subjects they found no significant effect from the behavior index. They do however find that the GSS index, as well as two of the questions that make up that index, are significant predictors of contribution in their public goods game. The authors conclude that the behavioral link does not exist in their public goods game. However, their results do coincide with part of Glaeser et al's (2000) findings on the GSS trust questions. The most widely used question of the three - how trusting do you believe others to be? - was insignificant in both studies despite its broad use in the literature. Rahn and Rudolf (2005) also find that generalized trust questions about some "other" are not good predictors of behavior despite the literature's heavy reliance on them. In their study that addresses both attitudinal and behavioral conceptualizations of trust in the experimental setting. In their multi-level analysis of trust in government they find that questions that probe attitudes are better at predicting attitudes, while questions that probe behaviors are better at predicting behaviors.

In summary, trust, as defined here includes two dimensions shown by the literature to be components of "trust"; attitudes and behavior. The distinction to make between the two measures may be simplified to what people say, attitudes, and what people do, behavior. A combination of attitudinal and self-reported behavioral questions was used in an experimental pre-survey that is discussed in detail below. Seeing as one measure is more widely used than the other the pre-survey will evaluate the

[5] The authors note that the disparity in socioeconomic status may account for the culturally specific difference in answers on the trust survey. While their survey answers differed, their trusting behavior during game play was very similar, sending 53% of their initial endowment in Tanzania and 51% of their original endowment in Sweden(Holm:2005).

[6] These were modeled after Glaeser et al's (2000) trusting behavior questions.

influence of trust and the advantage, if any, to using one type of measure over the other in the experimental setting.

The aforementioned literature shows that trusting people generally cooperate and contribute more than those who are not as trusting. Therefore, subjects with higher personal trust, attitudes or behavior, will cooperate more than those with a lower trust value when cooperation is judged by a subject's decision to cooperate in each prisoner's dilemma game. Because the questions used to derive the behavioral trust measure are based on actions and observed behaviors, a dependent variable that measures related actions and behaviors may bias the findings for significant behavioral trust results (Rahn and Rudolph 2005). That being said, I suspect the behavioral measure of trust to perform well in the models.

H2: Increasing ego trust increases cooperation.

Specifically, trust, in either dimension, will have a positive effect on cooperation. Individuals with high pretest measures of trust, or high trusters, should cooperate more in the prisoner's dilemma games, on average, when compared to low trusters.

1.4 Trust and Position

With the current literature we cannot establish the effect of networks on different levels of trust within a population. Often times this relationship is viewed as one of substitutes (Yamagishi et al 1998). If a population has a high level of one cooperation-generating element (trust or structural benefits), the other is not needed. On the other hand, it is quite possible that some networks might be better suited for or more successful in environments with higher or lower levels of trust. To capture this possibility, the interaction of trust and network position, Trust X Member (Leader, Follower) is analyzed in the following experiment.[7] For different sub-populations, specifically those with high (low) levels of trust, an open (closed) structure might damage (aide) their abilities to cooperate. If we take Putnam's (2000) example of bonding relationships we see that when a group of like-minded or homogenous individuals come together a degree of 'group think' is facilitated and maintained. A bonded group of high trusters and a bonded group of low trusters will differ in that high trust norms dominate in the former with higher cooperation while low trust norms dominate in the latter with less cooperation. That being said the same network structure may elicit two very different outcomes depending on some underlying characteristic of the population. The experiment tests this with trust predispositions as the underlying characteristic.

Fukuyama (1999) recognizes this possibility, although his main concerns are technology and hierarchy. He argues that when trust or high instances of reciprocity are present, the structure (hierarchy of relationships) of a network becomes less important for successful and efficient production. When groups have a lot of trust to begin with the structure of a network will not matter as much for facilitating cooperation. In a way this becomes a substitute for the benefits of specific structures. It is groups that have very little resources in the way of trust who should get the most out of a network structure. In the cooperation experiments presented here, I argue that those with high

[7] For estimations, the behavioral trust measure is interacted because of a significant mediating relationship between Behavioral and Attitudinal measures of trust. The Attitudinal measure is still included in all models but it is not interacted with structure. Multiple tests have shown the robustness of the model even with the inclusion of an Attitudinal interaction. Significance and sign remain the same on all variables as well.

trust levels cooperate at high levels regardless of game structure, so that the influence of structure becomes decreasingly positive as a subject's predisposition to trust increases.

H3: The positive effect of triad closure on cooperation decreases as ego trust increases.

As a subject's level of trust increases the structure of a network will have a decreasingly positive effect on their likelihood of cooperation. When subjects are prone to cooperate, on average, the structure of a network will make little difference in raising their average cooperation.

1.5 The Influence of Alters

The success of any one individual may be tied to other group participants without taking structural influences into consideration. Axelrod (1984) finds that an environment of defectors can be successfully invaded by cooperators and cooperative strategies prevail. And so I presume that while an individual can make cooperative choices, the frequency of these choices may be hampered (enhanced) by their random placement into a group of low (high) trusters. The variable AlterTrust reflects this possibility. Just because a subject is a high truster he or she may not be successful if paired with two low trust partners. Referencing the prior discussion of norms and trust, I propose a group of high trusters will cooperate significantly more than a group of low trusters. This effect should be magnified in the closed triads where their common trust can be reinforced with similar norms and increased interactions.

I predict that on average, alter trust has a positive effect on ego's cooperation in the prisoner's dilemma game. As the general trust of ego's environment increases, so too will their probability of cooperation. An interaction of ego and alter(s) trust measures the compounded effect of not only Ego's trust level but those of his/her partners. *Trust Environment* is this interaction. High trusters rely less on the trust levels of alters to increase their own cooperation, therefore I hypothesize:

H4: The positive effect of high alter-trust decreases as Ego's trust increases.

I expect a negative coefficient on the interaction, meaning ego benefits less and less from alters' trust as her own trust values increase. A negative interaction would imply that for every one unit increase in Ego's trust the positive influence gained from a trusting alter will decrease.

1.6 Experimental Design

What follows is a description of the experimental and empirical methods used in evaluating the preceding hypotheses. Experimental sessions were conducted in the XS/FS- Experimental Social Science at Florida State - Lab, a combined Economics and Political Science Department resource at The Florida State University. The subject pool for all XS/FS experiments is drawn from undergraduate social science classes. Using iterated prisoner's dilemma games, in three position treatments and controlling for trust, I analyze the effects of both structural impacts and attributes on cooperation. In total, sixty-six subjects in three sessions were randomly assigned to play eighty periods of prisoner's dilemma games in the spring of 2008.

1.6.1 Pre-survey

A pre-treatment survey was created to operationalize trust over two dimensions, attitudes about trust (Gachter et al 2003, Holm & Danielson 2005) and past and self-reported trusting behavior (Glaeser et al 2000,Orbell & Dawes1991). Each dimension contains an index of three questions modeled after findings from Glaeser et al (2000) and questions from the General Social Survey (GSS) (Gachter et al 2003, Holm & Danielson 2005).[8]

The pre-survey makes possible tests of position's effect over the range of trust values. With the ability to control for subjects' trust prior to experimenting, it becomes easier to speak directly to the effect of position. If network structure alone increased cooperation, and not trusting behavior, there should be a uniform trend of cooperation or defection across pretest trust values. Of course the same is true for position differences if trust alone is responsible for cooperation.

1.6.2 Experimental Session

Each session of the experiment consisted of groups of three subjects playing repeated prisoner's dilemma games in one of two structures.[9] Figure 1.2 shows the normal form prisoner's dilemma stage game and the payoffs for each player depending on their choice and the choice of their partner(s). Payoffs are set at 0, 25, 75 and 100. "Mutual cooperation (payoff = 75) provides a substantial advantage over mutual defection (payoff = 25), although the choices were presented to subjects as alternatives A and B rather than as 'cooperate' and 'defect' (Ahn, Esarey and Scholz 2007). Monetary values are in experimental denomination units (EDU) which are converted to U.S. dollar amounts upon completion of the experiment (400 EDU = 1 USD). The average earnings over three sessions were about thirty U.S. dollars.

The experiment is set up to mimic the elements that encourage and maintain social capital. Repeated interactions among a group of individuals involve reciprocity (in the form of payoffs and benefits from cooperation) as well as the ability to sanction group members are essential to the design of a cooperative, social capital building experiment. In the experiment this assumes that if two players have a history of cooperation, they should on average continue to reciprocate cooperate.

Two of the three sessions contained 21 subjects and a third contained 24 for a total of 66 subjects. Figure 1.3 below illustrates a mapping of one experimental session of 24 subjects. First, half (12) of the subjects were randomly assigned to begin playing prisoner's dilemmas in the closed triad (positions A, B and C), while the other half began in the open triad (positions D, E and F).[10] The example in Figure 1.3 shows the path of subjects randomly assigned to the open triad first. In the second step those 12 subjects (1-12) are assigned to triad groups of three subjects each and in the third step to positions within the triad. For example subject 4 is assigned to a follower position in an open triad with subjects 5 and 6. Within each triad group and with each partner, subjects play 20 periods of prisoner's dilemma games before being randomly assigned to a new triad group and position. In the open first triad treatment, subjects play two 20-period rounds in open triads and two 20-period rounds in closed triads. This order reverses for subjects in the closed first triad treatment. Using subject 4 in

[8] Additional questions were included on the pre-survey to establish demographic information as well as control for questions asked in previous studies (Glaezer et al. 2000).

[9] The experiment was programmed by Justin Esarey and conducted with the z-Tree software package (Fischbacher 2007).

[10] In the first session of 21 subjects, 9 started in the open structure while 12 started in the closed. This was reversed for the second session of 21 subjects.

the bottom of figure 1.3 again as an example, she is now randomly assigned to a closed triad with subjects 9 and 11. Essentially each subject has four groups of partners to which she is randomly assigned. With each group of partners she plays twenty periods of prisoner's dilemma games, in one of three positions in two structures.

Since leaders play 2 games to each follower's one, the total number of observations for each subject varies according to their randomly assigned position in the open triad rounds. Referring back to Figure 1.1 a subject assigned to position E in both open rounds has a total of 160 observations because two games were played in every period. A subject assigned to position D or F for both open rounds only has a total of 120 observations; two games in every closed triad period (40 + 40) and one game in every open triad period (20 + 20).

1.7 Empirical Analysis and Measurement

My central hypotheses concern the interactive effect of trust and position on a subject's cooperation in a series of prisoner's dilemma games. Is trust a significant predictor of cooperation? If so is this a sufficient effect or is trust's effect impacted by ego's triad position. Additionally I examine measures of the subjects' strategic environment and whether or not alter attributes significantly affect ego cooperation. Specifically, do environments of high trust alters encourage or discourage cooperation within a group?

Each subject in the experiment has at least 120 observations over the course of 80 periods of game play, some with as many as 160 observations meaning they have two observations in every period. Thus, the nature of the experimental data lends itself well to a two-way cluster-robust probit model,[11] corrected for a data structure that includes multiple observations per subject in a single period (Cameron et al 2011, Petersen 2009, Thompson 2006). This model was originally developed for firms with multiple contract observations in a given year and thus matches the multiple coordination observations in a given period in the data presented here. This correction adjusts the standard errors so that they reflect the variance of a subject cluster, period cluster and a subject- period cluster (see Petersen 2009[12]).

1.7.1 Measuring Cooperation, Trust and Position

The dependent variable measures the observed cooperate choice made by a subject in each period.[13] The following probit models use a single dichotomous variable of cooperate (1) - did not

[11] The results of various additional model specifications can be found in Appendix A. These models include a random effects panel poisson and a random effects panel probit, both clustered by subject. When estimating a random effects model it is important to determine the need for additionally robust standard errors. Unlike pooled models, which leave the element of time uncontrolled, robust standard errors are not always necessary in panel estimations, especially in long panels with random effects (these estimations). One of the key requirements for the use of robust standard errors is a dependent variable variance that is significantly larger than the sample mean (Cameron & Trivedi 2008, 620). In the experimental data presented here, the sample mean is 1.204 while the variance is much smaller with a value of .5607. In any case all models are estimated with random effects and clustered by subject ID. Appendix A also includes robusticity checks (bootstrapped standard errors) and models limited to certain nested samples of data.

[12] See also, the paper's supplemental website:
http://www.kellogg.northwestern.edu/faculty/petersen/htm/papers/se/se_programming.htm

[13] The fact that some subjects have one (followers) and others have two (members or leaders) opportunities to cooperate in any one period is controlled with a *possible cooperation* exposure component in the Poisson estimations see Appendix A.

cooperate/defected (0) for each subject pairing. In Figure 1.1, this means that some subjects, those in the closed triad or leaders in the open triad, have two observations per period because they play a prisoner's dilemma with two other subjects in each period.[14] The subject cluster is a unique session/closedfirst/subject identifier.[15] Additionally, period was standardized for all subjects so that period 1 is each subject's first period in their first open round and period 80 is their last period in their second closed triad round, with a dummy variable to indicate whether the open or closed session was played first; thus controlling for the possibility of an ordering effect. An additional discussion of controls can be found below.

The trust literature focused on two dimensions of trust, attitudes and behavior. Factor and principle components analysis both confirmed that there were indeed two dimensions within the survey. Six questions, three of each type, were distributed on two dimensions; one component loading primarily with three behavior questions and the other with three attitude questions. These components, with eigenvalues of 1.9 and 1.3 respectively, are used as a subject's behavioral and attitudinal trust measures.

With two potential measures of trust there are various approaches to analyzing this relationship. In a preliminary analysis, I evaluated trust attitudes and trust behavior as distinct measures gauging their effects separately. When evaluated separately each has a significant effect on cooperation, but when estimated in the same model the attitude component is insignificant. This pattern suggests a mediating relationship between trust attitudes and trust behaviors. While trust attitudes did not appear to be directly related to cooperation in the experiment, after checking for a mediating relationship we see that a significant attitude effect is carried through trusting behavior.[16] In other words, the impact of trust attitudes works though trust behaviors (Baron and Kenny 1986). With these results I would caution that omitting either trust attitudes or trust behavior would introduce bias into the estimation. The attitude component remains in the model as a control while the behavior component serves as the primary measure of *Trust* both on its own and as a constitutive term of the trust interactions.

Recall that structure is discussed both in terms of triad and position. Some estimations use a closed triad dummy, with closed = 1. Others use three dummy variables to control for the three positions in the two triads. *member* = 1 when a subject is assigned to the closed triad. The open triad produces two dummies, one for the *leader*, or position A, and the second for the *follower*, positions B or C. When positions are used as measures of structure, leader is used as the reference category.

AlterTrust is measured by the average of each ego's alter trust (behavior) components.[17] In Figure 1.1, the alter trust variable for a member (B) and a leader (E) would be the average of subject A and C or D and F's trust component scores, since members and leaders make decisions with both of their alters. In the open triad, follower D or F's alter trust score is their leader's trust component score.

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[14] For this reason the panel probit models were set by period j(period), the standardized time panel.

[15] When faced with nested clusters, one simply clusters at the highest level of aggregation (Cameron, Gelbach and Miller 2011, 3). Model specifications utilizing lower levels of aggregation are available upon request. In most instances standard errors were much smaller. Aggregating at the highest level is the more conservative approach.

[16] In an earlier OLS estimation, based on the average cooperation in each structure, (two observations per subject) this relationship was also significant. A Sobel (1982) test on a logit model confirmed the presence of a mediating relationship between attitude and behavior trust with $\beta/s.e.$ = z-score of -3.172 and p-value < .000 (Baron and Kenny 1986) That is, the effect of attitude on cooperation works through behavior (see Baron and Kenny (1986) for more). Imai et al (2010) offer additional solutions.

[17] Panel probit models were also estimated based only on the relevant partner's trust values. These results are available in Appendix A.

Thus, an alter's trust score is only incorporated into the average when ego and alter have a direct interaction.

1.7.2 Controlling for Treatment Effects

closedfirst is a dichotomous variable, coded 0 for starting game play in the open structure and 1 for starting game play in the closed structure. The conditional effect of an initial, hostile structure could affect game play in the other. I predict closedfirst to have no significant conditional effect on cooperation/social capital. Additional control variables include a set of round dummies controlling for experimental progression of game play and *last periods* which controls for the natural tendency of unraveling, consistent with the backwards induction associated with finitely repeated prisoner's dilemma games (Osborne 2004).

1.8 Results

1.8.1 Cooperation Trends by Position and Trust

The ultimate goal in estimating these models of cooperation is to directly test whether the level of trust a person has, the trust of their partners, their position, or a combination of these effects will be a significant predictor of experimental cooperation in iterated prisoner's dilemma games. Before getting into the results of the two-way cluster robust probit estimations it will be beneficial to first examine some of the general cooperation trends captured in the experiment.

The results reported in Table1.1a do not support Hypothesis 1, which argues that closed triads should result in higher levels of cooperation than open ones. The total number of cooperate and defect decisions are reported in the main table, with the number of decisions in the closed triad adjusted (divided by 1.5) to equalize the number of observations. The table on the right indicates the proportion of each decision made in open vs. closed triads and the lower table indicates the proportion of decisions in each triad type that were to cooperate or to defect. Closed triads actually cooperated less than open ones (72% vs. 73%), but the difference as measured by t-test was not significant.

When separated into the three positions in Table 1.1b, it is leaders who have the highest level of cooperation among the three, cooperating 75% of the time. However, members and followers are not far behind, each with about 72% cooperation, and this difference is not statistically significant. It appears at least from the raw data that structure and position have little to no direct effect on cooperative choices.[18]

When broken down in Table 1.1c by trust category (=1 if in the bottom 33%, =2 if in the middle 33% and =3 if in the top 33% of trust scores) the data provides support for Hypothesis 2, indicating that subjects with high trust scores cooperate more than subjects with low trust scores. The raw data confirms this expectation in the aggregate, seen in the top left portion of Table 1.1 c. Low trusters, those in the bottom 33% of trust scores, cooperate about 59% of the time. Those with trust scores in the top 33%, high trusters, cooperate about 80% of the time. Those in the middle 33% of trust scores cooperate about 75% of the time.

[18] One additional test of structure's impact is the comparison of the cooperation level of members with alters in the closed triad and leaders with followers in the open triad, the two positions with two games per period. If structure had no effect we would expect no difference in cooperation between the two positions. The correlation between ego's cooperate choice with partner one and ego's cooperate choice with partner two as a member, is higher (.42) than their 2-link counterpart in the open triad, leaders (.34).

Breaking trust category down by alter trust pairings,[19] the top right of table 1.1c., it is the combination of high trust ego's and high trust alters that see the most cooperation regardless of position, cooperating on average 85% of the time. At the other extreme, a low trust ego paired with a low trust alter(s), on average, cooperated only 38% of the time. For all levels of ego trust, increasing alter trust increased ego average cooperation. This increase in cooperation was highest among low trust egos. The implication is not only that subjects in higher trust categories cooperate more, confirming Hypothesis 2, but also that cooperation for all categories of ego trust is conditional on the cooperation of alters. Indeed, low trusters are the most responsive in terms of change in cooperation rates, primarily because they begin at a very low rate when paired with other low trusters.

This general pattern holds primarily for members when the results are distinguished by position in Table 1.1c, with cooperation increasing with both ego and alter trust levels. Leaders and followers, on the other hand, exhibit somewhat different patterns. Remember that the "alters" of followers are in fact leaders, and when a follower is a low truster she follows the usual pattern of increasing cooperation as the leader's trust increases.). However, mid and high trust level followers actually cooperate considerably less with high than with mid-level trust leaders, and their levels of cooperation with high trust leaders are actually lower than those of the low trust followers. It appears that leaders with mid- level trust are able to elicit higher levels of cooperation from more trusting followers than high trust leaders.

Among leaders, the response to high trust alters provides the anomaly, with levels of cooperation being highest for low trust leaders and dropping as trust decreases. This suggests that the interaction of position and trust deserves closer attention, although the number of observations is too small in some of these cells (particularly low trusting leaders with high trusting followers).[20]

Table 1.1c is illustrated graphically in Figure 1.5a, which reports the average number of cooperative choices in each of the 20 periods for each position in each of the four rounds.[21] The experimental design randomly assigned subjects to start in the open and closed triad, but since no significant difference was found between subjects starting in one of the other position, Figure 1.5a (and 1.5b) aggregated and labeled open triad rounds as rounds 1 and 2 and closed triads as rounds 3 and 4, even though half of the subjects actually experienced the closed triads as rounds 1 and 2 and open triads as rounds 3 and 4. High trusters are shown with solid lines and low trusters are shown with dashed lines. In the open treatment leaders are shaded a light grey and followers a dark grey. Members of closed triads are shaded black. Again, the high and low trust categories were determined from the top and bottom 33% of trust values respectively. The sharp differences between rounds are the result of random partner matching at the beginning of each round.

Looking first at the closed triad rounds (3 and 4) in Figure 1.5a, high trusters consistently cooperate at higher rates than low trusters, which is also consistent with the patterns in Table 1c and hypothesis 2.[22] The highest average cooperation among low trusters in the closed triad is about 75%,

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[19] Alter trust is measured as the average trust level of ego's partners (iff they play a game with them directly in a period).

[20] This cooperation percentage is based on two ego-alter combinations (77/80 cooperate choices), so that the conclusions drawn from this segment of the raw data are by no means backed by robust tests of statistical significance. See the empirical section below for a discussion of significance.

[21] Figure 5 was created in Stata with the "graph twoway lowess" command, conditioned on 12 combinations of the standardized period, truster and position.

[22] The drop off at the end of each round is a normal progression in finitely repeated prisoner's dilemma games. The knowledge that play will end incentivizes players to defect in the last round, T, for optimal payoffs. But since this is a common strategy all players know all others will be defecting in the last round, T, so they defect at

but this quickly tapers off and most cooperation levels are in the 40-60% range. The open rounds in Figure 1.5a shed more light on the anomalous behavior of leaders and followers in the open triads. In the first open round high truster cooperation (solid lines) is, on average, higher than low truster (dashed lines) cooperation, regardless of position, with low trust leaders having the lowest level of cooperation in every period. In the second open round, however, it is low trust leaders who out-cooperate the high trusters. Low trust leaders who have already experienced one round of open play (in either position) dramatically increase the level of cooperation! Figure 1.5b further distinguishes between low and high trust leaders when paired with low and high trust followers. It appears that at least part of the high levels of cooperation in the second round among the low trust leaders in figure 1.5a is the result of those leaders (2 subjects) being partnered with high trust followers (4 subjects), as is shown in Figure 1.5b. Up until the normal end-of-round defections, these two triads were cooperating almost 100% of the time. In fact it is the case for all leaders that they always cooperated more when they have followers who are as trusting or more trusting than them. I control for this phenomenon empirically in the next section with a series of dummy variables and restricted model estimations.

Putting aside the low trust leader puzzle for a moment, small trends of maintaining cooperation are visible in figure 1.5a. Among high trusters, prior to the end of game decreases in the last three periods, the effect of being in the closed structure increases average cooperation by about 8% over being in the open structure (based on open triad cooperation levels). In addition, their level of cooperation is sustained and actually increases over time within each of the closed rounds. In the open structures this initial level of cooperation is not maintained. Average cooperation among high trusters in round 1 of open triad play is about 86%, and decreases to 77% in their second round playing in the open triad.

The differences between open and closed structures among low trusters are also best illustrated by the average cooperation levels prior to the end of game decreases. There is actually no significant difference in average cooperation for low trusters in the closed triad between rounds and the trend of cooperation for low trusters does not increase as it does for their high trust counterparts. Low trusters in round one of the open triad cooperate on average 54% of the time, regardless of their position. In round 2 low trust *followers* continue the low cooperation trend with a slightly elevated average of 63%, below all high trusters, regardless of triad position. Low trust *leaders* on the other hand, rise to an average cooperation of 89%, for a total low truster average round 2 cooperation of 76%.[23]

1.8.2 Statistical test of hypotheses

Comparing high and low trusters overall it is evident that high trusters cooperate a greater percentage of the time and it is their ability to sustain high levels of cooperation even in open networks that sets them apart from low trusters. As hypothesized, it appears much easier to maintain cooperation in the closed structures, especially for high trusters. For low trusters, figures 1.5a and 1.5b are inconclusive when determining whether the average cooperation in the closed triads is higher or lower than in the open triads. Regardless of position, low trusters seem to increase their average cooperation over time in the open triad while it decreases in the closed. Figures 1.5a and 1.5b also leave out some of the intricacies of the ego, alter, position relationship.

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round T-1, but all players know this as well so they defect at T-2 and so on (Osborne 2004). This phenomenon is controlled for with the variable *last periods*. As expected its coefficient is both significant and negative. You will also notice that the last round of the experiment enhances the end of round decline.

[23] This low trust leader/high trust follower trend is the result of two leaders' behavior. Empirical analyses with dummy variables for these two subjects yield results similar to those reported here.

In sum, this initial view of the data suggests several hypotheses to be tested in the series of models discussed below. . First, is a high truster' s average cooperation significantly greater than a low truster' s cooperation, as Figure1.5a suggests? In addition, does triad structure significantly condition this effect as it appears to do among high trusters in closed triads and low trusters in open triads? What of ego's partners, does alter trust significantly increase cooperation? If so, is the positive impact observed significant in both triads?

1.8.3 Ego and Alter Trust Increase Cooperation

The statistical tests of the above hypothesis are performed using two-way cluster robust probit models gauging trust and position's effect on cooperation.[24] The results from these models hold when examining alternative measures of cooperation, ego trust and alter trust, all of which are presented in Appendix A. Table 1.2 Column 1 shows the results clustered by subject, period and subject and period. The probit2 procedure in Stata used for this double cluster estimation adjusts standard error estimates to accommodate repeated subject observations within a single period (Petersen2009).

Column 1 estimates the effect of trust (ego and alter) and triad, making no distinction between leaders and followers. In this estimation three key control variables are significant and in the expected direction: lastperiods, round 2 and round 3. The final three periods in a round significantly decrease cooperation as was observed by the extreme end of round defection rates in Figure 1.5a. In addition, rounds 2 and 3, the non-standardized round dummies, increase cooperation compared to round 1, while round 4's effect on cooperation is not statistically different from that of round 1. The control for round 2 low trust leaders, an interaction between trust and leader in round 2 as explained above, is significant and negative. This coefficient confirms that it is *de*creasing levels of round 2 leader trust that *in*crease cooperation. As was shown in figure 1.5b this is likely the effect of low trust leaders partnered with high trust followers.

Among the key variables of interest, triad structure alone does not have a significant effect on cooperation while ego and alter trust both significantly increase ego's cooperation. Because probit models do not conform to the assumptions of linear models, the interaction of ego and alter trust must be interpreted in ways other than coefficients and standard errors alone. A graph of the predicted probabilities and first difference (Brambor, Clark & Golder 2006) will illustrate this point. The constitutive terms of the interaction, ego and alters' trust are both significant in column 1. Their interaction is not, though it does carry the expected negative sign. The following analysis shows the points on a range of ego trust scores that are significantly affected by an increase in alter trust. The panels in Figure 1.6[25] show this effect in the closed (6a) and open (6b) triads.[26] The solid line in both figures represents the difference in predicted probability of moving from the mean alter trust score (0.03) to one standard deviation higher (about 1.0) over the range of ego trust values. The dotted lines represent a 95% confidence interval in a two-tail test. The area where this interval does not include the zero line contains the significant portions of the first difference.

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[24] Models were estimated in Stata with the probit2 command in the cluster2.ado file (Petersen 2006, http://www.kellogg.northwestern.edu/faculty/petersen/htm/papers/se/se_programming.htm).

[25] Code to produce these graph can be found on the webpage accompaniment for (Brambor, Clark & Golder 2006), at http://homepages.nyu.edu/~mrg217/interaction.html.

[26] Predicted probabilities were calculated on Table 1 Column 1, absent the effect of rounds 2, 3 and 4. Aside from ego trust and closed, round2leader=0, experimental treatment controls were set to appropriate values for each triad and AlterTrust and Attitude were set to their means.

In both the closed (6a) and open (6b) triads, the difference in predicted probability of cooperation is significant over all values of ego trust except the very highest scores (1 and above, about 20% of the subjects). These high trust subjects appear likely to cooperate regardless of the environment in which they are playing, while subjects with lower levels of trust appear to respond positively to the trust of others in their group. Congruent with hypothesis 4, the line is negatively sloped indicating as ego's trust increases the effect that her alters' trust has on her decision to cooperate decreases. For egos with a trust score of 1 and greater, alter trust has no significant impact on their decision to cooperate.

Column 2 in Table 1.2 breaks the structural dimension down by members, leaders and followers. With leader as the reference category, coefficient estimates distinguish not only the between-treatment effects absent differences in the number of links (leaders with two links compared to members also with two) but also the within-treatment effects of a simple count of links (leaders with two links compared to followers with just one). The control variables' signs and significance are unchanged. Ego and alter trust are both again significant; here the significant coefficient for ego trust reflects the impact of trust for the omitted category of leader, and the positive coefficients for trust interactions with member and with follower indicate even greater impacts for them. The insignificance of these coefficients indicates only that they are not significantly different from the impact of trust on leaders. The results of first differences by position are presented in the panels of Figure 1.7.[27] As in Figure 1.6, it is low trust egos in all positions that seem the most effected by alter trust. The positive effect of higher trust alters dissipates as ego trust increases.

The first difference in predicted probabilities for the three comparisons (members and leaders, leaders and followers, and members and followers) can be found in Appendix A. Column 3 models the effects of trust and position without experimental treatment controls, to demonstrate the robustness of results. When these controls are removed the variables retain their general sign and significance, with the exclusion of ego trust which drops in significance by one level.

1.8.4 Observations Within Triads and Within Rounds

Tables 1.3 and 1.4 analyze the differences between the earlier and later rounds observed in the previous section by focusing on rounds with open and closed triads separately. The results of the full model with all rounds and all variables distract from some more obvious trends when the data is analyzed within triad and round. Column 1 is an estimation of the variables from the previous model on data from both open triad rounds, and columns 2 and 3 estimate each round independently. Table 1.4 simply reconfirms the results in the previous model for closed triads in both rounds. For all models, ego and alter trust are positive and significant in accordance with hypothesis 2.

Table 1.3, on the other hand, provides a slightly different interpretation for the notable increase in cooperation among low trust leaders in the second round observed in Figure 1.5. The first column coefficients reports that leaders do not cooperate at significantly higher rates than followers (the omitted category). Nor does trust affect leader cooperation any differently than it affects follower cooperation in the first period (again, first period is the omitted category of leader x trust). However, the significant negative coefficient for the interaction of Round 2 Leader and trust indicates leader trust has significantly less impact on leader cooperation in the second round in comparison to the first

[27] Predicted probabilities were calculated on Table 1 Column 1, absent the effect of rounds 2, 3 and 4. Aside from ego trust and position, alterTrust was increased by one standard deviation from its mean, round2leader=0, experimental treatment controls were set to appropriate values for each triad and Attitude was set to its mean.

round. The same story emerges from the independent analyses of each round: the insignificant coefficient for the leader and trust interaction in the first round indicates no difference between leaders and followers in the influence of trust, while the large significant negative coefficient in the second round indicates that trust has if anything a negative impact on leader cooperation. Apparently experience garnered in the first round of play in open triads represses the influence of initial trust attitudes on cooperation, but only for subjects in the leadership position.

Two other differences between open and closed triads are evident in comparing the two tables. First, alter trust has little or no impact on cooperation levels in the open triad, suggesting that strategies are less conditional on the play of the opponent in open than in closed triads. In the same vein, the interaction between ego and alter trust has a significant negative impact in the open triad in column 1, indicating that a pairing of opposites tend to enhance cooperation more than a pairing of high trust in open triads. However, the effect is not significant for the individual analyses, suggesting caution in interpreting this result.

Second, the impact of the order of play suggests a small and fleeting novelty effect in which changing from closed to open triads or the opposite both provide a short term boost to cooperation. The significant positive effect of closedfirst in the first round of open triads in Table 1.3 indicates that playing in the closed setting first increases cooperation in the first round played in the open setting. When this variable =1, the open rounds were actually ego's third and fourth experiences playing the iterated prisoner's dilemma games with new sets of partners. Thus the first open round corresponds to the third experience when closedfirst=1. The positive impact of playing in closed first does not last to the second round of open triads, however, since the coefficient is not significant in column 3. On the other hand, the negative coefficient for closedfirst in the first round in Table 1.4 (labeled round 3) indicates that cooperation is lower in closed triads when the first experience comes in the closed triad compared to when the first experience is with open triads. In other words, subjects playing the open triad first increase their cooperation when they first encounter the closed triad game. Again, the impact does not last to the second round of the closed triad.

In summary, subjects who entered the experiment with high levels of trust cooperated more often than those who did not. Subjects generally responded contingently to alters in the sense that they cooperated more with high trust alters, who in turn cooperate at higher levels than low trust alters. The major exception to contingent responses was in the open condition, particularly for those in leadership position. When subjects lacked this personal trust they were better off when matched with high trust alters. Leaders in the second round of open triads cooperated at the same level regardless of their trust levels. In experimental prisoner's dilemma games, where the risk of defection is high, the expectation was for structure to play a much larger role than it did.

1.9 Conclusions

The idea that both individuals and networks themselves are responsible for facilitating and maintaining social capital is not a new concept in the literature. This study provides a unique analysis of the interaction between preexisting individual trust predispositions and randomly-assigned relationships in predicting cooperative choices in iterated prisoner's dilemma games. Separating the measure of trust from cooperation illustrates that trust and network structure are indeed distinct concepts from one another and cooperation, deserving of separate attention when predicting collective behaviors.

Throughout the literature trust is defined on dimensions of behavior and attitudes. When other studies looked at both dimensions they concluded that one or the other was more or less

significant and influential at predicting cooperation and/or collaboration. After including both dimensions in my model I found what first appeared to be similar results. Only past instances of self-reported trusting behavior had a significant effect on experimental cooperation. Further analysis showed a significant mediating relationship between the two, that is, the effect of attitude on cooperation works through trusting behavior. This relationship is a novel finding within the trust literature and I encourage current and future experimenters to consider the possibility of a mediating relationship before discounting either trusting attitude's or trusting behavior's effect in the future.

This paper examined the role that personal trust, position and group member characteristics play in an individual's decision to cooperate in a series of prisoner's dilemma games. The goal was to determine what had the greatest effect—characteristics about individuals such as their level of trust, or at a more macro level, the structure and organization of a relationship network. The results of the research suggest, as predicted, that it is a combination of both. Subject's overall level of cooperation increased with higher trust scores. When in a closed network, subjects with high trust scores cooperated the most while low trusters did significantly worse comparatively. In the open structure, trust still played an important role, but leaders with experience in open structures were much less responsive to different levels of trust, and both leaders and followers were less responsive to trust of alters.

Being a high truster in a closed network increased the probability that a subject cooperated in the experiment. This probability decreased when subjects were classified as a low truster. Closed structures provide the resources, especially for groups of high trusters, to easily maintain cooperation; implying high trusters are better able to utilize the benefits of closed structures. Conversely, groups of low trusters re-enforce their low trust norms, circulate defective behaviors, resulting in less average cooperation. Open networks, on the other hand, are capable of increasing cooperation for low trust leaders, who showed greater improvements period to period and round to round while high trusters gradually decreased their cooperation. For at least low trusters it appears that open triads that represent bridging relationships can be just as effective as closed, bonded structures. For high trusters who are already prone to cooperate moving from an open to a closed structure provides no significant benefit though cooperation is more easily maintained.

Additionally, the findings suggest a strong contingent influence on a subject's decision to cooperate. In the experiment subjects with low to moderate levels of trust were greatly affected by their partners' levels of trust. This finding supports numerous theories within the literature on the effects of bridging and bonding relationships and their role in establishing and maintaining behavioral norms among a population (Putnam 2000, Coleman 1988, Tadellis 2007, Fehr & Fichenbacher 2004, Ostrom 1990, Axelrod 1984, North 1990).

The lower a subject's personal trust the greater the effect their partners' trust had on their cooperation. The behavior of high trusters in the experiment did not differ significantly when paired with alters of high or low trust. The idea that alter trust becomes less important the greater ego's trust supports Fukuyama's (1999) claim that those with high trust do not need to rely on other supporting factors for cooperation to take place. Rather they rely on their own beliefs to make the decision to cooperate. Low trusters, particularly low trust leaders in the open triad responded positively to high trust partners, greatly increasing their average cooperation over the course of the game.

In conclusion I find that trust and structure interact to maintain social capital with mutual trust supporting cooperation in closed networks. For any level of ego or alter trust and any combination of subjects, networks and institutions can be structured to increase the likelihood of cooperation. High trusters and high trust environments respond well to structures with many bonded links and closure,

while low truster leaders and complacent followers seem to cooperate more in open, bridging and disconnected structures.

1.10 Further and Future Explorations

The influence of intra- and interpersonal trust on collective behavior has been established, but how and why personal trust interacts with the trust of one's partners in a strategic situation has yet to be determined. Future research should explore the relationship between individuals, their trust and the strategies that they employ in the laboratory setting. It is likely that subject's trust is correlated with their initial strategy selection, for instance, high trusters might always cooperate or play TFT while low trusters use a grim trigger strategy or always defect. Factor in the impact of structure and it may be the case that one or the other is better suited to influencing subjects into switching to more cooperative strategies.

When all three elements enter the calculus, ego trust, structure and alter trust, the available avenues for exploration grow exponentially. Take for instance the observation in this study that the pairings of a low trust leader and high trust followers cooperated almost 100% of the time. How did this play out strategically in the iterated prisoner's dilemma games? Was it low trusters conforming to the cooperate norms of their high trust followers, or was it that high trust partners are more likely to follow the lead of others? Questions like these can be answered through a detailed analysis of the strategy profiles for different types of subjects. If the former is true do we see followers punishing leaders for their lack of cooperation with a tit-for-two-tats (Axelrod 1984) strategy? If it is the latter, do we see high trust followers adapting to whichever strategy is employed by their low trust leader, following their lead?

These are all questions for a finitely repeated prisoner's dilemma game. Future research should look at the trends associated with changing the horizon of the game or the conditions of the interaction itself. The next chapter expands the analysis from the traditional prisoner's dilemma to three games of coordination, where presumably the risk of defection is much lower. Preliminary intuition would suggest that now, with an emphasis on the mutual benefits from coordination the dynamic between trust and position in the series of games will be somewhat altered.

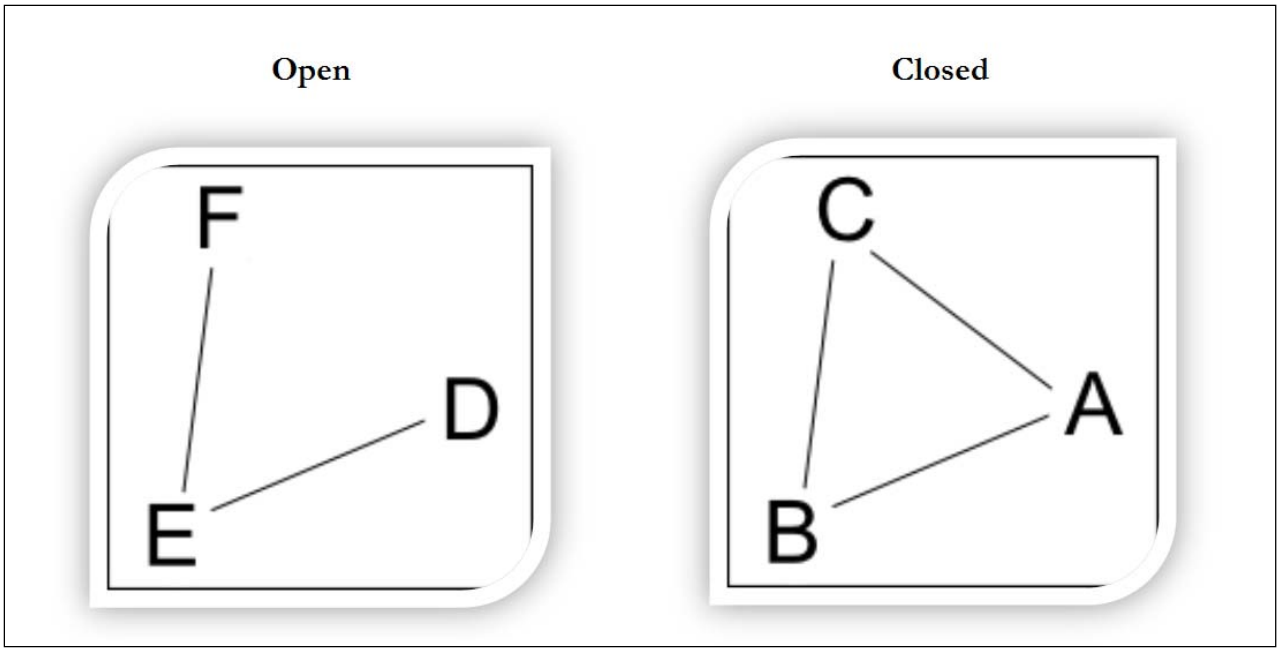


Figure 1.1 Experimental Triad Diagram

Positions A, B and C are members of the closed triad. Positions D and F are followers, and E is the leader in the open triad.

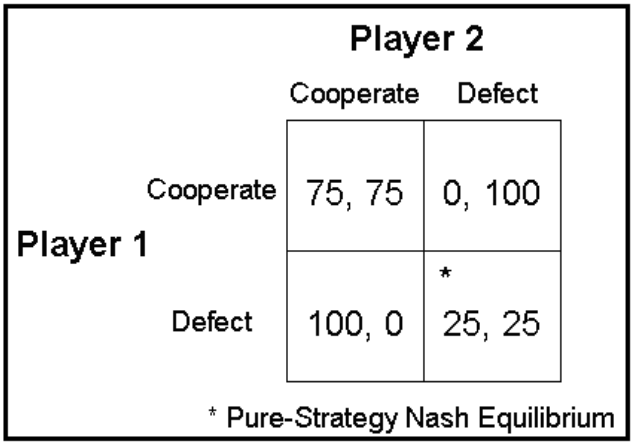


Figure 1.2 Experimental Prisoner's Dilemma Game

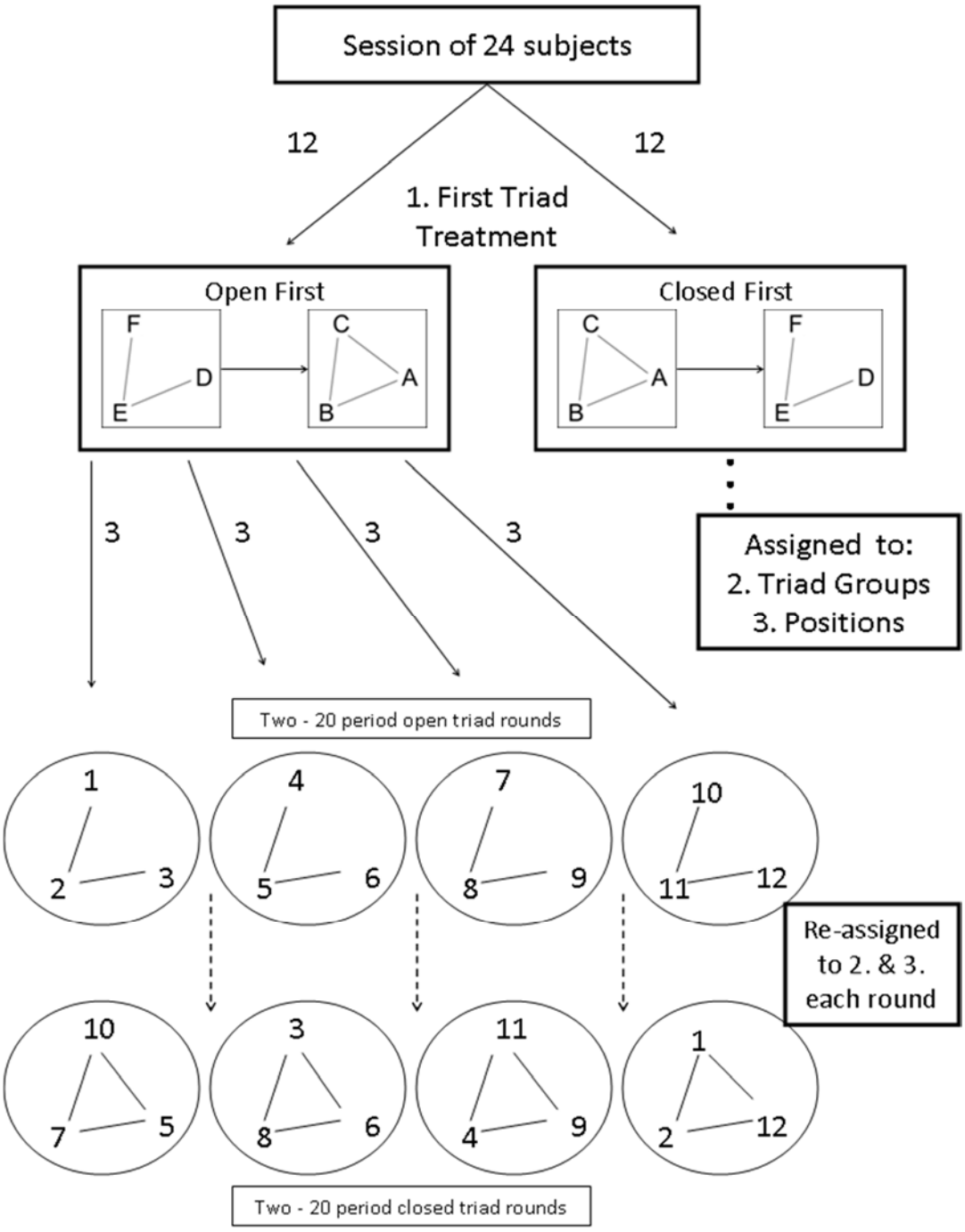


Figure 1.3 Experimental Map of Each Session

Table 1.1a Ego cooperation choices, by triad

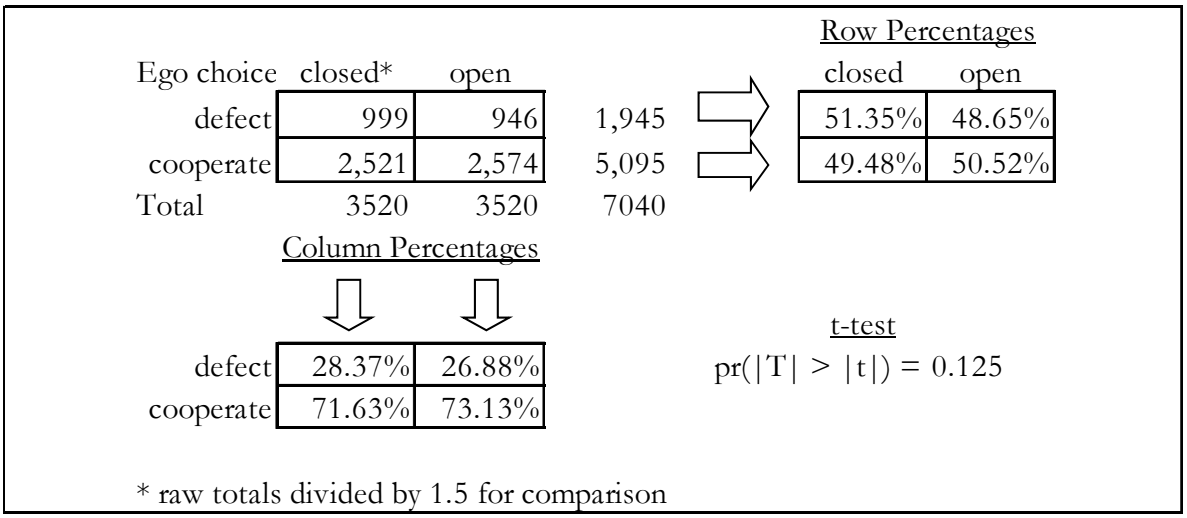


Table 1.1b Ego cooperation choices, by position

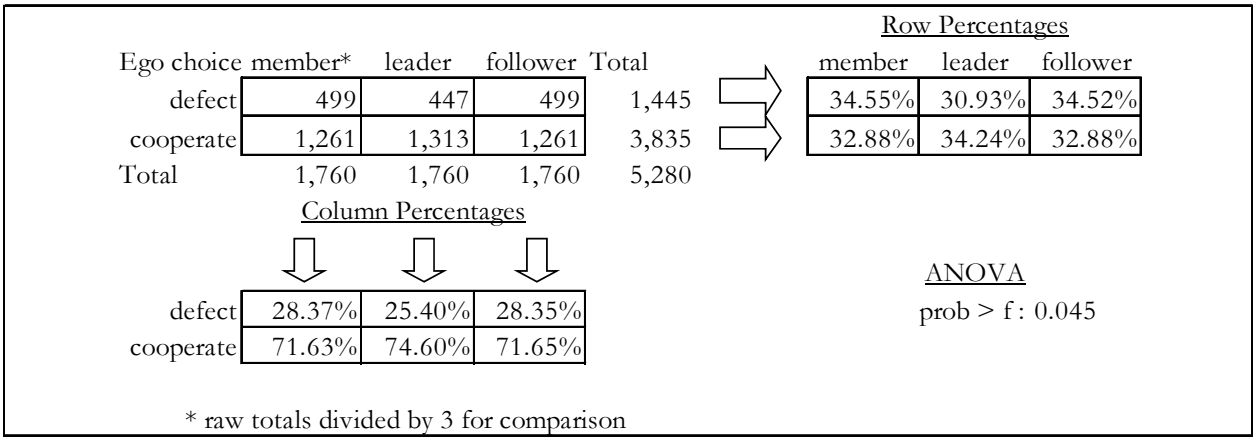


Table 1.1c Ego cooperation choices by ego trust, alter trust and position

Ego Cooperation by Truster

low	58.97%
med	74.55%
high	79.53%

All cells indicate the % of observed cooperation given the possible number of cooperations for a given ego-alter trust combination.

All Positions

Ego \ Alter	low	med	high
low	38.33%	57.17%	71.52%
med	66.15%	76.67%	79.49%
high	74.03%	83.33%	85.29%

Members

Ego \ Alter	low	med	high
low	43.61%	54.42%	66.61%
med	61.79%	75.96%	81.09%
high	73.13%	82.00%	92.05%

Followers

Ego \ Alter	low	med	high
low	22.50%	56.88%	74.29%
med	79.17%	81.43%	69.33%
high	85.63%	88.89%	70.00%

Leaders

Ego \ Alter	low	med	high
low	--	63.33%	96.25%
med	63.33%	75.42%	88.75%
high	71.67%	82.50%	82.50%

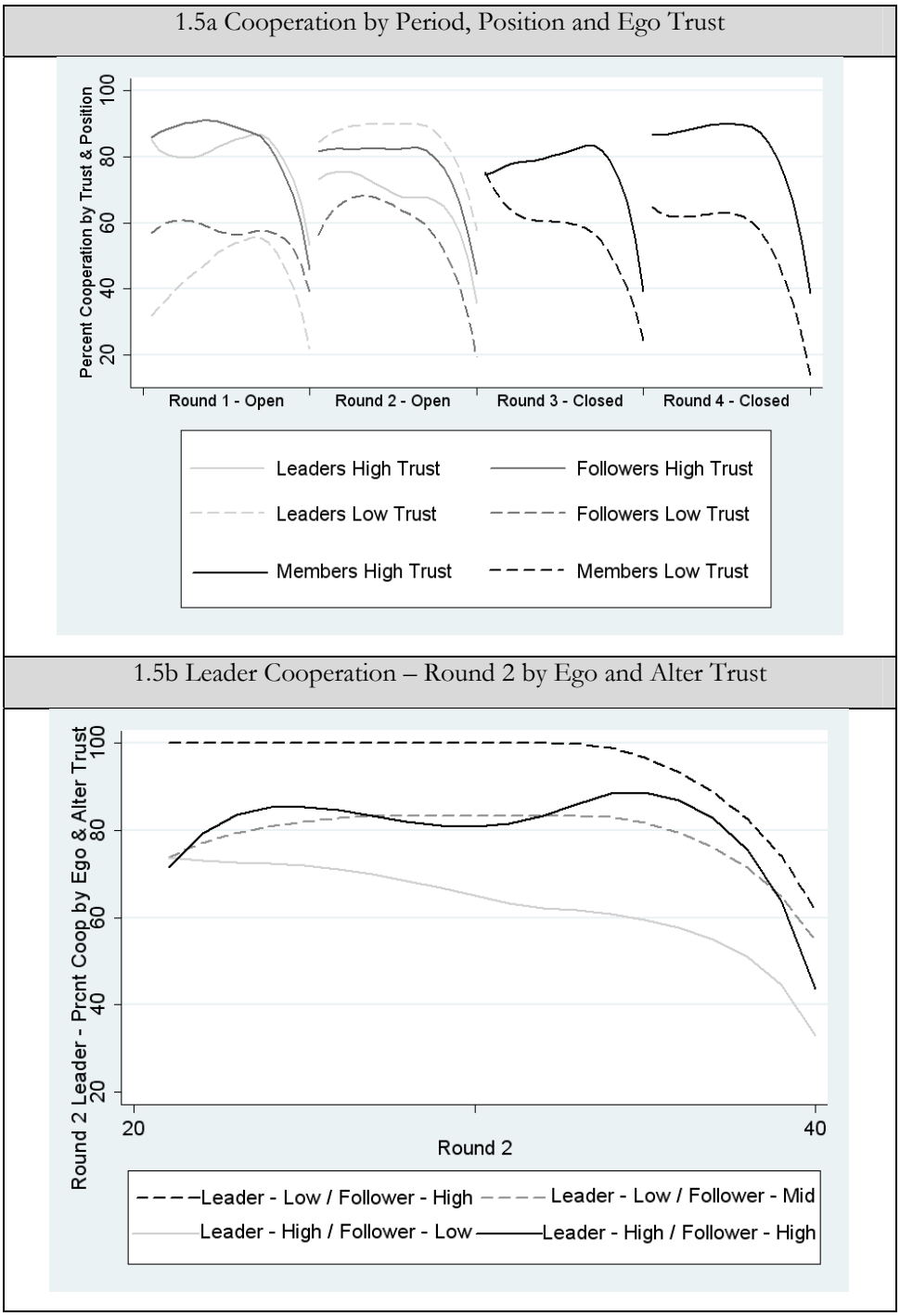


Figure 1.5 Cooperation by Period, Position, Ego and Alter Trust

Table 1.2 Determinants of Experimental Cooperation

	Open/Closed b/se[1]	Position b/se	Position no controls b/se
Closed/Member	0.003	-0.085	-0.084
	(0.11)	(0.15)	(0.15)
Follower	--	-0.135	-0.122
		(0.15)	(0.15)
Ego Trust	0.286***	0.207*	0.194+
	(0.09)	(0.12)	(0.12)
Alter Trust	0.177***	0.182***	0.169***
	(0.06)	(0.06)	(0.05)
Trust X Closed/Member	0.086	0.151+	0.135
	(0.08)	(0.12)	(0.11)
TrustXFollower	--	0.126	0.117
		(0.13)	(0.12)
Ego X Alter Trust	-0.022	-0.032	-0.020
	(0.04)	(0.04)	(0.04)
Trust Attitude	0.040	0.045	0.039
	(0.05)	(0.05)	(0.04)
Round 2 Leader	-0.093	-0.126	-0.110
	(0.13)	(0.13)	(0.12)
Round 2 Leader X Trust	-0.260***	-0.227**	-0.207**
	(0.10)	(0.11)	(0.10)
closedfirst	-0.029	-0.026	--
	(0.13)	(0.13)	
lastperiods	-0.756***	-0.757***	--
	(0.19)	(0.19)	
Round 2	0.416***	0.418***	--
	(0.14)	(0.14)	
Round 3	0.413***	0.418***	--
	(0.12)	(0.12)	
Round 4	0.180	0.185	--
	(0.15)	(0.15)	
constant	0.560***	0.651***	0.740***
	(0.15)	(0.19)	(0.14)
N	8800	8800	8800
d.f.	13	15	10
loglikelihood	-4696.4	-4688.8	-4942.5

+ p<10 (one tail), *p<10 **p<05 ***p<.01 (two tailed)

[1]Two-way robust std. errors clustered by subject and period

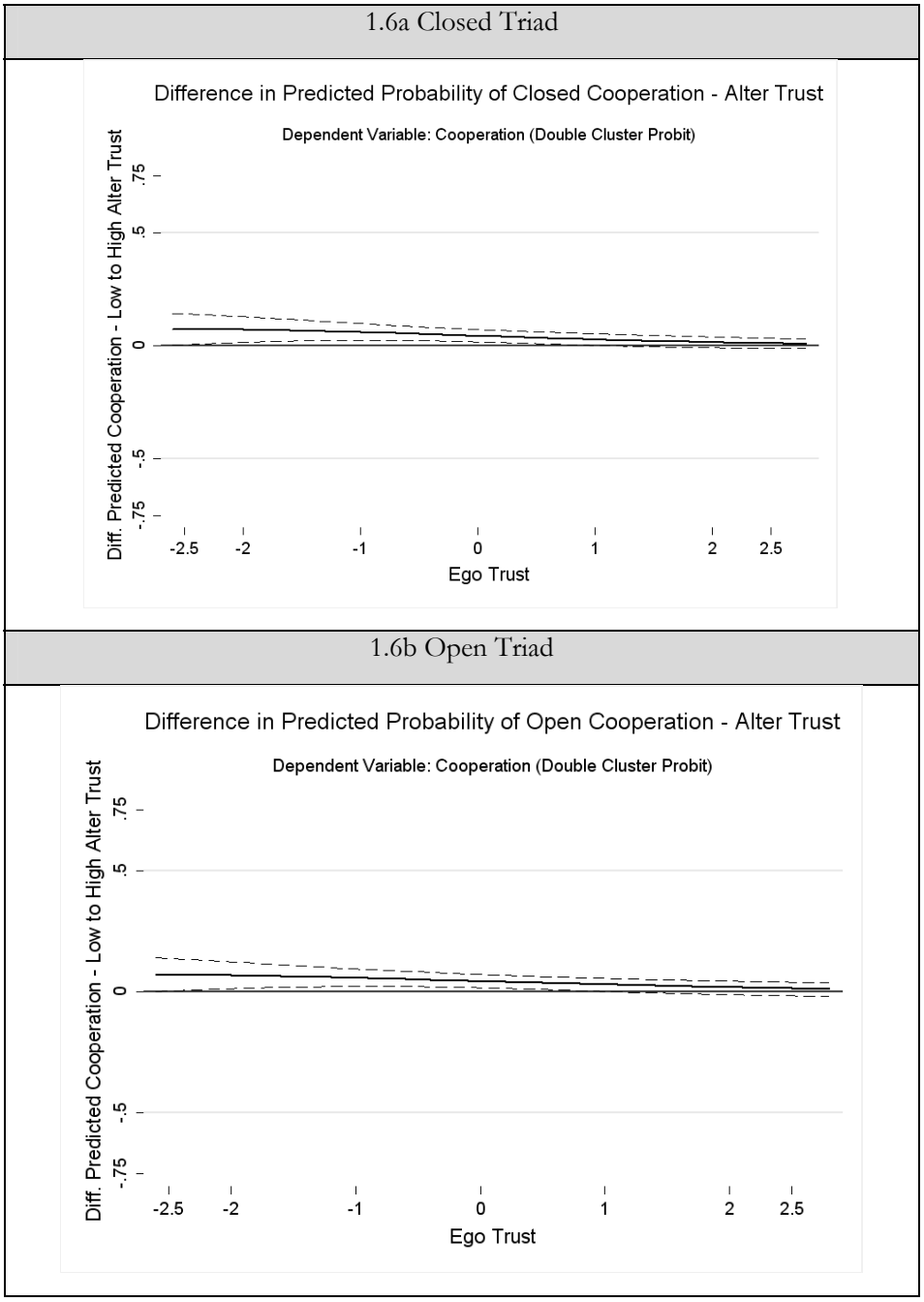
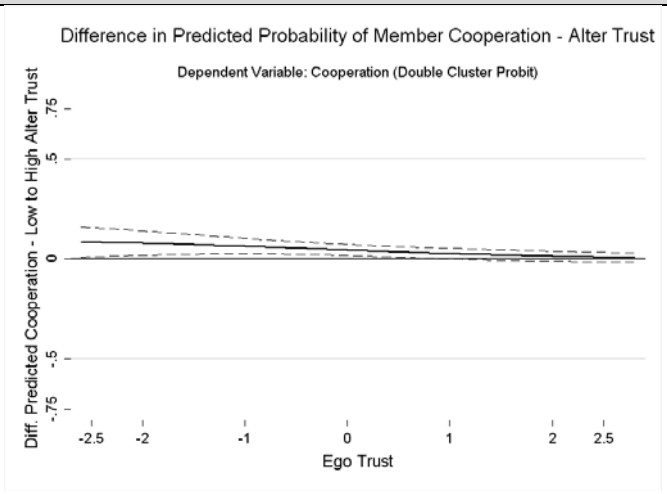
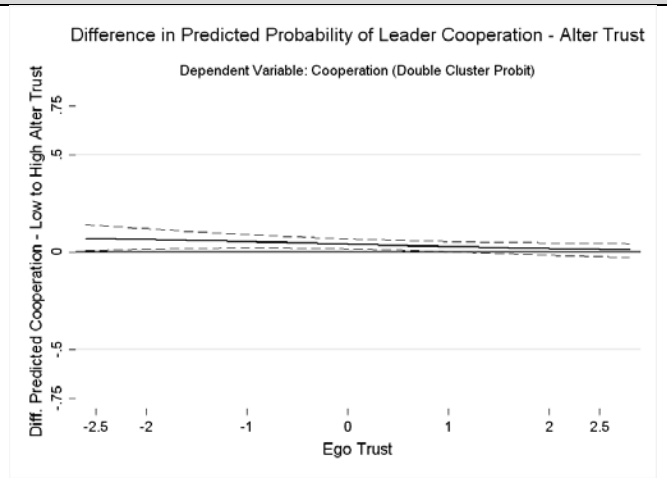


Figure 1.6 Difference in Predicted Probabilities for Ego and Alter Trust by Triad

1.7a Members



1.7b Leaders



1.7c Followers

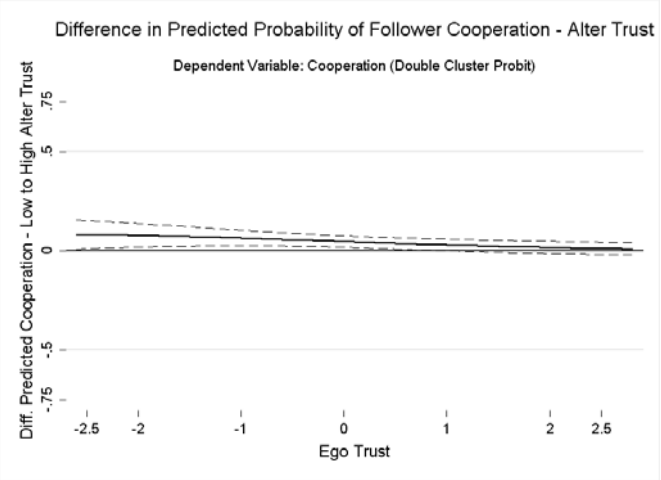


Figure 1.7 Difference in Predicted Probabilities for Ego and Alter Trust by Position

Table 1.3 Determinants of Experimental Cooperation

	Open Rounds Only		
	Rounds 1 & 2 b/se[1]	Round 1 b/se	Round 2 b/se
Leader	0.130	0.049	0.028
	(0.16)	(0.21)	(0.24)
Ego Trust	0.366***	0.265**	0.318**
	(0.09)	(0.12)	(0.13)
Alter Trust	0.033	0.146	-0.061
	(0.06)	(0.13)	(0.09)
TrustXLeader	-0.141	-0.115	-0.484***
	(0.13)	(0.21)	(0.18)
Ego X	-0.102*	-0.097	-0.095
Alter Trust	(0.06)	(0.17)	(0.08)
Trust Attitude	0.065	0.094	0.082
	(0.06)	(0.08)	(0.08)
Round 2 Leader	-0.280+	--	--
	(0.19)		
Round 2 Leader X	-0.297*	--	--
Trust	(0.15)		
closedfirst	0.137	0.503**	-0.232
	(0.18)	(0.22)	(0.24)
lastperiods	-0.636***	-0.531+	-0.763**
	(0.24)	(0.35)	(0.35)
constant	0.732***	0.473***	0.850***
	(0.15)	(0.18)	(0.20)
N	3520	1760	1760
d.f.	10	8	8
loglikelihood	-1902.0	-909.0	-956.8

+ p<10 (one tail), *p<10 **p<05 ***p<.01 (two tailed)

[1]Two-way robust std. errors clustered by subject and period

Table 1.4 Determinants of Experimental Cooperation

	Closed Rounds Only		
	Rounds 3 & 4 b/se[1]	Round 3 b/se	Round4 b/se
Ego Trust	0.297***	0.318***	0.298***
	(0.06)	(0.07)	(0.08)
Alter Trust	0.367***	0.428***	0.337***
	(0.07)	(0.09)	(0.11)
Ego X	0.088+	0.035	0.072
Alter Trust	(0.05)	(0.07)	(0.11)
Trust Attitude	0.016	0.055	-0.016
	(0.05)	(0.06)	(0.08)
closedfirst	-0.174	-0.430**	0.103
	(0.14)	(0.17)	(0.19)
lastperiods	-0.842***	-0.642*	-1.074***
	(0.26)	(0.39)	(0.36)
constant	0.873***	0.892***	0.860***
	(0.11)	(0.11)	(0.13)
N	5280	2640	2640
d.f.	6	6	6
loglikelihood	-2790.2	-1472.2	-1273.9

+ p<10 (one tail), *p<10 **p<05 ***p<.01 (two tailed)

[1]Two-way robust std. errors clustered by subject and period

COORDINATION IN EXPERIMENTAL NETWORKS: THE EFFECT OF TRUST AND STRUCTURE

The focus of this chapter is again drawn to the premise that encouraging and maintaining social capital is done by both structuring institutions in effective ways and taking advantage of the existing norms in a community, group or society. Until this point, the discussion of social capital has been developed in terms of observable outputs, with a specific focus on analyzing cooperation. In the experimental setting a focus on cooperation often entails the analysis of prisoner's dilemma games, either single shot (Cooper et al 1994, Marwell and Ames 1981) or repeated interactions (Axelrod 1984, Ahn and Scholz 2009). This chapter extends a study of social capital to an understudied set of collective action problems, coordination games. The games range from a simple matching game to the increasingly complex tasks of conflicting coordination points (battle of the sexes) and assurances of continued coordination (stag hunt). Together they represent an extensive set of collective action problems where multiple equilibria are possible requiring actors to come together to choose one or the other.

These outputs, or social capital, are typically attributed to the structure of existing institutions (transparency, hierarchy, command decision-making, bargaining, institutional rules) or the attributes of an existing population (norms of trust, sanctions, risk aversion, cooperative behaviors, ethics). Rarely are they examined in conjunction with one another, and are often viewed as substitutes or replacements. But, as chapter one argued in the cooperative setting there exists a complex relationship between individual attributes and institutional structures; certain populations (high/low trusters) cooperate more often in certain network structures (closed/open triad). Scholars of both formal and informal institutions need to consider the interaction of institutional pressures and group attributes on productivity. Once again, I utilize the experimental setting to analyze direct network structure effects, personal attribute effects and partner attribute effects on coordination.

The incentives and temptations surrounding behavior in coordination games no longer favor defection as was the case in the prisoner's dilemma; instead subjects see higher payoffs when they work toward coordinated outcomes. Now with different incentives the benefits of certain structures and types may differ as well. Of the two experimental triads, open triads give the appearance of a leader even if in presentation only, since one player is connected to the other two who do not share a link. This is merely a visual representation of leadership, as leaders do not enjoy a payoff advantage based on their position. To preview one of my hypotheses, the presence of a leader in open triads will help in coordinating behavior. When a "leader" is visible coordination is not only simpler, but more likely. This prediction compliments findings from chapter one as well as the risk hypothesis (Berardo & Scholz 2010) when applied to games of coordination. When the risk of defection is low, clustering (closed triads) is not as important for combating problems of collective action. Since coordination games characteristically have less risk of defection when compared to the prisoner's dilemma, I do not expect triad closure to be as necessary for coordination as was the case for cooperation. I do however expect the influence of partner attributes to once again be critical for collective behavior in the experimental setting.

This chapter takes the analysis presented in chapter one an additional step by analyzing subjects preferred strategies based on their trust, position and partner's trust. Findings suggest that high trust subjects are those most willing to coordinate on their partner's preferred option, switching from their initial choice to their partner's choice. This is especially true in the simple matching game. In the prisoner's dilemma this same combination of a high trust ego paired with high trust alters had,

on average, the highest level of cooperation. In the coordination setting, such reciprocity does not provide the same benefits associated with high trusters in the cooperation games, especially when all members of the triad are high trusters and willing to switch. Triads of high trusters in coordination games have some of the lowest instances of coordination.

2.1 Social Capital and Coordination

In political science as well as the many other social science disciplines, conceptualizing social capital is generally done in terms of the output one is interested in; in chapter one this was cooperation, by far the most common of outputs, others use contribution in public goods games (Andreoni 1995), money sent in dictator games (Holm and Danielson 2005), resource provision improvements in policy arenas (Berardo 2009, Berardo and Scholz 2010, Scholz et al 2010), attrition and academic performance (Coleman 1988), and as in this experiment subject performance in three coordination games. Even from this limited survey of work it is evident that not all outputs are the same, yet many analyses of them are. While each has their own set of incentives and preferences that guide subject behavior, little work has been done with the specific intension of distinguishing them from each other empirically. More often than not results are painted with a broad brush with a nod toward the larger concept of social capital particularly when it comes to the use of the prisoner's dilemma (See Snidal (1985) for an early exception to this norm). I will argue that while a general definition of social capital includes the product of various types of human exchange, the type and qualities surrounding each type of exchange will condition the effects of two known capital generators; individuals' attributes and the structure of their relationships.

Why should we expect institutions and individual norms to work the same way regardless of the by-product of our interaction? The short answer is that we should not. It is not just the traditional social sciences that recognize the heavy attention paid to cooperation in the prisoner's dilemma when analyzing social capital (Snidal 1985). Law scholars also push for the inclusion of a broader set of collective action problems, suggesting that equal if not more attention should be paid to coordination problems, the more common dilemma playing out in America's legal system (McAdams 2008). Enemark, McCubbins and Weller (2011) discuss coordination problems as likely the most common type of interaction for most political, economic and social situations, yet this class of games is remarkably understudied.

While subjects in cooperative games benefit from closed overlapping structures if they already have a propensity to cooperate (high trust), are these same characteristics beneficial for games of coordination, especially where there is no dominant payoff to coordinate on (matching)? Some work, specifically "coordination with costs" (Enemark et al 2011) has shown a similar effect for coordination games, though the added cost to cooperate does make for a "cooperative coordination game."[28] If these costs are removed along with preferences for coordinating on a specific choice, do the same traits that make cooperation more likely actually make it more difficult to coordinate?

Briefly I will go over the coordination task involved with each of the three games analyzed in this chapter. In the experimental design section I detail the order and length of time that subjects played each of these games. I begin with the simple matching game and continue by gradually increasing the complexity of the coordination task with the stag hunt game followed by the battle of the sexes. The matching game seen in Figure 2.1[29] below is the simplest coordination task given to subjects and has

[28] The authors even suggest that the coordination with costs game is very similar to the prisoners dilemma.
[29] This is one of 3 possible color combinations subjects may have seen in the experiment.

no dominant strategy. Subjects must decide which of the equally profitable colors to coordinate on. Coordination on some choice is more important (in ECUs) than what that choice may be. If subjects select the same color, each receives 50 experimental currency units (ECUs). If they select different colors each receives 0 ECUs. Once players have selected a common color they have no incentive to deviate from the coordinated equilibrium and there is no expectation for them to change their choice in the remaining periods. Social capital, here measured as coordination in the matching game, can arise out of any number of norms or attributes that might determine a focal point (Schelling 1960). A subject's favorite color and favoring a row/column location are examples of such norms. The experimental design has made every attempt to control for these subjective possibilities, varying the color choices and color choice ordering by round.[30]

The second game, the stag hunt, is a game of assurances and it is shown in Figure 2.2. In the classic strategic example of a stag hunt two hunters are faced with the dilemma that while hunting and killing a stag is the most preferred option, each hunter must be assured that the other will join in the hunt since it takes two to kill the stag. Otherwise, each hunter would be better off hunting a guaranteed rabbit on their own. The experimental payoffs reflect this problem of assurances. There is a mutual coordination payoff for both subjects choosing "stag" (Silver), 75 ECUs, and a mutual coordination for both choosing "rabbit" (Brick), 50 ECUs. When two subjects mismatch, the one who chose stag receives 0 ECUs, while the other who chose the risk averse rabbit option always receives 50 ECUs. This implies that subjects will choose stag if they are assured their partner is likely to choose stag as well. This trade-off is reflected in many policy settings where policymakers must choose between the safer, less risky policy in the short term that does not depend on many others, or the more productive but politically risky policy that requires extensive bipartisan support or long term commitment from other actors. Coordination trends in finite iterated stag hunt games closely resembles cooperation trends in finite iterated prisoner's dilemma games (Camerer 2003).

The final game, a battle of the sexes in Figure 2.3, presents a coordination situation of asymmetric player with mixed motives and conflicting incentives. Classic examples of a battle of the sexes game include a couple choosing to go to the ballet or a baseball game, and choosing a movie or restaurant with a friend. For all situations, coordination on one choice is preferred to mismatching, but each person has a clear preference for which choice they prefer to coordinate on. In the experiments analyzed here both subjects prefer to coordinate on a particular color, but they disagree on which color they prefer to coordinate on. For at least half of the experiment subjects have two partners at a time. When this is the case they prefer one color with one partner and the other color with the other partner. Each subject receives 0 ECUs if they mismatch, 75 if they match on their preferred color and 50 if they match, but on their partner's preferred color. If coordination is achieved in a one shot game one subject always receives a sub-optimal payoff. In iterated games the payoffs can be similarly one sided, continually coordinating on one subjects preferred color (average payoffs of 75 or 50 ECUs) or a fair payoff profile where subjects alternate between coordinating on each other's preferred color (each with an average payoff of 62.5 ECUs). Mismatching is also very common in iterated battle of the sexes games (Cooper et al. 1994, Straub 1995), with rates of mismatching usually around 60% in laboratory experiments. Coordination in battle of the sexes games is more common when the experiment provides a focal point for subjects, allowing communication (Cooper et al.1994), precedent in iterated games, outside options, or a first mover (Camerer 2003). In the absence of these typical focal points, I will argue that bridging network structures provide their own endogenous focal point in repeated games,

[30] Once a color is used for a round, subjects never see it again. One notable exception was a color treatment where subjects could choose grey in one round and silver in the next. On the computer screens these two colors were essentially indistinguishable.

where subjects have the benefit of selecting the color an obvious "leader" chose in a previous period. Some subjects may be more or less likely to switch to their partner's choice once it is observed and this is discussed in the section on trust. The conditional relationship implied by the previous statements is one that remains understudied in political science, especially for coordination games and will be the focus of this chapter.

2.2 Bridging Triads Encourage Coordination

The full set of relationships among and between actors is critical for those facing the collective action dilemma. When pursuing individual preferences in a strategic situation leads to suboptimal outcomes, how and with whom an actor communicates is import. Work in experimental and network analysis has shown that the structure or pattern of connections and links in a network significantly affect exchange relationships and the by-product of these exchanges. Structural patterns can also be linked to certain types of costs and benefits, for instance closed networks of clustered, overlapping and dense connections have been linked to strong in-group trust and out-group bias (Coleman 1988), faster mobilization (Huckfeldt et al 2004), confirmatory information (Carpenter et al 2003) and reducing the risk of defection (Berardo & Scholz 2010). One the other hand open networks of sparse, "weak-tie" connections have been linked to higher out-group trust and tolerance (Mutz 2006), non-redundant exchange (Burt 2005) and more diversity (less homophily) among actors.

The previous chapter describes the benefits of closure for cooperation environments such as the prisoner's dilemma, where the thrust of the theory was based on the risk hypothesis (Berardo and Scholz 2010). In situations where the risk of defection is great, as it is in the prisoner's dilemma, closed networks foster cooperation especially when in a repeated setting. When the dynamics of the task are altered and the risk of defection is much lower the risk hypothesis would suggest that closure is no longer necessary or as beneficial to encouraging collective behavior. In the three coordination games presented in this chapter the traditional risk of defection no longer enters the equation. Each game has a unique strategic uncertainty about what the other subject will do, making for subtle differences in how a subject might approach coordination. In the matching game the only incentive is to coordinate on one of five equally profitable equilibria, no higher payoff can be achieved from a mismatched scenario. The same lack of an attractive defection option is evident in both the battle of the sexes and the stag hunt, coordinating always produces higher average payoffs than mismatching.

Since closure is not necessary, are there any advantages of a more open network of relationships? In situations such as these, it is argued (Burt 2005, deSouza Briggs 1997, Putnam 2000) that bridging ties can be just as effective and in fact, encourage certain collective behaviors. Holding the number of actors constant, when there are fewer direct links and thus fewer separate decisions to make, arriving at the same choice becomes a simpler task. When an experimental treatment enters the equation, focal points such as a first mover, a designated leader (Coleman and Ostrom *MS*) or channel of communication (Freidman 1994) allow subjects to coordinate quickly and more often in the case of repeated games. This is true of games when payoffs depend on the group's coordination. This experiment asks if simply a group's structural focal point affects each independent pair of decisions. Even when individuals have no incentive to coordinate at the group level, can the structure of relationships increase individual level coordination, thus increasing the overall group coordination?

The experimental triads shown in Fig 2.4 again represent the simplest version of the two network types. Lettered nodes represent subjects and the links or lines represent that a game played in each period. The closed triad includes three subjects who all play each other, so that each subject plays two coordination games per period for a total of 6 decisions per period. In the open triad there is one

subject who plays two others who do not play each other for a total of 4 decisions per period. For purposes of discussion, I will again refer to positions as either *members* of the closed triad, *leaders* in the open triad or *followers* in the open triad. The position labels are unknown to subjects. The behavior of leaders compared to followers is an obvious extension of the structure treatment broken into position. While all payoffs are equal and symmetrical, and there is no strategic advantage to being a leader,[31] the absence of a link between followers makes E a natural focal point in the open triad interactions. With its natural focal point, subjects in the open triad should coordinate more than subjects in the closed triad.

H:1 Open triad structures increase coordination.

It is also worth noting that in three distinct games some with degrees of coordination, unique paths to a coordinated equilibrium are also possible with the presence of a focal point or leader. For matching games, where subjects must distinguish between five equally profitable equilibria, the presence of a leader could be critical. The leader's choice provides a focal point for both followers, who simply choose the leader's period *t*-1 color in period *t*. Members in the closed triad have no such focal point, and are therefore more likely to go through cycles in which some, neither or all partners switch to one or both of their other partner's color, continuously mismatching. The benefits of a leader in the stag hunt and battle of the sexes games again arise from the observing leader behavior in period *t*-1. In the stag hunt this might mean encouraging others to let go of the safe rabbit payoff and choose stag at time *t*. In the battle of the sexes leaders might initiate a "nice" strategy where they are willing to take their sub-optimal payoff with both partners or their choice(s) could initiate one of many switching equilibria. Thus, a structural focal point, or leader, is most important when there is no strategic incentive to choose one color over another, as is the case in the matching game. When there are incentives to choose one color over another, leaders provide guidance on which equilibrium path to choose.

For all of these scenarios, the visibility of all interactions within a group is important for leadership to develop. The subject, or *ego*, must be able to observe her partners('), or *alters(')*, choice(s) before she can follow their lead and choose their color from *t*-1. The open triad physically draws a subject's attention to the fact that there is a single central actor and two peripheral actors.[32] The closed triad on the other hand, does not have an obvious leader and leadership must emerge by actions alone such as the observance reciprocated coordination. Thus, within each three subject triad, triad structure, current position, payoffs and a four period history for all players are visible to all subjects at all times.

2.3 Personal Trust and Coordination

Trust, when not equated with cooperation or coordination is generally seen as the most influential individual-level component of social capital (Hardin 2000, Ostrom and Ahn 2003). The mechanism behind this effect is simple; the behavioral propensity to trust increases the probability of cooperative behavior and choosing coordinating alternatives. Chapter 1 detailed the benefits of trust in the cooperative iterated prisoner's dilemma setting and I assume many of those effects prevail here. Most individuals, regardless of their level of trust, engage in projection (Orbel & Dawes 1991), or are biased toward expecting others to do the same as them. Thus, individuals with high trust, on

[31] Leaders, with two games per period, do have a total payoff advantage for any given round compared to each of their partners' single games.

[32] The triads are displayed just as they are shown in figure 2.4, such that there is no top down mentality associated with the leadership position.

average, believe that their partners are also trustworthy. The belief that partners are good-natured and willing to coordinate makes switching to a coordinated equilibrium much more likely, since it is believed that all parties are willing to coordinate. Trust and the resulting switching behavior become extremely important when other obvious focal points are absent, such as structural cues or mutual payoff advantages, and when subjects must choose between multiple coordinated equilibria. This argument also applies to theories that focus on the role of trust in decisions involving risky behavior (Berardo and Scholz 2010, Macpherson et al 2011). With the absence of a risk of defection, the role of trust takes a back seat to other more obvious focal points like triad structure and position. However when there are significant risks to defection, trust and the observable behaviors it encourages are critical for coordination.

In addition to switching behaviors, high trust could also be manifesting as "fairness," or a willingness of ego to take a lower per game payoff if they have the period payoff advantage, as is the case for leaders of open triads in the battle of the sexes.[33] If judging coordination in terms of payoffs, this nice leader behavior in the battle of the sexes is not captured appropriately. Additional model specifications, with alternate measures of coordination, are needed and will be discussed in the empirical analysis and measurement section.

To summarize, in games where there are conflicting incentives, such as the stag hunt and the battle of the sexes, trust should play an important role in guiding subjects' behavior. The matching game, where no such conflicts exist, should be less affected by ego trust, instead the leader or focal point in the open triad should be more influential. On average, as a subject's trust increases so too will their likelihood to engage in coordinated behaviors, switching or conforming to their partner's choice in the previous period. Conversely, low trust subjects will be those most likely to stick their ground and those least likely to make the switch and coordinate.

H2: Trust increases coordination

Again trust is evaluated as both behaviors and attitudes. Given the significant mediating relationship present in the cooperative analysis (Chapter 1), trusting behavior questions operationalize trust and trust attitude questions are once more utilized as a control.

2.4 Partner Trust and Coordination

The success of the individual in networked games, depends not only on their choices, but the choices of their partners. Unlike the general positive influence of trust in cooperation games (Chapter 1), the behaviors associated with increasing trust levels, switching or conforming, have the potential to prevent reaching equilibrium in coordination games when reciprocated, but not for a lack of trying. While it is important for trust to be reinforced with mutual coordination in repeated games to maintain coordination (Ostrom and Ahn 2003), high trust subjects are those I hypothesized most willing to follow and hence most willing to switch to their alters(') choice. When paired with other high trust subjects they may find themselves circling or cycling through the color options, finding it much more difficult to coordinate initially, especially in the matching game where there are no dominant color preferences. Alternatively, in games where incentives to coordinate or not to coordinate exist, the

[33] By taking the suboptimal payoff (50) with both partners, leaders earn 100 ECU per period. This combined payoff is still more than their partners who earn 75 each, but these nice leaders earn less (100/2) on average than their followers.

presence of conditional benefits of high trust alters should be no surprise given their role in the prisoner's dilemma games in chapter 1 (Enemark et al 2011).

The situation of many followers and no leader is one extreme, thus I would expect, on average, outside of these matched high trust triads alter trust, just like ego trust, has a positive effect on reaching and maintaining a coordinated equilibrium. When groups consist of all high trusters it takes longer to reach equilibrium and one would observe less coordination on average. That being said, triads benefit from a mix of high and low trust partners, especially in games where the coordinated choice is not a dominant strategy.

H3: On average, alter trust increases coordination.

H4: When both ego and alter(s) have high trust, coordination is more difficult to achieve.

2.5 Position and Trust

2.5.1 Too Much Trust and Closure

In chapter one, many of the differences in subject performance came from the influence of alter trust and ego position, especially for leaders of the open triad. In coordination tasks I have posited that the presence of a leadership position, if in appearance only, will dramatically impact subject coordination. Thus in situations where trust also plays an important role, the battle of the sexes and the stag hunt games, the conditional effect of trust and position once again requires my consideration.

In the prisoner's dilemma, where the risks of defection are high, the literature postulates that trust has a positive effect when paired with closed bonded structures (Coleman 1988, Putman 2000). Closure keeps trust norms alive and circulating within the group of subjects (Ostrom and Ahn 2000, Chapter 1). Some have even suggested that trust and closure are substitutes (Yamigishi et al 1998), and in high risk situations absent closure trust indeed decreases instances of defection on partners (Chapter 1). If closure maintains existing norms, this compounds the problem associated with the behavior of high trusters in coordination games especially when partnered together. In the closed triad, where there is no obvious leader, groups of high trusters should perform very poorly, always switching, cycling through colors and more often failing to reach equilibrium. On average, holding all else constant,

H5: As trust increases, open triads increase coordination.

Thus, the visibility of a leadership figure becomes extremely important for groups of high trusters. All else equal, a group of high trusters will coordinate more easily in the open triad where there is an obvious leader.

2.5.2 Trust, Position and Game

Evidence of trust's discriminating and conditional role in cooperation within and between triads in the prisoner's dilemma foreshadows likely differences between the three coordination tasks in this chapter. I have general expectations for each game, but they are just that and should not be viewed as formal hypotheses since the literature is underdeveloped with regard to expectations for each triad/trust setting.

In the simple matching game I expect high trust subjects in the closed triad partnered with other high trusters to do poorly. If any of these elements are reversed, coordination levels should

improve. Studies of cooperative coordination (Enemark et al 2011) suggest that the stag hunt game should perform much like the prisoner's dilemma, where mis-matching on ego and alter trust benefited subjects in the open triad. This would suggest that leaders and followers in the stag hunt game do well when they are not all high trusters, or not all low trusters. The findings from the prisoner's dilemma in closed triads suggest that groups of high trusters might also benefit from closure in the stag hunt, if the stag equilibrium has been reached. Because it is still a game of coordination, a group of high trusters might not be able to move from the (rabbit, rabbit) to the (stag ,stag) equilibrium as easily as a group of mixed trusters.

The battle of the sexes was the most mentally taxing game subjects were faced with. If they had two partners, they preferred a different coordinated outcome with each, forcing subjects to keep track of and keep straight more information throughout the course of the games. Since no equilibrium is a best outcome for both subjects they have at least four possible coordination options, leaders of the open triad have one additional. The first coordination path is to continually accept their least preferred coordinated outcome, receiving 50 ECUs in each period from each partner. The second possibility is to insist on taking their preferred coordinated outcome each time, receiving 75 ECUs in each period from each partner. The third would be to alternate between the preferred and least preferred outcome with each partner, alternately receiving 50 and 75 ECUs in each period with each partner.

The fourth and leader options apply only to those subjects with two partners. In the fourth path, leaders and members take the preferred payoff continually with one partner and the least preferred with the other for 50 ECUs in each period with one partner and 75 ECUs per period with the other partner. For leaders and members of the closed triad the third and fourth options are equivalent if looking at average payoffs over an entire round (though not within a given period). The last coordination option in the battle of the sexes is available only to leaders of the open triad. Recognizing that they have two games per period and their partners only have one, if they took the sub-optimal payoff (50) with both of their partners they would still come out as the top earner in the triad for any one period. Their average payoff per period would be lower than their partners, who each would receive 75 ECUs. Leaders exercising this strategy and not exploiting their position, are what I will refer to as "fair leaders." I hypothesize that those subjects most likely to be fair leaders tend to have higher trust.[34] This configuration (sub-optimal coordinated choices) of payoffs is not possible in either the simple matching or the stag hunt game.

H6: As their trust increases, leaders in the battle of the sexes game are more likely to employ a "fair leader" strategy.

2.6 Experimental Design

What follows is a description of the experimental design, implementation and methods used to evaluate coordination in a simple matching, stag hunt and battle of the sexes game. All sessions were conducted in the spring semester of 2010 at the XS/FS—Experimental Social Science at Florida State—Lab, a combined economics and political science departments resource at The Florida State University. All programming was done in the Z-Tree (Fischbacher 2007) software package.[35] In total, 84 subjects

[34] The measure of trust attitudes includes a question from the General Social Survey that asks subjects the following about fairness, "Do you think that most people would take advantage of you if they got a chance or would they try to be fair?" If it is assumed that projection (Orbell and Dawes 1991) occurs for generalized trust, one could also assume that feelings and beliefs about fairness project in similar ways.

[35] Special thanks to Justin Esarey for providing the basic program and to Sean Collins for his help at the re-programming stages.

spread over four sessions, and one "expert sample" of 15 subjects, each played 62 periods of coordination games (10 in matching, 32 in stag hunt and 20 in the battle of the sexes). The 84 subjects were drawn from a pool of introductory undergraduate social science courses and, on average, earned $21 (including a $10 show up fee) with a maximum pay-out of $28.50. The expert sample consisted of both students and faculty with knowledge of game theory. Their presence is controlled in various ways that are discussed below.

2.6.1 Pre-survey

A pre-treatment survey was once again administered to operationalize trust over two dimensions, attitudes about trust (Gachter et al 2003, Hold & Danielson 2005) and past self-reported trusting behavior (Glaeser et al 2000, Orbell & Dawes 1991).[36] Each dimension consisted of the same three question index described in chapter 1. Principle components analysis again confirmed the two dimensions of trust.[37] Post test survey results of the same questions are also highly correlated with subject's pre-survey answers. By measuring trust prior to the experiment, its effect can be separated from coordination as well as from the influence of triad and position. If triad structure alone impacts coordination and not trusting behavior, a uniform trend of coordination should be observed over all trust values. The same of course is true of position and triad differences if trust dispositions are solely responsible for coordination.

2.6.2 Experimental Sessions

Within each session all subjects played each game in each triad structure. In the matching game (Figure 2.1) subjects played one five-period round in each structure. There were 4 8-period stag hunt rounds (Figure 2.2) and subjects played two consecutive rounds in each structure. Twenty periods of the battle of the sexes game (Figure 2.3) were split into two 10-period rounds, one round per triad structure. In total subjects played 62 periods, but depending on their assigned position in the open triad rounds they could make between 93 (never leader) and 124 (always leader) separate decisions over the course of a session. 6,138 total decisions were made over the five sessions. The assignment to triads and positions and the ordering of games is discussed below.

2.6.2.1 Random assignment within and between sessions. The validity of conclusions in the experimental setting relies on the use of random selection and random assignment, both of which were an integral part of the recruitment and experimental design. In addition to the random subject pool, the experiment contains five levels of random treatment assignment. Figure 2.5 illustrates these levels. The first was a "first game" treatment (1. First Game Treatment In Figure 2.5). The sequential ordering of the games remained the same across all sessions, with matching followed by stag hunt and battle of the sexes. Subjects were randomly assigned to start their session in one of these games. For example subjects assigned to the stag hunt game first progressed through the stag hunt, and then moved on to the battle of the sexes, followed by the matching game. Subjects beginning in the battle of the sexes next played the matching games followed by the stag hunt rounds. Each session contained

[36] Additional questions were included on the pre-survey as distracters and to establish demographic information as well as control for questions asked in previous experiments (the prisoner's dilemma game sessions in chapter 1).

[37] The pre-surveys for all coordination sessions also included two risk aversion questions; the choice over a lottery (Macpherson et al *MS*) and the subject's self reported comfort with taking risks (Ehrlich & Maestas 2010). These questions will not be used for this analysis.

two different first game treatments and subjects were positioned in the lab such that those sitting next to each other were not in the same first game group.[38]

The next level of random assignment was to a "first triad" treatment (2. First Triad Treatment). Here the starting triad was randomized so that one group started all games in the open triad and the other started all games in the closed triad. Those assigned to the closed first treatment always played the closed round(s) of the games followed by the open round(s), and vice versa for those assigned to the open first treatment. The "first triad" treatment is constant for all subjects within a "first game" treatment. The pairing of "first triad" and "first game" treatments is complete, meaning there were enough sessions to match each first game with both an open first and a closed first group.

Once assigned to the first game and first triad treatments, subjects were then randomly assigned to a three-subject triad group (3. Triad Group). This treatment was repeated seven more times over the course of a session. The random (re-)assignment occurred when the game, structure or round changed; twice for matching, four times for stag hunt and twice for the battle of the sexes. These re-assignments were also done within the first triad treatments.

Subjects were randomly assigned to positions within their three person group (4. Position). In the closed triad there is no difference since each subjects plays both others. In the open triad, one subject is assigned to the leader position and the other two are assigned to each of the periphery follower positions. The number of total observations per subject varies according to this stage of random assignment in the open network. Leaders, like all players in the closed network, play two games per period. Followers only play the leader and thus have one half of the observations for a given round.

Lastly, the configuration of the color choices that subjects made also differed based on the unique configuration of treatments, thus insuring that subjects next to one another had different images on screen based not only on their first game and first triad assignments, but also on color orderings (5. Color Scheme). A separate color scheme was used for each first game group of subjects. Three separate color combinations were created to use over the course of the experiment and no color was repeated to a subject within a session. Within game treatments, colors also changed when structures changed and a subject's color choices were displayed in a different order than their partner's choices were displayed.

Subjects possessed complete information with knowledge of all random (re-) assignments throughout the game. Not only did they know the outcomes of their own games, but also the outcome of all games in their triad. The experimental screen showed all game histories for up to 4 periods. A simulated screen shot is shown in Figure 2.6, for position E in the Open triad in the matching game. These histories were reset after every partnership (re)assignment.

[38] Subjects were also separated by partitions between computers and rows.

2.7 Measurement and Empirical Analysis

The central hypotheses concern numerous interactive effects between behavioral dispositions and structure and their impact on coordination in a series of three games. I explore answers to the following research questions; is trust a significant predictor of coordination? Are these effects conditional on the dispositions of partners and the structural position of subjects? How do the effects differ across different coordination games?

2.7.1 Measuring Coordination in Three Games

Since payoffs differ across games, I use one to three dichotomous variables to represent three dimensions of coordination. The coding of coordination in all games coincides with the optimal coordinated payoff and equilibria unless otherwise noted, thus coding corresponds to a subject's payoffs. In the matching game, if subjects coordinate on any color they receive a one, if not, their coordination is coded as a zero. The stag hunt game contains three possible coordination outcomes which will be used as dependent variables in the models presented below; first, like the simple matching game, if both subject and partner coordinate on stag or rabbit they are recorded as coordinating, the second awards a one to those subjects and partners coordinating on stag and the third awards a one to those subjects coordinating on rabbit. The battle of the sexes has coding similar to the stag hunt. The first awards subjects a one for either coordinated outcome, the second for coordinating on their optimal payoff (75,50) and the third on their sub-optimal payoff (50,75) For each period a subject's *coordination* is recorded once in the matching game and three times in the stag hunt and battle of the sexes. Because a coordination value is recorded with each partner, subjects in the leader and member positions will have two observations per period.[39] A discussion of how these decisions are linked in the estimation is discussed in the estimation section (2.8.4).

2.7.2 Trust and Position

Six trust questions in the pre-survey include three self-reported trusting behaviors that have proved effective in predicting trust-related behavior in experiments (Glaeser & Soutter 2000, Orbell & Dawes 1991), including "How often do you lend CDs, DVDs or money to friends?" and "Have you ever benefited from the honesty of others?" Three additional questions from the General Social Survey measuring trust attitudes (Gachter 2003, Holm and Danielson 2005) were also included. Chapter two, the study of open and closed triads in the prisoners dilemma game has confirmed that the behavioral trust questions are better predictors of cooperative behavior than the attitudinal measures.[40] After confirming with principal components analysis, the *trust* variable is the component that loaded most

[39] In all models, subjects have a unique partner one and partner two ID, allowing for clusters within each partnership.

[40] In previous estimations we have found that despite its wide spread use, attitudinal trust is a poor predictor of trusting behavior in the laboratory setting. Self –reported trusting behaviors are not only better predictors but robust to alternative specifications. We conducted identical tests to our previous analyses and found that like our previous findings, after principle components analysis two significant components emerge; one loading primarily with the GSS questions and another loading primarily with the behavior questions.

heavily on the three trust behavior, recoded to a scale from 0 to 1 with 1 being the most trusting and 0 being the least.

Position in the open or closed triad is represented by three dummy variables, *member, leader* and *follower,* for each of the positions in Figure 2.4. Members are those subjects in the closed triad. Leader equals one when a subject is in position A of the open triad and followers are those in the periphery positions B and C of the open triad. Leader is used as the omitted reference category for all estimations. With leader as the reference category, coefficient estimates distinguish not only the between-treatment effects absent differences in the number of links (leaders with two links compared to members also with two links), but also the within-treatment effects of a simple count of links (leaders with two links compared to followers with just one).

2.7.3 Controlling Treatment Effects

I control for possible design effects with a set of variables, most of which control for ordering effects and the subject's background. Variables controlling for the effect of any one subject's personal experience include *age*[41] and dummy variables *male* and *experts,* with the latter variable used to designate subjects in the session that recruited students and faculty with knowledge of game theory. The ordering of games are controlled with indicators of game ordering (*Matchfirst*, *Stagfirst* and *Bosfirst*, with Bosfirst as the reference category) and triad ordering (*closedfirst* and *openfirst*, with openfirst as the reference category). Three round indicators are also included for the stag hunt estimation, with Round 1 as the reference category.

2.7.4 Estimating the model

The nature of the experimental data, multiple observations per subject within a period, requires a model that incorporates not only clustering of subjects and period, but subjects within periods. Because each of the 99 subjects has repeated interactions over ten periods in the combined matching games, 20 periods in the combined battle of sexes games, 32 periods in the combined stag hunt games, and the dependent variable is measured with up to three dichotomous variations, I use two-way cluster robust probit models (Petersen 2009) for estimating the effect of position and trust on coordination. This model was originally developed for firms with multiple contract observations in a given year and thus matches the multiple coordination observations in a given period in the data presented here.

2.8 Results

The following section will focus on three primary estimations of the effect of both trust and position on a subject's ability to coordinate in the three separate tasks. When appropriate I use additional model specifications to highlight effects within and between certain demographics of subjects. A preview of my results again highlights the conditional impact of both trust and position in three different tasks. Many of the significant conditional effects confirm my hypotheses, while others are quite unexpected. When generalizing over all games, I find that as the complexity of the task increases with regard to the

[41] Normally age is a non-issue since most undergraduates fall within a 5 year age range, but for this analysis age controls are added because the "Expert Sample" session consisted of graduate students and faculty members. In general laboratory settings age increases coordination (Heinneman et al 2008), and giving in ultimatum (Guth, Schmidt and Sutter 2003) and dictator games (Bosch-Domenech et al. 2007).

motivation and incentives behind coordination, subjects tend to rely on their interpersonal trust for coordination decisions. In both the stag hunt and especially the battle of the sexes, the most demanding of the three games, the impact of subject and partner trust supersedes position effects. On the other hand, subjects in the matching game, the least complex of the three, are significantly impacted by their position and structure.

Trends in both the raw data and model estimations show one critical distinction for the role of trust; when partnered subjects do not have conflicting incentives, as is the case in the matching game where all coordinated outcomes are equally profitable, and in the stag hunt where both subject's best outcomes are stag, on average, trust facilitates coordination. However, when subjects face conflicting incentives to coordinate as in the battle of the sexes, on average, trust makes coordination difficult.

Other general observations across most models include two experimental design effects, both of which conform to what one would expect given the hypothesized impact of game and structure complexities. The first is the positive impact from assignment to the battle of the sexes as your first game. On average, subjects playing the most challenging game first saw increased coordination in the other two games compared with subjects starting with the other two games, though this did not take effect until those later games. I believe there to be two possible explanations for this positive conditioning. The first is a function of forced learning; subjects had to learn fast or lose ECUs. Subjects placed in the most difficult task first never again encountered the level of sophistication in thinking needed for the battle of the sexes. The remaining two games did not deal with conflicting incentives that differed by partner, making their choices easier. My second supposition involves the unique relationship between leaders and followers in the open triad. Those subjects benefitting from a "nice" leader in the initial stages of the experiment might carry a more positive outlook onward. Since the "nice" leader is only an option in the battle of the sexes, those who play that game first did not have their outlook polluted by leader behavior in previous games. The set of dummy variables that control for a subject's first game of a session, tests this supposition. If BOSFirst is positive and significant, those subjects playing in the battle of the sexes first coordinated more on average than those subjects whose first game was the stag hunt (reference category). I should also note that the stag hunt had the highest levels of coordination over the three games, so its place as a reference category is a conservative comparison.

The second treatment effect that carries weight across models is the impact of playing in the closed triad first. Subjects assigned to the closed first treatment, on average, do better in open triad games than those who begin in the open triad games. Again I believe this is a learning effect, where subjects faced with more difficult tasks initially benefit in the long run from their forced learning. This effect is also only positive in the open rounds. Coordination decreases the first round of any game played in a closed triad, compared to those subjects starting game play in the open triads.

I proceed with results by coordination task, beginning with the simplest test of coordination, a simple matching game and increasing the level of complexity with the stag hunt followed by the battle of the sexes. Within each game I will first discuss the raw data and move into how well it illustrates significant treatment effects.

2.8.1 Matching

The matching game depicted in figure 2.1 required subjects to pick the same color as their partner. If both subjects chose the same color they were awarded 50 ECUs each, otherwise they earned nothing. Coordination in each period of this game is measured with a dichotomous variable equal to one when the same color was chosen by both subjects, and otherwise equal to zero. In all raw data tables below, low, medium and high trust were determined by the bottom, middle and top 33.3% of observed trust scores.

2.8.1.1 Analyzing levels of coordination in the matching game Table 2.1 presents the matching game outcomes broken down into the percent of coordinated outcomes for hypothesized treatment effects, and Table 2.2 further disaggregates data by triad, position and the configuration of ego (subject) and alter (partner) trust. The highest percentages are highlighted. Here we see preliminary support for hypothesis one; open triads increase coordination, for both leaders and followers. Support for hypotheses two and three are somewhat more complicated, for it appears that trust positively impacts only open triads where. pairs of high trusters gain the highest coordination rates of 87%. The opposite is true of closed triads, where the same combination of high trust subjects and partners leads to the lowest coordination levels in the game at 46%.

The negative effect implied by hypothesis four is observable in the closed triad only, where the disastrous combination of high ego and alter trust reduces coordination to less than 50% of the time. For the fifth and final hypothesis applicable to the matching game, triad closure decreases coordination for high trusters. Table 2.3 displays the coordination percentages by ego trust and triad. At least with raw data, hypothesis five is supported. As ego trust increases, closure decreases coordination rates by 3.8% among low trust subjects and by almost 19% among high trust subjects.

2.8.1.2 Estimating coordination in the matching game. Two-way cluster robust (Petersen 2009) probit models of coordination[42] on matching game observations are used to test the statistical significance of trends observed in the raw data. Column one of Table 2.4 contains the complete model and column two estimates the relevant variables[43] among subjects in the top half of the trust measure.

Column one shows that structure or position alone is not enough to impact matching. Contrary to the evidence in Table 2.1 that coordination was greater in open than in closed triads, members (and followers for that matter) are not significantly lower in coordination than leaders. The same is true for ego and alter trust; alone they do not significantly impact coordination. However, the matching game does provide a critical result for hypothesis five, the disastrous result when high trust subjects are members of the closed triad. The negative interaction of trust and member suggests that as ego's trust increases, closure of the network decreases the likelihood of coordination. The lowest observed coordination should be among high trust members. In open triads the leader provide a focal point for high trusters who are hypothesized to be most likely to switch, significantly increasing their chances of coordinating on the leader's color .

Limiting the estimation to only high trust subjects in column two brings out one additional result. It is still the case that subjects in the open triad are more likely to coordinate, but here we see this is primarily a function of the impact of high trust followers. On average, if followers fall above the

[42] Models were estimated in Stata with the probit2 command in the probit2.ado file (Petersen 2009, http://www.kellogg.northwestern.edu/faculty/petersen/htm/papers/se/se_programming.htm).

[43] Age is excluded from the high trust estimation because of sampling issues. The session 1, or "expert," control is an adequate control for age in any case. The subjects in Session 1, on average, had trust scores 26% lower than the typical undergraduate subject.

median on trust they are more likely to coordinate than their leader counterparts, thus receiving higher payoffs. Additionally, the interaction of trust and follower is significant and negative, indicating a situation of diminishing returns when that follower's trust increases above the median score. It is also worth noting that BOSFirst is also positive and significant in both the full matching model as well as in the high trusters only model. Those subjects who played battle of the sexes games first, on average, cooperated more often in the matching game than those who started their session in the stag hunt game.

The implications from these results suggest that trust in the matching game actually suppresses coordination in closed triads, at least in comparison with the role of the leader's trust in the open triad. This support for hypothesis four also illustrates the positive impact of an open structure when ego and alters are all high trusters, concurrent support for hypotheses one and five. The increased level of coordination observed in open triads is partially explained by the impact high trust followers have in coordinating with low trust leaders. Though not an effect consistent across the range of trust values and positions, trust does have a positive impact on coordination for high trust followers, moderate support for hypothesis two.

2.8.2 Stag hunt

The stag hunt game in figure 2.2 required subjects to choose between "rabbit"-- the safe and guaranteed payoff of 50 ECUs-- or "stag" – the higher 75 ECUs payoff if their partner also chose stag but the riskier zero payoff if their partner chose rabbit. When estimating coordination, I explore three separate outcomes. The first is a simple dichotomous variable that equals one if both subjects coordinated on either outcome, stag or rabbit.[44] The second and third measures indicate if this coordination occurred on either the optimal outcome of stag, or the sub-optimal outcome of rabbit.

2.8.2.1 Analyzing levels of coordination in the stag hunt. Table 2.5 presents the coordination data from the stag hunt game broken down into the percent of any coordinated outcome over the hypothesized treatment effects and Table 2.6 does so further by position and the configuration of ego and alter trust. The most striking feature of the stag hunt data is the high levels of coordination regardless of treatment, which suggests that the payoffs favored stag too much to provide much variance in outcomes. Coordination is lowest among leaders, and even then subjects coordinated almost 90% of the time. Looking at coordination over ego trust and triad in Table 2.7 no clear pattern emerges, and the differences are not statistically significant.

Although members of the closed triad coordinate more on average (Table 2.6), the difference between the open and closed treatment is not statistically significant.[45] Hypothesis one is not supported by the tables. Unlike the matching game where subjects benefited from mutual high trust in the open triad and mutual low trust in the closed triad, subjects in the stag hunt seem to do better when they are in mixed company (Table 2.6). The highest of already high coordination levels occurs among high trust leaders paired with low to mid-trust followers in the open triad and among a mix of high and low trust subjects in the closed triad. These trends continue even when coordination is limited to stag only

[44] The same variables that increase coordination on stag decrease the likelihood of coordination on rabbit and vice versa. Thus, partners mismatched on trust tend to coordinate on stag, while those matched on trust are more likely to coordinate on rabbit (especially matched high trusters). Because very few subjects chose rabbit over the course of the experiment (4.5% of choices, with mutual coordination on rabbit at only 2.8%), I was limited in my model specification options. Therefore, I present the results of a mutual rabbit coordination model in Appendix B.

[45] Based on a difference of means test with a p-value = 0.8365.

coordination, Table 2.8 and rabbit only coordination, Table 2.9. Many of the differences within the three position treatments are not statistically significant. The true tests of these effects will come with the model estimations below. For now, the raw data suggests positive trust effects, but limited triad and position effects.

2.8.2.2 Modeling coordination in the stag hunt game. Since previous experimental work highlights the similarities between iterated stag hunt games and the finite iterated prisoner's dilemma games, it is no surprise that many of the effects from chapter 1's analysis show up again here (Enemark et al 2011). The largest similarity is that ego and alter trust impact coordination in much the same way as in cooperative situations. Table 2.10 displays two columns of two-way cluster robust probit models. The first column contains all variables from the previous model for matching as well as the experimental treatment controls and estimates coordination on either rabbit or stag. Round 2, round 3 and round 4 are dummy variables that control for the progression of play in the stag hunt. In each round subjects were randomly assigned to new partners. The first round of stag hunt games, round 1, is the reference category. Even with such high instances of coordinated outcomes, most of which were on stag, the results still show the critical role of trust in the stag hunt game.

The positive and significant effects of ego and alter trust are countered by the negative interaction of ego and alter trust. This indicates that on average when ego is low on trust having a high trust alter increases coordination. The reverse is true for an ego with low trust alters, the likelihood of coordination increases as ego's own trust increases. This suggests in the stag hunt that partners at opposite ends of the trust spectrum, those mismatched on trust, coordinated more often than those partners matched on higher or lower trust. The interaction of ego and alter trust is negative confirming this relationship. As ego's trust increases the positive effect gained from having higher trust partners decreases.

For an explanation of why we see this substitution effect, we turn to column two in table 2.10 where I focus on one end of the trust dimension, that which caused so many difficulties in the matching game, high trusters. This model limits the estimation to only those subjects above the median trust score and analyzes their coordination on the optimal and most common outcome, stag. Though no longer statistically significant in a two tail test, ego and alter trust are once again inversely related and the same diminishing returns from increasing ego and alter trust are present. Judging by this lack of significance among high trust egos, their coordination on stag does not depend on their trust relative to their alter's trust, rather their trust and their position. Thus for high trusters coordination on stag is most affected by position and not partner trust. High trust members and followers are more likely to coordinate on stag as their own trust increases and when alter trust is at its lowest. Such that among high trusters, hypothesis two cannot be rejected but three can. Negative coefficients on member and follower indicate that the lowest trusters are more likely to coordinate on stag if they are leaders in the open triad.

Given that ego trust is constant when moving from one triad to another and it is position and alter trust that vary, favorable positions and partners are contingent upon random assignment. Thus for those subjects classified as high trusters they should hope to be randomly paired with low trust alters in the closed triad of the stag hunt. In the open triad high trusters do best if placed in the follower position, and if they find themselves in the follower position they should hope for a low trust leader. The behavior of low trusters supports hypothesis three, coordination increases when paired with high trusters in both the closed and open triads.

2.8.3 Battle of the sexes

In the final game, Figure 2.3 the battle of the sexes, subjects still have the incentive to coordinate, but now they have conflicting preferences over the two coordination choices. Because the payoffs in the battle of the sexes encourage coordination I suggested that triad structure was not critical for facilitating coordinated behaviors. In situations where a clear payoff advantage comes from coordinating, subjects will rely on their individual attributes more so than the structural cues. As was the case in the stag hunt, there are again three possible coordination outcomes to explore. The first is looking at coordination on any outcome, the second coordinating on the optimal outcome from the subject's perspective (75,50) and the third coordinating on the subject's sub-optimal outcome (50,75). Each outcome is treated as a dichotomous variable when calculating the percentages of coordination in the tables below. I would also note the overall coordination rate for the battle of the sexes game. Subjects were able to coordinate on either outcome over 70% of the time, well above the normal rate of coordination (Cooper et al. 1994, Straub 1995) in iterated battle of the sexes games.

2.8.3.1 Analyzing levels of coordination in the battle of the sexes. Table 2.11 presents the data on any coordinated outcome in the battle of the sexes game over all hypothesized treatments and Table 2.12 further separates the data into position and the nine ego and alter trust combinations. Initial results show that instead of increased coordination in the open triad, we see higher coordination in the closed, a rejection of hypothesis one. Results for hypothesis two also contradict expectations. In both triads and in all three positions increasing ego or alter trust decreases coordination on either outcome (Tables 2.11 and 2.12). Coordination over ego trust and triad in Table 2.13 suggests that as ego's trust score takes on more extreme values, moving farther from the median truster in either direction, closure actually increases coordination, though this difference is not statistically significant.

When analyzing coordination on any outcome, the battle of the sexes does not confirm any of my original expectations for hypotheses one through five. Because of the complexity of the task, it appears low trusters have the advantage. By not switching they provide a much needed focal point for their partners. This combined with the unusual behavior of subjects in the open triad, I believe, is one reason why the trends observed in the matching and stag hunt game fail to gain significance here. It is still the case that partners matched on high trust struggle to reach optimal coordination in the closed triad, and they do significantly worse in the open also. Hypothesis six, the prediction that leaders choose sub-optimal coordination more often as their trust increases, is partially supported. While there is a clear tendency for leaders to choose the sub-optimal outcome, evidenced in Tables 2.14 and 2.15, this choice actually becomes more likely as leader trust *de*creases. These final two tables detail the skewed frequency with which leaders take the sub-optimal payoff and followers receive the optimal payoff.

2.8.3.2 Estimating Coordination in the Battle of the sexes. Now I estimate of three types of coordination in the battle of the sexes, shedding light on what seem like initially mixed results. Much like the matching game, subjects in the battle of the sexes clearly prefer coordination, but which outcome to choose is not as clear. Column one of Table 2.16 contains the full model with all variables and experimental controls. As expected, structure does not seem to be a significant predictor of coordination when predicting any coordinated outcome. The most striking finding is that significant impacts on coordination are largely a function of ego and alter trust, but in this case both coefficients are negative rather than positive: in the battle of the sexes subjects are better off when paired with alters of similar trust levels, particularly those paired with other low trusters. The significant and negative coefficient on Trust in column one shows that when holding alter trust constant, increasing ego trust makes coordination less likely. The positive interaction of ego and alter trust, not significant by traditional standards, also confirms the relationship for the lowest of trusters.

Figures 2.7, 2.8 and 2.9 show the difference in predicted probabilities of coordination as alter trust increases from the 25th percentile to the 75th percentile of trust scores for each position; members, leaders and followers respectively. The portion of the effect where the dashed 95% confidence interval falls completely above, a positive effect, or below, a negative effect, the 0 line is a significant effect. Thus, in all positions, subjects with low (ego) trust decrease their likelihood of coordinating as their alter trust increases. The conditional effects of ego and alter trust becomes insignificant for the highest of trusters. In the battle of the sexes low trust egos paired with low trust alters, the model and figures suggest, coordinate most often.

What is not clear in the aggregate is a trend predicted in hypothesis six, that high trust leaders in open triads will exhibit fairness or "nice" tendencies. The experimental design provided subjects in the open triad with a unique payoff option. Tables 2.13-2.15 show that leaders in fact took more (50, 75) payoffs than their partners, who received (75, 50) payoffs more often. Columns two and three of table 2.16 estimate the previous model on subject performance in the open triad with coordination on ego's *suboptimal* outcome (50, 75) as the dependent variable. Column two uses leader as the reference category and column three uses follower as the reference category. As expected the effects of follower in column two and leader in column one are significant and opposites. Being a leader of the open triad significantly increases the likelihood of coordination on their sub-optimal outcome, while in the case of followers this likelihood is decreased. Members of the closed triad did not have the appearance of the same "nice" option since everyone in the triad played two games. When comparing the percentages of coordination on any outcome to each individual outcome, members seem to be alternating their payoffs in one of the two ways discussed above, alternating optimal and sub-optimal outcomes within partners or between partners, or continually taking one payoff or the other.

The nice leader option seems to be an artifact of the experiment and payoff structure. That being said, which triads of leaders and followers were more likely to partake in this "nice" strategy profile? I hypothesized that high trust leaders were the most likely to engage in what seemed like fair behavior, but in fact it was low trust leaders paired with low trust followers who engaged in this strategy most often.[46] I have one explanation for why this may be. Orbell and Dawes' (1991) projection hypothesis suggests that low trusters would generally expect their partners to act very similar to themselves, at least initially. This perceived unwillingness to be the first to switch leads them to introduce a fair and reasonable compromise, the nice leader strategy. On the other hand, high trusters, with their willingness to switch, might assume that one of the more profitable alternating equilibria can be reached. Unfortunately the combination of high trust egos and high trust alters in both triads (see All Positions in table 2.12) proved one of the most difficult partnerships to attain the optimal coordination outcome(75,50), lending credit to hypothesis four. Thus, structure did not significantly impact the frequency of coordinated outcomes to support hypothesis one, rather it impacts the subject's choice over coordinated outcomes. On average, members of the closed triad alternated between the optimal and sub-optimal outcomes, while subjects in the open triad engaged the "nice" leader strategy in a large number of cases.

In general those subjects with the highest level of coordination in the battle of the sexes were low trusters matched with other low trusters. This result shows clear support for hypothesis four but does not satisfy hypotheses two and three, that independent of one another ego and alter trust should increase coordination. However, regardless of position, decreasing ego and alter trust made coordination more likely. It seems the same switching behavior that encourages coordination when

[46] See Appendix B for counts of two consecutive periods of suboptimal payoffs.

payoff preferences align as in the stag hunt game, decreases coordination when subjects' payoffs conflict in the battle of the sexes.

2.9 Implications and Future Study

The primary goals of this chapter were to first expand the current literature on social capital experiments to a set of coordination games with varying coordination requirements and second, detail the conditional relationships between formal and informal institutions in three coordination games. The results from 99 subjects illustrate that when we move beyond the prisoner's dilemma, unique interactions of institutional pressures and group qualities effect productivity. Additionally, these effects differ according to the incentives behind each coordination task. In other words, those qualities that increased coordinated outcomes varied not only by task, which was expected as each game varied in its complexity, but also by ego and alter trust.

When payoffs insure that everyone is on equal ground, as is the case in the matching game, structure contributes significantly to coordination. Thus, the simple matching game provides support for hypothesis one most clearly. The presence of a focal point, or a leader, significantly increased coordination for groups of high trusters. High trust egos paired with high trust alters, the most difficult pairing to coordinate, did significantly better in the open triad than in the closed. The switching behavior associated with high trusters, did not bode well for subjects attempting to match in the closed triad. In the open triad however, the same pairings did exceedingly well. While structure did not significantly impact the frequency of coordination in the battle of the sexes, it did however impact a pairing's choice over the coordinated outcome profiles. On average, partners in closed triads used one of the alternating equilibria, while a large number of open triad partners engaged in the "nice" leader approach.

Support for hypotheses two and three, that ego and alter trust increase coordination, is mixed, though in general, as motivations and incentives surrounding payoffs became more obvious, the subjects' reliance on interpersonal trust increased as well. As games became progressively complex, and subjects faced incentives to coordinate on one color or another, the clear dynamic between trust and structure dissipated. Conditional benefits from specific ego and alter trust pairings replaced structural effects in the stag hunt and battle of the sexes. In the stag hunt subjects in mixed trust pairings coordinated more often and in the battle of the sexes it was groups of all low trusters that had the highest instances of coordination, lending support to hypothesis four. In other words, when payoffs incentivize subjects to choose specific colors, alter trust effects ego's coordination choice. When payoffs lead subjects to the same outcome (stag hunt) trust is good, though in the stag hunt we saw how too much trust can be a bad thing; subjects were better off with partners of opposite trust scores as their own trust increased. Conversely, when payoffs conflict and subjects are at odds over which coordinated outcome to choose, as is the case in the battle of the sexes, trust decreases coordination.

This chapter expands the theoretical and empirical attention paid to an understudied class of experimental social capital. Since most interactions in the business and policy world take on the qualities of coordinated behaviors, not cooperative behaviors, studies such as this should be the focus of future extensions. In particular, there is as much variation within the realm of collaborative behaviors as is between it and other forms of working relationships such as hierarchies, contractual agreements and principal agent relationships. Results from these games stress the importance of considering the complete picture of social interactions, resisting the temptation to paint all types of social capital and the exchange of social capital with the same broad brush. This study shows, at least in the experimental

setting, that encouraging and maintaining social capital is done not only through structuring our institutions in effective ways, but taking advantage of existing community, group or societal norms. Thus it is important for stakeholders to not only consider the outcomes they desire, but also the individuals and institutions they will be working with, such that they may structure the rules of the game to incentivize desired behaviors.

While the results do not point to many clear trends, they do validate my supposition that we must not treat coordination, and collective behaviors in general, as the blanket concept that so many of us are guilty of. I am sure that the nuanced impacts of trust and structure discussed here merely scratch the surface of possible effects.

Others Choice:

Your Choice:	yellow	pink	red	orange	violet
orange	you: 0 other: 0	you: 0 other: 0	you: 0 other: 0	you: 50 other: 50	you: 0 other: 0
pink	you: 0 other: 0	you: 50 other: 50	you: 0 other: 0	you: 0 other: 0	you: 0 other: 0
violet	you: 0 other: 0	you: 0 other: 0	you: 0 other: 0	you: 0 other: 0	you: 50 other: 50
red	you: 0 other: 0	you: 0 other: 0	you: 50 other: 50	you: 0 other: 0	you: 0 other: 0
yellow	you: 50 other: 50	you: 0 other: 0	you: 0 other: 0	you: 0 other: 0	you: 0 other: 0

Figure 2.1 Matching Game

Others Choice:

Your Choice:	brick	silver
silver	you: 0 other: 50	you: 75 other: 75
brick	you: 50 other: 50	you: 50 other: 0

Figure 2.2 Stag Hunt Game

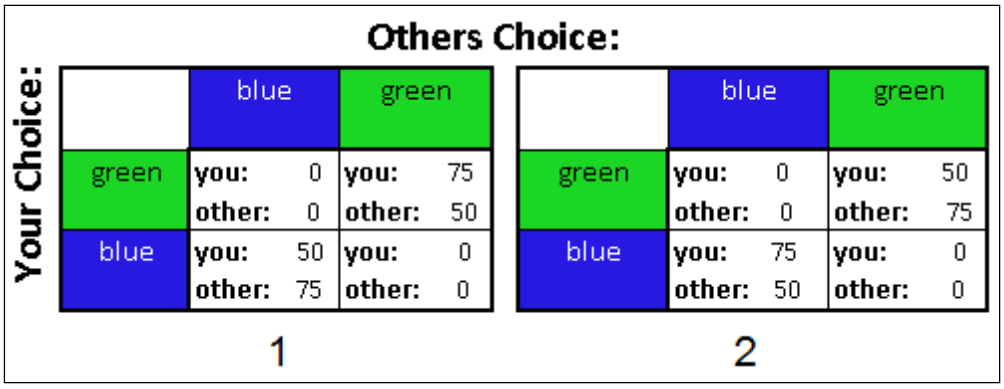


Figure 2.3 Battle of the Sexes Game

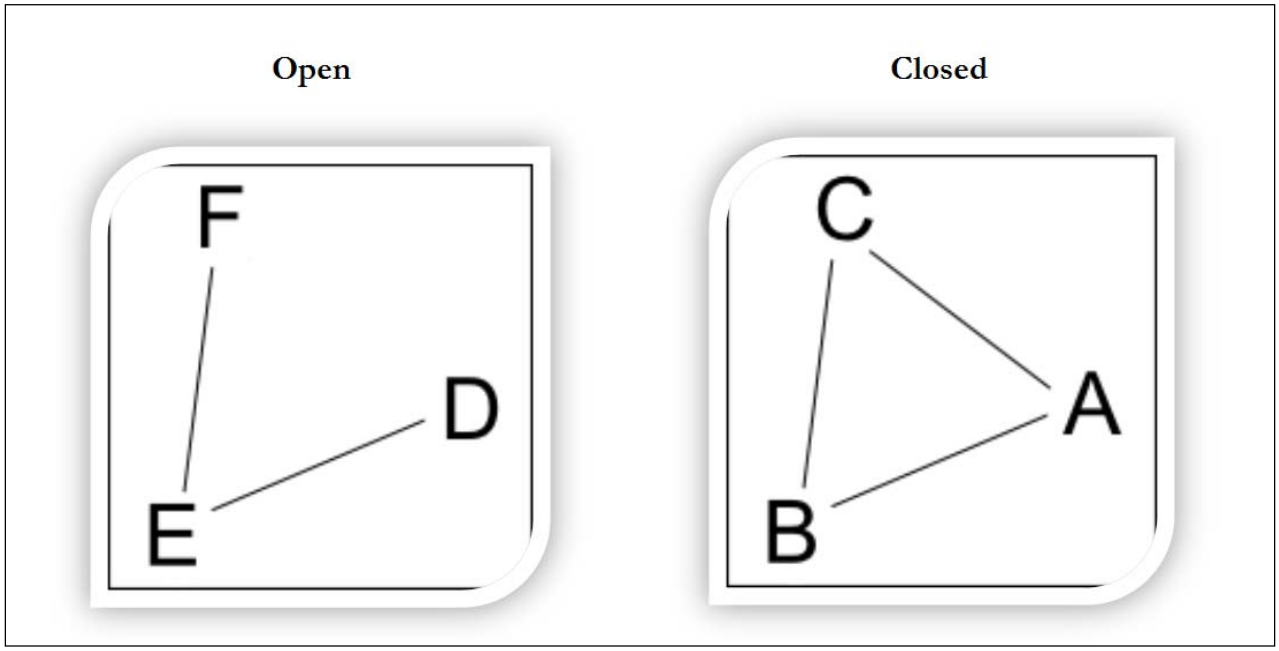


Figure 2.4 Experimental Triads

Positions A, B and C are members of the closed triad. Positions D and F are followers, and E is the leader in the open triad.

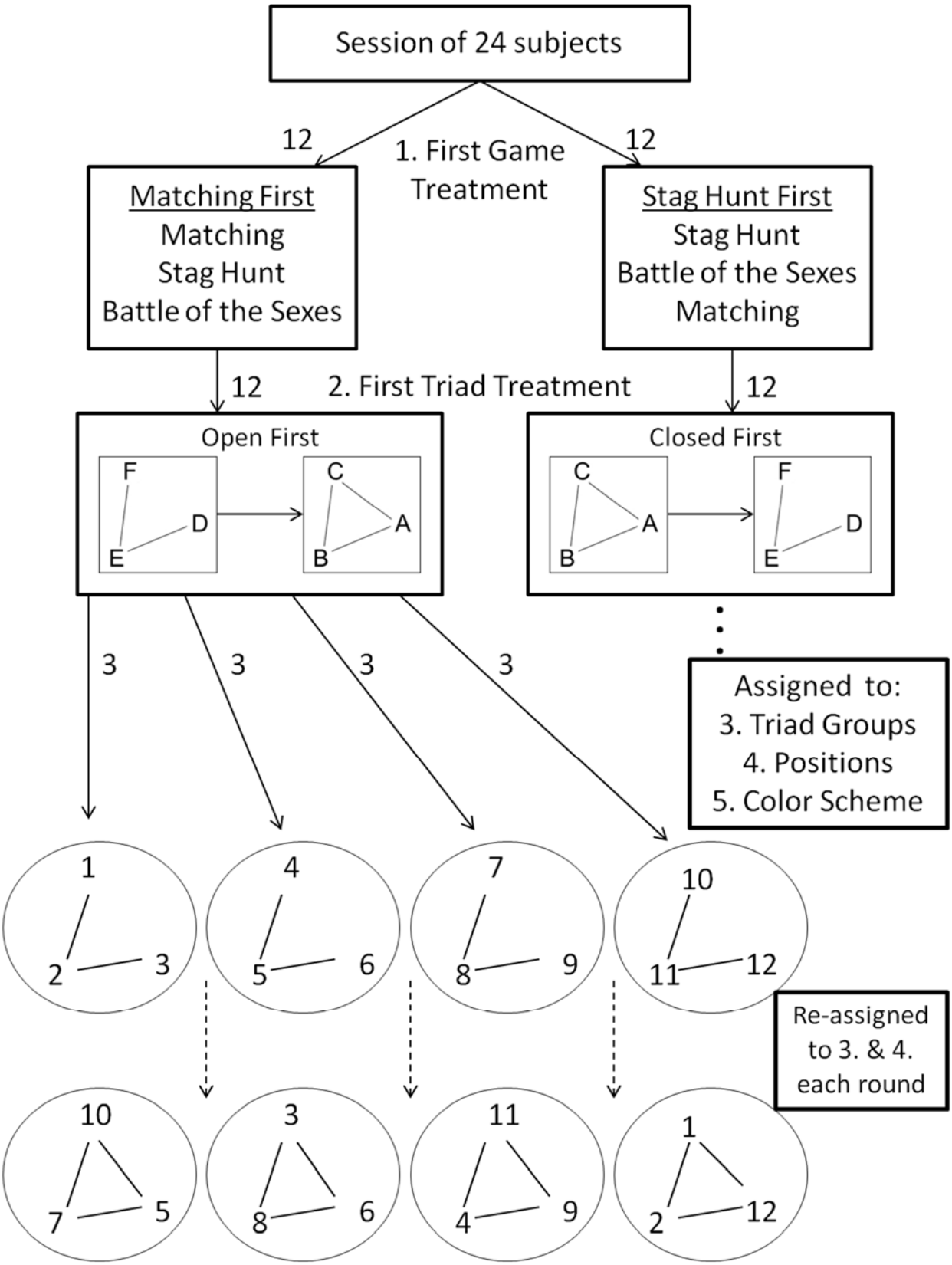


Figure 2.5 Experimental Random Assignment

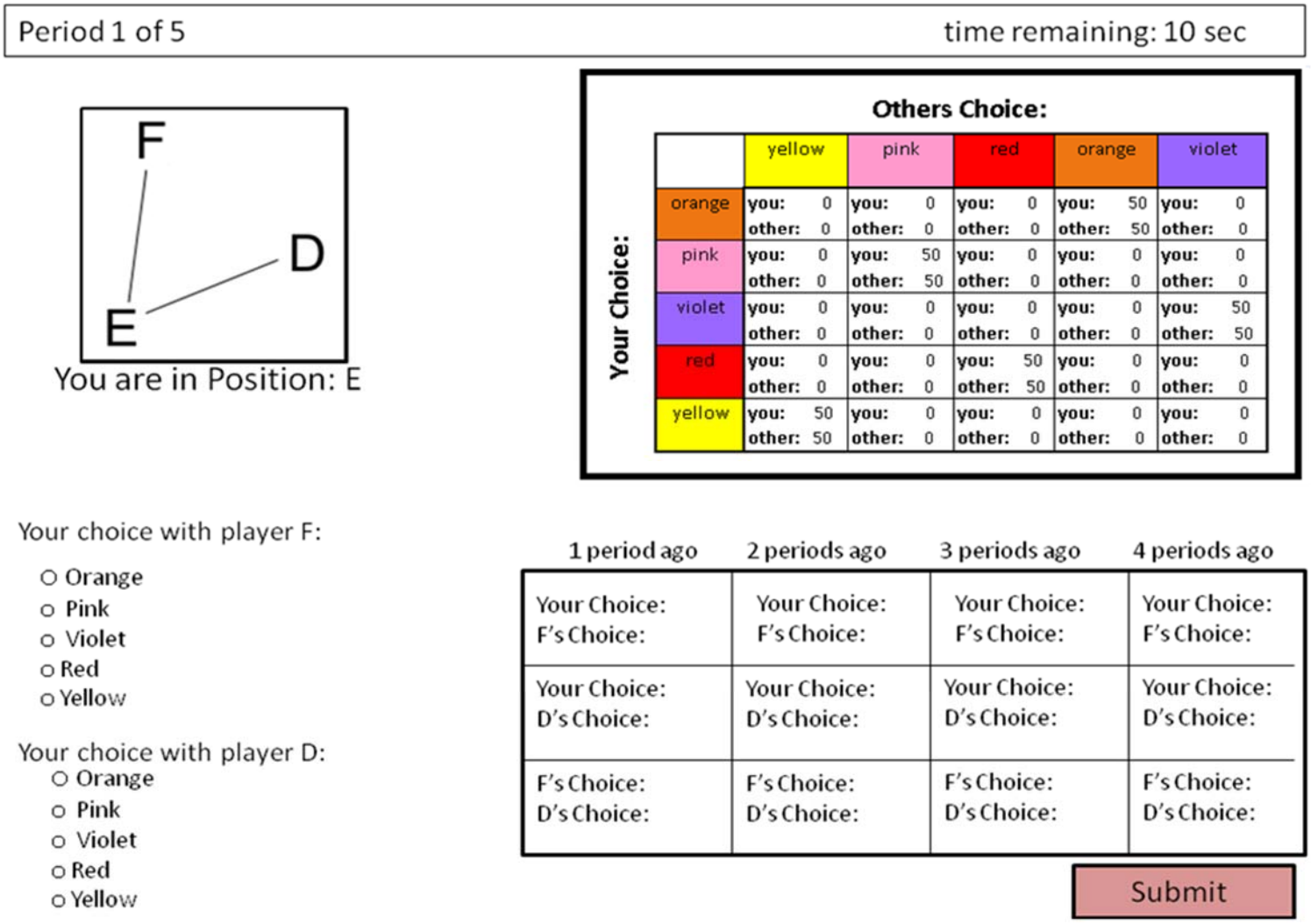


Figure 2.6 Simulated Screen Shot of Matching Game Decision Screen

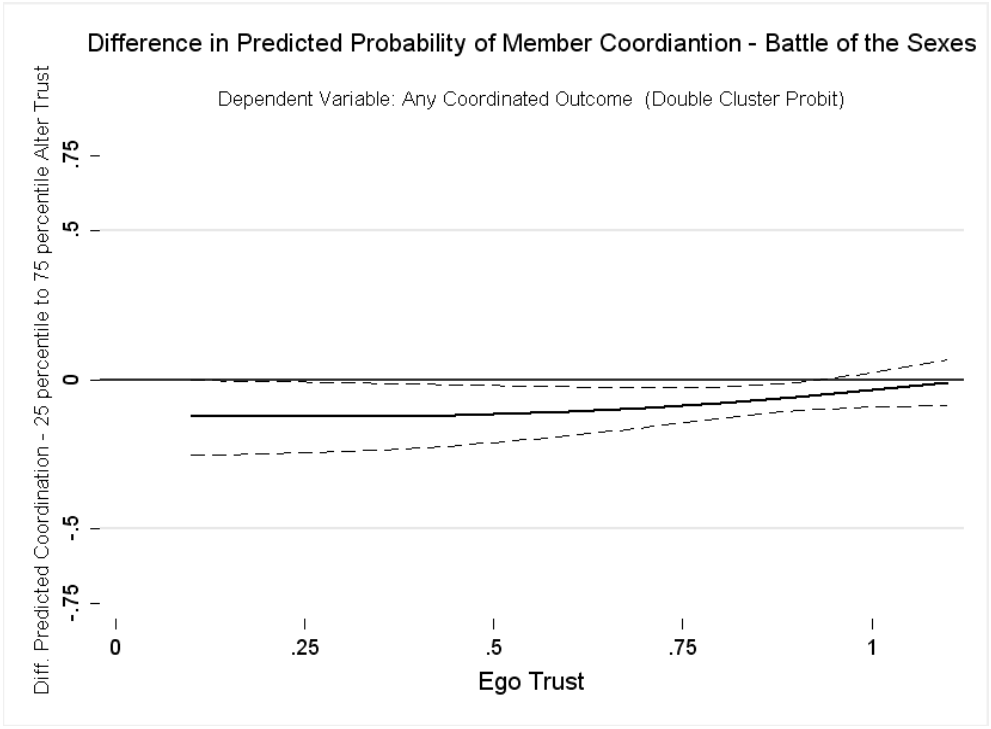


Figure 2.7 Difference in Predicted Probability Member Coordination – Battle of the Sexes

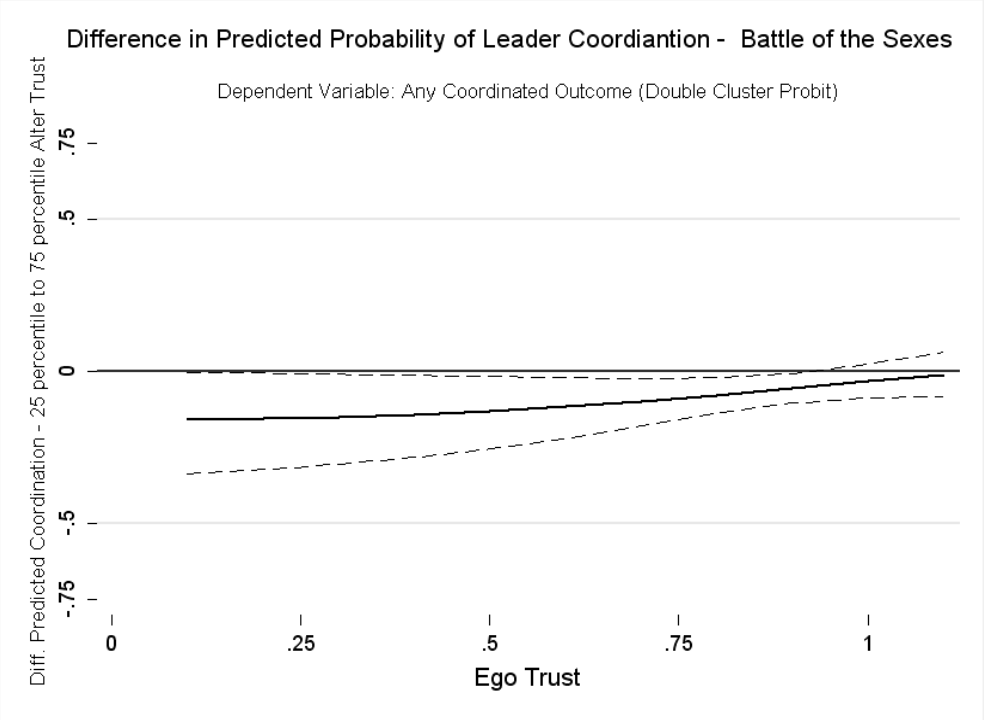


Figure 2.8 Difference in Predicted Probability Leader Coordination – Battle of the Sexes

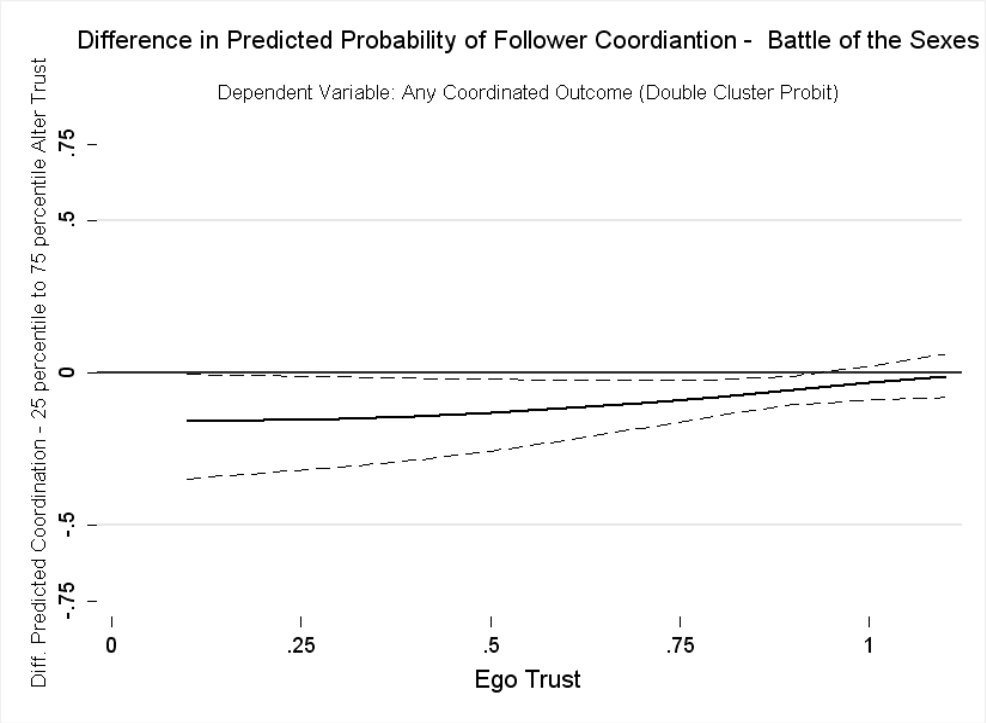


Figure 2.9 Difference in Predicted Probability Follower Coordination – Battle of the Sexes

Table 2.1 Percent coordination over treatment effects in the matching game

	Totals		
	%	n	N
Total	68.48%	1130	1650
open	75.45%	498	660
closed	63.84%	632	990
leader	75.45%	249	330
follower	75.45%	240	330
member	63.84%	632	990
Low Trust	72.14%	404	560
Med Trust	66.73%	357	535
High Trust	66.49%	369	555

Table 2.2 Percent coordination over treatments in the matching game

All Positions

Ego/Alter Trust	Low	Med	High
Low	77.22%	75.60%	58.46%
Med	66.49%	71.30%	64.68%
High	77.44%	56.00%	64.86%

Open

Ego/Alter Trust	Low	Med	High
Low	74.29%	71.67%	75.00%
Med	70.67%	73.33%	77.89%
High	77.65%	66.67%	87.06%

Closed/Members

Ego/Alter Trust	Low	Med	High
Low	79.09%	79.23%	51.11%
Med	63.64%	70.00%	55.71%
High	77.27%	52.31%	46.00%

Leaders

Ego/Alter Trust	Low	Med	High
Low	70.00%	72.00%	80.00%
Med	75.00%	70.00%	77.14%
High	80.00%	65.00%	87.50%

Followers

Ego/Alter Trust	Low	Med	High
Low	76.00%	70.00%	73.33%
Med	69.09%	76.00%	80.00%
High	76.36%	68.00%	86.67%

Table 2.3 Percent coordination by ego trust and triad in the matching game

	Ego Trust and Triad		
	Open	Closed	Difference
Low	73.65%	69.81%	3.84%
Med	73.96%	63.12%	10.85%
High	77.12%	58.53%	18.60%

Table 2.4 Determinants of Experimental Coordination – Matching

Any Coordinated Outcome		
	Full	High Trusters
	b/(se)	b/(se)
Trust	0.674	-1.006
	(0.79)	(2.53)
AlterTrust	-0.483	-4.352
	(1.08)	(3.64)
member	0.113	1.171
	(0.60)	(0.85)
follower	-0.043	1.865***
	(0.24)	(0.69)
TrustXMember	-0.961*	-2.785***
	(0.56)	(1.01)
TrustXFollower	-0.009	-3.002**
	(0.55)	(1.20)
egoXalterTrust	-1.474	4.752
	(1.86)	(5.00)
Attitude	0.010	0.007
	(0.02)	(0.03)
age	-0.012	--
	(0.02)	
male	0.077	0.157*
	(0.10)	(0.09)
closedfirst	0.141*	-0.008
	(0.08)	(0.08)
MatchFirst	0.025	0.326***
	(0.10)	(0.09)
BoSFirst	0.238**	0.262**
	(0.10)	(0.11)
Session1	-0.141	-0.259
	(0.24)	(0.29)
constant	1.057	1.829
	(0.88)	(1.93)
N	1650	840
df	14	13
loglikelihood	-995.2	-498.8

*p<10 **p<05 ***p<.01 (two tailed)

Table 2.5 Totals and the Percent of any coordinated outcome over treatments in the stag hunt game

	Totals		
	%	n	N
Total	96.52%	5096	5280
open	96.21%	2032	2112
closed	96.72%	3064	3168
leader	96.21%	1016	1056
follower	96.21%	1016	1056
member	96.72%	3064	3168
Low Trust	97.29%	1759	1808
Med Trust	94.61%	1544	1632
High Trust	97.45%	1793	1840

Table 2.6 Percent of any coordinated outcome over treatments and trust in the stag hunt game[47]

All Positions			
Ego/Alter	Low	Med	High
Low	95.17%	98.05%	99.16%
Med	93.75%	91.48%	97.92%
High	97.92%	99.78%	95.95%

Leaders			
Ego/Alter	Low	Med	High
Low	96.88%	96.88%	99.38%
Med	87.50%	--	89.06%
High	100.00%	100.00%	97.27%

Followers			
Ego/Alter	Low	Med	High
Low	94.27%	--	97.32%
Med	94.85%	--	100.00%
High	95.14%	96.88%	97.50%

Members			
Ego/Alter	Low	Med	High
Low	95.05%	98.58%	99.69%
Med	95.17%	91.48%	98.75%
High	98.61%	100.00%	94.64%

Table 2.7 Percent of any coordinated outcome over ego trust and triad in the stag hunt game

	Ego Trust and Triad		
	Open	Closed	Difference
Low	96.75%	97.77%	-1.02%
Med	92.85%	95.13%	-2.28%
High	97.80%	97.75%	0.05%

[47]Cells with (--) indicate that random matching within treatments did not produce this configuration of partnerships.

Table 2.8 Percent of coordination on stag over treatment effects in the stag hunt game

Leaders			
Ego/Alter	Low	Med	High
Low	96.88%	96.88%	99.38%
Med	67.97%	--	89.06%
High	100.00%	100.00%	91.80%

Followers			
Ego/Alter	Low	Med	High
Low	89.06%	--	97.32%
Med	89.34%	--	100.00%
High	95.14%	96.88%	88.75%

Members			
Ego/Alter	Low	Med	High
Low	94.79%	98.58%	99.69%
Med	94.89%	85.23%	95.31%
High	98.61%	100.00%	86.83%

Table 2.9 Percent of coordination on rabbit over treatment effects in the stag hunt game

Leaders			
Ego/Alter	Low	Med	High
Low	0.00%	0.00%	0.00%
Med	19.53%	--	0.00%
High	0.00%	0.00%	5.47%

Followers			
Ego/Alter	Low	Med	High
Low	5.21%	--	0.00%
Med	5.51%	--	0.00%
High	0.00%	0.00%	8.75%

Members			
Ego/Alter	Low	Med	High
Low	0.26%	0.00%	0.00%
Med	0.28%	6.25%	3.44%
High	0.00%	0.00%	7.81%

Table 2.10 Determinants of Experimental Coordination – Stag Hunt

The Stag Hunt		
Any Coordinated Outcome		Coordinate on Stag
	Full	High Trusters
	b/(se)	b/(se)
Trust	4.742***	4.865
	(1.71)	(7.58)
AlterTrust	4.816***	7.480
	(1.56)	(6.56)
member	0.269	-3.611**
	(0.28)	(1.59)
follower	0.065	-5.867**
	(0.36)	(2.51)
TrustXMember	-0.537	4.905**
	(0.54)	(2.32)
TrustXFollower	-0.183	8.803**
	(0.74)	(4.09)
egoXalterTrust	-7.812**	-16.764
	(3.04)	(11.51)
Attitude	-0.043	0.058
	(0.04)	(0.08)
age	-0.026	-0.062
	(0.02)	(0.05)
male	0.072	0.212
	(0.15)	(0.31)
closedfirst	-0.176	--
	(0.14)	
MatchFirst	0.190	0.256
	(0.20)	(0.30)
BoSFirst	0.141	0.860***
	(0.16)	(0.27)
Session1	0.673**	0.247
	(0.29)	(0.63)

Table 2.10 Continued

The Stag Hunt		
Any Coordinated Outcome		Coordinate on Stag
	Full	High Trusters
	b/(se)	b/(se)
round2	0.389**	0.114
	(0.16)	(0.10)
round3	0.248**	0.245
	(0.12)	(0.26)
round4	0.666***	0.344
	(0.23)	(0.25)
constant	-0.757	1.332
	(1.06)	(4.32)
N	5280	2672
df	17	16
loglikelihood	-752.3	-575.9

*p<10 **p<05 ***p<.01 (two tailed)

Table 2.11 Percent of any coordinated outcome over treatments in the battle of the sexes

	Totals		
	%	n	N
Total	71.58%	2362	3300
open	69.09%	912	1320
closed	73.23%	1450	1980
leader	69.09%	456	660
follower	69.09%	456	660
member	73.23%	1450	1980
Low Trust	75.14%	834	1,110
Med Trust	72.83%	772	1,060
High Trust	66.90%	756	1,130

Table 2.12 Percent of any coordinated outcome over triad and trust in the battle of the sexes

All Positions			
Ego/Alter	Low	Med	High
Low	78.64%	75.38%	71.22%
Med	79.78%	63.87%	71.67%
High	67.43%	68.28%	65.71%

Leaders			
Ego/Alter	Low	Med	High
Low	78.75%	71.67%	78.00%
Med	78.75%	63.33%	70.00%
High	63.75%	40.00%	58.33%

Followers			
Ego/Alter	Low	Med	High
Low	66.67%	90.00%	55.71%
Med	80.00%	74.00%	65.00%
High	73.64%	76.67%	56.67%

Members			
Ego/Alter	Low	Med	High
Low	84.58%	75.00%	72.92%
Med	80.00%	61.50%	74.44%
High	65.00%	69.58%	71.79%

Table 2.13 Percent of any coordinated outcome over ego trust and triad in the battle of the sexes.

Ego Trust and Triad			
	Open	Closed	Difference
Low	73.47%	77.50%	-4.03%
Med	71.85%	71.98%	-0.13%
High	61.51%	68.79%	-7.28%

Table 2.14 Percent of coordination on optimal outcome over treatments in the battle of the sexes.

	Leaders			
Ego/Alter	total	Low	Med	High
Low	29.58%	23.75%	41.67%	27.00%
Med	22.50%	26.25%	21.67%	18.33%
High	27.27%	23.75%	40.00%	27.50%

	Followers			
Ego/Alter	total	Low	Med	High
Low	42.38%	46.67%	65.00%	28.57%
Med	47.73%	50.00%	58.00%	35.00%
High	37.39%	47.27%	20.00%	31.11%

	Members			
Ego/Alter	total	Low	Med	High
Low	33.48%	41.67%	37.78%	22.08%
Med	39.22%	41.15%	32.00%	44.44%
High	37.21%	36.88%	32.08%	41.79%

Table 2.15 Percent of coordination on sub-optimal outcome over treatments in the battle of the sexes

	Leaders			
Ego/Alter	total	Low	Med	High
Low	47.08%	55.00%	30.00%	51.00%
Med	49.00%	52.50%	41.67%	51.67%
High	31.36%	40.00%	0.00%	30.83%

	Followers			
Ego/Alter	total	Low	Med	High
Low	22.86%	20.00%	25.00%	27.14%
Med	26.82%	30.00%	16.00%	30.00%
High	30.00%	26.36%	56.67%	25.56%

	Members			
Ego/Alter	total	Low	Med	High
Low	44.24%	42.92%	37.22%	50.83%
Med	33.44%	38.85%	29.50%	30.00%
High	32.21%	28.13%	37.50%	30.00%

Table 2.16 Determinants of Experimental Coordination – Battle of the Sexes

The Battle of the Sexes			
Any Coordinated Outcome		Sub-Optimal Choice	
	Full	Leader	Follower
	b/(se)	b/(se)	b/(se)
Trust	-3.036*	-0.516	0.547
	(1.57)	(2.13)	(2.43)
AlterTrust	-3.263**	0.788	0.788
	(1.59)	(2.34)	(2.34)
member	0.255		--
	(0.29)		
follower	-0.017	-0.942*	--
	(0.36)	(0.50)	
leader	--	--	0.942*
			(0.50)
TrustXMember	-0.267	--	--
	(0.49)		
TrustXFollower	0.021	1.062	--
	(0.71)	(1.00)	
TrustXLeader	--	--	-1.062
			(1.00)
egoXalterTrust	4.634	-1.196	-1.196
	(2.96)	(4.24)	(4.24)
Attitude	0.021	-0.007	-0.007
	(0.02)	(0.06)	(0.06)
age	-0.041**	-0.067	-0.067
	(0.02)	(0.04)	(0.04)
male	0.193**	-0.090	-0.090
	(0.08)	(0.16)	(0.16)
closedfirst	-0.147+	-0.109	-0.109
	(0.11)	(0.16)	(0.16)
MatchFirst	0.138+	0.045	0.045
	(0.11)	(0.22)	(0.22)
BoSFirst	-0.103	0.032	0.032
	(0.10)	(0.19)	(0.19)
Session1	-0.328	0.194	0.194
	(0.26)	(0.52)	(0.52)
constant	3.338***	1.458	0.516
	(0.84)	(1.15)	(1.26)
N	3300	1320	1320
df	14	12	12
loglikelihood	-1909.0	-815.9	-815.9

*p<10 **p<05 ***p<.01 (two tailed)

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