SOCIAL IDENTITY, SOCIAL TIES AND SOCIAL CAPITAL
A STUDY IN GAMING CONTEXT

A Dissertation in
Information Science and Technology

by

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Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

December 2012
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ABSTRACT

This work will focus on how different social relationships, namely shared identity and personal tie, will impact cooperative behavior, a form of social capital. I designed and conducted an economic game study to show that shared identity and personal ties work differently on cooperation among people and resource flow in social groups.

Many factors can have impacts on social capital. Social relations are considered a major source of social capital. However, social relationships of different kinds have different underpinning mechanisms that govern behaviors, so I am wondering if these differences can lead to different consequences. Social network analysis and social tie research has been around for a while and got much attentions; social identity/shared identity research also has a long root in sociology and social-psychology. In my dissertation study, I want to see if and how these two make difference.

I hypothesize that (H1) group members will put more resource in group-favoring activity and they will have less unsuccessful exchanges/transactions; (H2) in a social group, cooperation between people having ties will be higher than that between strangers and (H3) In groups with social identity, transactions between connected persons and that between strangers will be closer than in groups without or with low social identity.

To test these hypotheses and other related issues, I designed an online economic game to help me explore the phenomena. My hypotheses are supported by varied degrees, and it informs research of community design and community informatics. Another value of this study brings to the community is the way I approach the problem, which is widely used in sociology and economics but very few in CSCW and HCI. One
similar approach is the Shape Factory study. I designed an economic game to simulate a situation where both collective goal and individual goal presented at the same time and I also created a situation where players are not only put in dilemma of allocating resources, but also in dilemma of choosing partners. I believe this approach, and this design in particular, can contribute to the research in our community.

The results of this study can be informative to studies in community informatics and computer-supported collaborative work. And it also contributes to wider social sciences by raising questions about social relationships and cooperation and showing initial effort in studying related issues.
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ACKNOWLEDGEMENTS

I want to thank all my committee members: Dr. John M. Carroll, Dr. Mary Beth Rosson, Dr. Andrea Tapia and Dr. David Baker, who mentored me for many years. I also want to thank all my colleagues and friends who give me support and encouragement. I also want to thank all the participants who participated my dissertation. Specially, I want to devote this work to my mother.
Chapter 1
The Origin of the Quest

Development of a person, a social group, a community and even a society depends on resources a social unit can get. However, no single social entity possesses all resources it needs for its survival and thriving. Even if one has enough financial resource equal to or even more than one needs, division of labor forces the establishment of social exchange (Blau, 1964) in all societies since the dawn of the human race.

Every human being is born in a world of social relations and in exchange with other people we build social relations of our own (Blau, 1964; J. Coleman, 1993; Emerson, 1976). Even in very early life, at the infant stage, one starts to learn and build social relations and conducts exchanges with peers and more matured others in socially meaningful ways (Tomasello, 2009).

Social relations created in social interaction and exchange not only help individuals gain access to resources important to safety and development in their lifetime, but also create elements that constitute cognitive, psychological and social meaning of being a human (Hogg, Terry, & White, 1995; Turner & Onorato, 1999). Social exchanges not only form channels for resources flow and distribution, which benefits members of a society, but also help social entities larger than individuals achieve cultural accomplishments ever impossible in other species on the planet earth (Tomasello, 1999).
Communities and organizations play a very important role and they are becoming the basic building blocks in the constitution of the society (Scott, 2008). Communities and organizations are collectivities of social actors who share common goals and code of conducts. There are various forms of communities and organizations. In information age, new forms of communities and organizations appear as virtual communities, online communities or virtual organizations (Wellman et al., 1996).

The development of society is unavoidably accompanied with and to a large degree attributed to the establishment of social institutions instantiated as communities and organizations. The success of human species cannot be achieved without collective forms of life: social groups, communities and organizations; nevertheless collectivity is not challenge-free. Classic problems are, for example, tragedy of the commons (Hardin, 1968) and free-riding (Albanese & Van Fleet, 1985). Many issues we are facing today and in the future are issues of this class. For example, overconsumption of irreproducible energy (e.g., coal and crude oil) and preventing it from deteriorating are two examples and they are related to each other. For many issues like this, technological challenges exist, but the harder obstacles are from the constant social dilemma that imposes on every party involved.

These issues that we are facing threaten us at the global scale. On a more day-to-day basis, each individual social actor has to deal with similar matter, the problem of resource allocation. As a researcher, should I spend the night, writing several more pages? Or as a son far away from home, should I call my parents instead of writing? Or as a friend, should I go to the bar to meet my friend? Everyday, we have to decide
questions like these, sometimes consciously and sometimes not. There are no right answers to these questions, or it is more appropriate to say that the decisions could be made are contextual. These examples are just to show that how limited resources we possess are and we have to handle resource allocation all the time, even for seemingly very trivial things.

A more important point needs to draw attention to is that from a collectivity lens individual resource allocation influences the resource distribution in the social ecological sphere. There are issues related to fairness/equity of resource distribution (Alves & Rossi, 1978; Leventhal, 1976). Put aside fairness and equity, studying resource allocation and distribution has prominence as well. If we see social relations constitute ecology of people, then who gets what matters and who does not get what matters as well. Since not rewarding someone (not necessarily punishment) by rewarding someone else usually is not intentional, so it becomes unintended consequences (Merton, 1936) of resource allocations; and because it is not intended, it often time gets ignored.

A remedy to the issues mentioned is social capital (Coleman, 1988; Portes, 2000), a concept brought up by quite a few scholars in the late of past century. Although concerns of some negativity of social capital are emerging, it has been considered as a type of critical resource that can be beneficial to social/collective actions and benefit to individuals and communities in other aspects.

My dissertation study will pay attention to resource allocation and cooperation behavior from a social capital perspective. In particular, as laid out that social exchange and social relations are fundamental to construction of individual persons and
collectivities, I am more interested in understanding in-depth the relationship between social relations and social capital in terms resource allocations and cooperative behavior.

From this study, first, I want to empirically see and show social relations’ effect on cooperation as a form of social capital; second, I want to see and show if social identity and social ties have different effect on cooperation, and if they interact; third, I want to make theoretical contribution by advancing the understanding of social capital: broadening (potential) resource receivers vs. ensuring access readiness; and fourth, I want to make contribution by enriching search approaches: employing a game approach.

**Tragedy of the commons**

Individuals and social entities face many problems that are not possible to resolve individually. The problems are there, but the reactions are different among people and social entities (i.e., organization and nations); this is a meta-problem we are facing: the difficulty of putting resources together. In simple words, the problem is that it is hard to bring cooperation in action, which is the key to solve those hard problems. When the key to solve a problem is at stake, to solve the problem, even a simple one, becomes very hard. An example is natural resources in danger of depletion and pollution (Pretty, 2003). Those un-renewable natural resources (i.e., crude oil and coal) that our societies heavily depend on are on the edge of depletion. Before we find alternative resources that have equal volume and power or before we create renewable resources that can fully replace what we have been using for hundreds years, should we constrain our energy use to save some for the future generations? The condition of the natural environment of this globe is
deteriorating. Air and water travels from one place to another. Why should we keep them clean knowing that they may go somewhere else and the contaminated ones will flow in any time? Can we trust if other people in other place will also keep the water clean? Problems of this kind are hard to resolve. Besides possible technical difficulties, one barrier is the difficulty to put collective effort in action. These globally faced problems mentioned are only a few among many. In everyday ordinary life, we experience similar problems as well in our immediate soundings, like keeping public area clean or standing up in front of anti-social behavior and giving hand to somebody we just barely know, etc.

In sociology and economics, researchers have noticed these problems or phenomena for quite a long time and coined the term the tragedy of the commons (Hardin, 1968; Woolcock, 1998; Kollack, 1998), which sympathetically and anxiously remind us about the paradox that public goods that benefits most people receives least care and in fact are in danger of destruction. Studies on this topic have been a popular in social-economic research. Economic game – prisoner’s dilemma and pubic goods game – has been a paradigmatic approach to study human decision making on choice between cooperation and betray in the face of varied distribution of benefits/punishments (Kreps, Milgrom, Roberts and Wilson, 1982; Ostrom, Gardner and Walker, 1994; Andreoni, 1988, 1995). Many economic studies suggested that in repeated game people tend to cooperate, so participants can maximize their gain in the long run; studies (Rand, Dreber, Ellingsen, Fudenberg and Nowak, 2009; Fehr, E. and Gachter, 2000) also suggested punishments in repeated game is very effective in bringing cooperation. Coleman (1994) explained in detail that why self-interest driven men sometimes choose actions that do not maximize individual immediate gain. The assumption of these studies and theoretical
prediction is the existence of severer punishment from social sanctioning system and pressures from social norms. However, based on this economic or rational men assumption, if the punishments will conceivably come much later, saying decades or even hundred years later, then their sanctioning effect will be very weak and ineffective.

Again, these existing studies and theories provide insights to understand human behavior in social interaction. However, the assumption of rationale/economic men can only explain part of the human behavior. At most, those studies carried out only take into considerations of distribution of individual gains, loss and punishments. Although one can argue that in prisoner’s dilemma and public goods games there is a collective component in place, it is in fact a part of individual profit or in other words the collective gain is perfectly aligned with individual gain in repeated transactions. For example, in the classic public goods game, the collective part of money that has been multiplied eventually goes to individual. It is not to disparage the important role and the great scientific value of these economic games in simple forms. The study I am conducting is developed from public goods game. However, real social interaction and exchange are shaped by more complicated social situation and by adding more factors we can simulate situations closer to the reality.

In reality, punishments for wrongdoings or rewards for good deeds can sometimes be too far to be foreseen from the point where an action take place both in time and space; the satisfaction for selfish need of certain misbehaviors can be so strong that men cannot resist themselves doing them. This is actually what we are struggling when facing those aforementioned problems. Punishments for polluting environments may not impose on the polluters; wasting resources may not burn out oil tomorrow or next year. These are
not predicted by the theory of rationale men or economic men (Henrich, Joseph, et al. 2005).

The study I reported is an extended version of public goods game to simulate a more complex situation where individual gain and the collective gain are not perfectly allied and a collective exists rather than just as a simple aggregation of individuals.

A remedy to the tragedy of the commons, to many people, is social capital (Colemen, 1988; Dietz, Ostrom & Stern, 2003;). Detailed review of social capital and discussions related to it will take place in later section. However, a point needs to be laid out here is that social capital itself is largely considered to be by-products of social exchange and it is usually in danger itself. This leads to one of the purposes of this study, to study if and how more tangible factors (i.e., shared identities and social ties) can influence social capital and to help clarify our understanding of social capital.

From another perspective, a perspective from social actors who possess resources, the situation is getting more complicated. Anybody, or any party in a society, possesses only a certain types and amount of resources, even the party is willingly to cooperate, another dilemma will arise. That is, the options for social actors are increasing as the society develops. In other words, the choices where a social actor can allocate one’s resources are too many and very diverse. For example, even on TV, we can see many different advertisements asking for charity donations for different organizations and purposes. On a smaller scale, let us look at our individual life. As a typical researcher (student or faculty member) in a university graduate school, we need to allocate our resources (time, attention, intelligence, etc) very carefully and sometimes we have to
forgo some very promising opportunities, for the resources are so limited that we can not
do them all.

The inborn collective nature of human being

Studying nature and human society reveals to us the competition nature of
individuals and selfish behavior of individuals. Even collaborative/cooperative behaviors
observed in nature and society are seen as self-interest driven behavior that optimizes
individual advances in one way or another. Some researchers proposed, very
convincingly, different conditions for cooperation to exist (Nowak, 2006).

As a matter of fact, it has been a long history of the debate about if people are
selfish in nature or born altruistic. It is hard to settle even now. However, evidences from
human development research and anthropology have shown us a picture of early
formation of an awareness of we and us in the very early stage of human development
(Moll and Tomasello, 2007; Tomasello, 2009;). This “we” awareness is fundamental to
shared identity or collective identity conceptualized by the social psychologists. It is an
ability to perceive and maintain an understanding of joint goal and intention and the
ability to carry out the roles required by the joint goal for its success. According to
Tomasello (2009), the formation of this collective form of the self is a unique
phenomenon in human development and it appears in very early of age, around 6 months
of age. The ability and the fact that human form this level of awareness of being a
member of a unit larger than individuals is a small difference between human and even
the closest relative specie, but it gives humans a huge advantage to thrive and control the
physical world and accumulate cultural achievements to a level no other species ever

This is the collective nature of human being, the ability and the fact that we can
and do identify ourselves with others from the same species and register their attention
and form joint goals. It does not have to be altruistic, although it contributes to the
formation of altruism. This nature may or may not have a biological imprint on our gene,
but the discovery of the formation of the “we” perspective in young children provides us
a convincing proposal to solve the puzzle of why human species develops so quickly and
why its culture gets preserved and accumulated.

This debate and new evidence and postulation of cooperative men are worth more
of our thinking. There are two points particularly related to our future discussion. One is
about joint goal and intention. In commenting Tomasello’s theorization of joint intention
and cooperation (Silk, 2009) raised a very important point that, less than often goals of
social actors are be perfectly allied. In those individual goals perfectly inline situations
like highly coupled hunting action, the success of getting a prey relies heavily on
everyone successfully executing their roles and hence the dinner on the table. In cases
like this, everyone’s goal is convergent and the group goal is not more than everyone’s
goal getting fulfilled. In more complicated situations, perfect alignment of joint goals and
intentions become rather obscure than evident and members of a social group may carry
different goals that may compromise each other.

Another point is that during a group concept developed during the course social
interaction is more than simple aggregation of individual goals and benefits and it super-
imposes a collective aspect over individual members’ self-conception, which is called
social identity. Some scholars refer to this collective layer of self-concept as altruistic social preference (Silk 2009). Further more, collective forms of self may not help goal alignment between individual and group, but when a fully develop self, an overall identity with collective self, is at work, it may leads to benefits to the group. For example, individuals can be proud of just being a member of a social group, or they will forgo their personal benefits or risk themselves to protect groups they belong by altruistic behaviors. Also, I think the most significant situation is that one can see other as the same as the self or see the self and all other individual as objective existence and should receive the same treatment as the self.

Chapter 2

Theoretical Foundations and Research Questions

The scientific foundations that underpin this study come from critical literature review. Along the way we examine existing discussion about social capital, we bring up some critical issues and our analysis. To resolve our confusion, we then bring into theories from other domains, in this case the theory of social identity. This is the process how our thoughts are shaped. Based on the critical review and analysis and considering the phenomenon to which we want to call attention, we will offer our definition of social capital and hypotheses

The literature mainly comes from 1) sociology and organizational studies where most theoretical discourse of social capital took place and 2) information research, in
which we will look into the application of this concept in this field; 3) research from social identity theory.

Society develops on consumption of resources from different sources. Social systems were able to make use of selfish interests of individuals to generate actions and consequences that can benefit collectivities as well. However, it is not true for every instance in the society. We see social institutions fail and fall; we see individuals take advantages over collectivities. A question I constantly ask myself is that new forms of social life and social organizations are having less restrict mechanisms that directly reinforce and constrain behaviors, but why some of the new forms function better than our traditional, time-tested organizations.

A phenomenal example of this is the open source communities. These communities no doubt have problems. However, with much less formal management and administrative processes evolved, they not only operate well but also contribute to the society in enormous ways. How did this happen and what the underlying mechanisms are to keep these seemingly loosely bound institutes surviving and functioning well.

This fast developing forms of social organizations are benefited from massive growth of cooperation among members who participate in these communities and from social-technical mechanisms that enable cooperation. One angle we can use to look at it is social capital (Coleman, 1988), a type of resource or force that promote cooperation and collaboration.

Research in sociology pointed out that social relation is a major source of social capital. In this section, first I will review social capital, the core concept of my interest;
later, I will review the concept of social tie and of social identity, two key types of social relation, which are generators of social capital.

Social Capital

Sociologists introduced the term of social capital to North American academics in late 1980s, and the concept was quickly adapted in various research fields and became popular in economy, politics and everyday discussion of social life. When Putnam (Putnam, 1995) claims that social capital was declining in societies of North America, it got even more attention and led to a serial of debates over if social capital was declining, what the causes were, and what the social changes were, regarding to the possible transformations of social capital.

Capital is resources and resources can lead to larger return when they are exchanged and pooled; when they are invested resources, resources can grow. Before social capital, human identified many forms of capital such as financial capital, physical capital and human capital. Relatively recently, sociologists realized that social systems can help social exchange and reduce costs during transactions. Utilization of these social systems or mechanisms, although appearing to be intangible in most cases, often brings huge benefits that cannot materialize only by excising other resources alone. In Coleman’s masterpiece, trust established in a small community and monitoring mechanism created in a closed network plays critical role in enabling certain actions and in one way or another creating values for the society.
Coleman (1988, 1990) defined social capital in terms of its function. Social capital “is not a single entity, but a variety of different entities having two characteristics in common: they all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure” (1990, p302).

Direct effect of social capital may appear in different forms, but a common result is that social capital enables/promote direct or indirect resource exchanges. In some cases, social capital was understood as a result of pooling resource or resource exchange. For example, social support from family members, friends or even strangers in a community is considered social capital. It is the time and emotional efforts from others people; trust is a social atmosphere lubricating further social interaction and resource exchanges, like the diamond market case described in Coleman’s masterpiece. The key value of social capital is its ability to enhance resource distribution, improve resource mobilization and reduce the cost of transactions.

In Coleman’s mind, social capital generates from social interaction among actors in a social system. The more they know each other, the stronger the social capital generated and sustained. This closely linked social atmosphere was summarized by Coleman as network closure, a social network with no loose end. Of course, Coleman did not start from a social network analysis perspective to draw the social capital conclusion. In fact, his theoretical account for social capital and its antecedents were based on detailed analysis of sub social systems. However, in conclusion, a network point view and system perspective somehow converged.
Coleman (1990) starts from analyzing how social systems were formed and changed over time. Then he raised an interesting question that even though social actors are usually driven by self-interests, in countless social events, larger or small, people do sacrifice their own profits or even lives to the greater good. These social systems (e.g., trust, social norms and power and authority, sanctioning, etc) when they functioning and producing effects they are supposed to, as a side effect they also in one way or another promote resource exchange and cooperation. Most of these systems, according to Coleman and other researchers, are rooted in networks of human relations and supported by monitoring, which is more maintainable in a configuration of networked persons.

Coleman (1990) noted and warned us that social capital is not a whole new concept, but a group of different concepts and processes, which identifies the structural properties of different resources and their function to facilitate actions of agents which otherwise are hard or impossible to achieve. He considered it as a concept at higher level of abstraction, to allow researchers to study common consequences of many different social systems, such as norms and trust. Other scholars also stressed similar points even earlier than Coleman, just not quite using the term social capital.

Bourdieu (1985) challenged the reductionist view pervading in economics at the time, and gave emphases on cultural and social aspects of capital. To Bourdieu, cultural capital, something we can see as norms and way of conducts, exists in three forms: embodied state, objectified state and institutionalized state. In a sense, accumulation of cultural capital requires a longer time to achieve its objectified and institutionalized states, and needs significant investment in terms of time and learning effort for
individuals to make it embodied in the minds and bodies. Cultural capital is considered by Bourdieu as inherited from its possessors to new generations, and it cannot be converted into economic capital and be purchased in the embodied form, because the individuals have to be inculcated in person to be able hold the capacity such as academic achievements. This is very close to the idea of social identity as a process with which a person accustomizes and adapts himself with the symbolic and cultural aspects of being a member of certain social group.

Further, Bourdieu (1985) defined social capital as “the aggregate of actual or potential resources which are linked to possession of a durable social network more or less institutionalized relationships of mutual acquaintance and recognition – or in other words, to membership in a group – which provides each of its members with the backing of the collectivity-owned capital, a credential which entitles them to credit, in the various senses of the word” (p. 249). Similar to Coleman, Bourdieu also emphasized that the existence, maintenance and reinforcement of social capital are realized in exchanges. As he stated “The volume of the social capital possessed by a given agent thus depends on the size of the network of connections he can effectively mobilize and on the volume of the capital (economic, cultural or symbolic) possessed in his own right by each of those to whom he is connected. (p. 250)”.

A key element in Bourdieu’s definition of social capital is group, community identity and membership, “more or less institutionalized relationships of mutual acquaintance and recognition”. We can understand it as common ground about the relationships or membership in a community. Many researchers have been noticed the
importance of shared identity over social capital. For example, Marx and Engels (Cited in Portes, 1998) stated, when talking about class formation, class-consciousness and class struggling, that being thrown together in a common situation workers learn to identify each other and support their initiatives. This common fate is considered as an important source of social capital (Portes, 1998).

In Bourdieu’s conceptualization, social capital is “collective-owned” capital. When he talks about relationships that bring social capital, he emphasizes the institutional character of those relations. Also, as mutual acquaintance and recognition indicating shared identity among members, it is this identity or social bonding that secures the benefits of members when they come to claim them.

Portes (1998) defined social capital as “the ability of actors to secure benefits by virtue of membership in social networks or other social structures” (p. 6). His definition captures the common understanding of social capital, but this definition also gives rise to issues such as overlooked individualistic view on social capital.

In organizational studies, social capital also gets currency. Alder and Kwon (2002) defined social capital as “the goodwill available to individuals or groups. Its source lies in the structure and content of actor’s social relations. Its effects flow from the information, influences, and solidarity it makes available to the actor (p. 23)”. They further postulated a model in which three dimensions – opportunity, motivation and ability – comprise social capital.

The value of Adler and Kwon’s (2002) review lies in part of their call for attention to 1) the contingent effects of other factors over social capital and 2) the relative
positioning of internal and external ties. They considered this is an issue of unit of analysis. That is when examined from a different (larger) scope, external ties can be seen as internal. Although slightly different, this latter point is inline with our presumption that subgroups may exist in a given organization or community. And we want to study the relation between social capital and the interactions of these subgroups.

Nahapiet and Ghoshal (1998), with special focus on organizational life, proposed that social capital has structural, relational and shared cognitive dimensions. The structural property of social capital echoes the formalist view, which suggests the network configuration lead to origins of social capital. Relational property reflects the contents of ties, such as super-ordinate-subordinate relationship, friendship, etc. This is inline with the assumption that different content of connections will lead to different values for people who are connected. Cognitive aspect is shared representations, interpretations and systems of meanings among parties (Cicourel, 1973 cited in Nahapiet & Ghoshal, 1998, p. 244). Huysman and Wulf (2004) combined Adler and Kwon’s and Nahapiet and Ghoshal’s models and suggested a structural opportunity, a cognitive ability and a relational motivation dimension of social capital.

Sandefur and Laumann (1998) offered another group of dimensions that focuses on the effect (benefits) of social capital: information, influence and control, and social solidarity. These benefits are explicit or implicit in others’ conceptualization, and the contribution of Sandefur and Laumann (1998) is that they call attention to the effect of social structure properties (e.g., members’ mobility, size of network and sub-network, interaction patterns such as presence of outside intervention) over social capital.
Paldam (2000) reviewed and summarized conceptualizations of social capital into basically two major categories: trust-cooperation complex definition and network definition. The former defines social capital in regard with something (trust) that makes the cooperation work, or the degree of voluntary cooperation. The latter defines social capital from social network analysis perspective: intensity of work (how many connections one has in a network). However, both categories Paldam (2000) summarized somewhat overlooked the collective aspect of social capital. The macro level social capital is only regarded as simply aggregation of social capital members have.

Fukuyama (2001) defined social capital as “an instantiated informal norm that promotes cooperation between individuals” (p. 7). However, Fukuyama, along with other researchers (e.g., Dasgupta, 2000) challenged public-goods view of social capital by claiming that it is actually private goods. Their arguments seem to be based on the statement that “since co-operation is necessary to virtually all individuals as a means of achieving their selfish ends, it stands to reason that they will produce it as a private good” (p. 8). Fukuyama’s view of social capital represents an individualistic view of social capital. It is not the same as the individualistic or egocentric view of social network analysis, but it provides an important perspective of social capital that we will discuss in great detail later. The comparison between the collective view and private/individualistic view raises the challenge that we will discuss and try to resolve in discussion session.
Social Fabrics

Social Ties

In defining social capital, scholars explain it from how social system works. However, there is another approach to social capital, starting from analyzing connections among people rather than from thorough understanding of mechanisms of social systems. Quite a few sociologists studied benefits of social actors from a social network perspective, in which they emphasized the role played by connections between people and the configuration of a set of connections, the network. As mentioned earlier, social system approach to social capital, although usually implies some kind of network configuration, emphasizes on understanding how and why certain social system come into being and work in certain ways. On the flip side, social network analysis and social tie approach starts with connections and configuration of the network, and it interests in how a network is evolved topologically and how the shape of a network influences resource distribution.

Social relationship and social network have been studied in sociology for decades (Scott, 1988). One of the elements that distinguish human society from other organizations of animal kingdoms is interpersonal relationship between individual actors. Many inferior and less sophisticated forms of life live in collective forms. For example,
even insects such as bees and ants have their own hierarchical organizations and division of labor. However, humans build and maintain very complicated relationships between individuals. Interpersonal relationships become indispensable and defining features of the self of social actors, and we seem to savor them and enjoy the benefits yielded from them.

Sociologists had discussed the benefits generated from social relationship long before. Loury (1977) studied the unequal opportunities on the job market for white and black people by stating that because of their cultural and economic background and lack of outreaching connections, i.e., dense but truncated community (Portes, 1998), black people in general have less opportunities. The key concern of social network analysis and tie research is about distribution of resources such as knowledge, information and financial resources.

Granovetter (1973; 1983), Burt (Burt 1997; Burt 2000; Burt 2001) and Lin (Lin and Dumin, 1986; Lin, 1999) have studied network connections and social ties in job searching context and social status attainment. We can also see similar phenomena in Bourdieu’s discussion of cultural capital and in Coleman’s on information potential (1990) or information channel (1988).

In his seminal work on weak ties, Granovetter (1973) reminded us of values brought by weak ties, which once was underestimated and under-researched in academia. In existing literature, I do not see any formal definition of social ties. In Granovetter’s (1973) work, he denoted four proximal measures of strengths of tie: communication frequency, emotional intensity, reciprocity of services and intimacy. A few items (e.g.,
social distance, etc) were added in later research, but emotional intensity is found to be the most reliable indicator of strength of a social tie (Marsden & Campbell, 1984).

This emerging branch of research focuses on relations among people. Depending on the focus of unit of analysis, some studies deal with ties or connections among people, and some of them study bigger structure of social system. For example, in the first category, ties are termed as external or internal, bridging or bonding, and strong or weak. Although these categories may be slightly different, one category can usually imply character from other pairs. It is likely that external ties tend to be weak as well as provide bridging function, while internal ties are usually strong and provide bonding effect.

Focuses on bigger structure of social systems look at the distributions of connections in those systems. For example, two important ideas are closure of network (Coleman, 1988; 1990) and structure holes (Burt, 2000) in social network.

Closure of a network is degree of reciprocal relationships among members of a social network, and the highest degree of closure is the situation where every member in a network knows each other. Closure of a network provides environment for norms to be effective (Coleman, 1988). Structure holes are the critical nodes that connect different networks, which otherwise are not connected (Burt, 2000). For Burt, structure holes enable resource to flow between different network, and the persons who are at the positions of structure holes have advantages in many aspects, such as social status, economic rewards and job opportunities, etc.

Social exchange theory implies to a degree the function of social ties. Interaction between social actors through ties is, in fact, resource exchange. You are living in New
York, and during holiday you go to Hawaii to visit your best friends. Normally, we would not consider it as resource exchanges. However, your visit requires your time, some amount of financial resource and your emotional effort in talking to your friends and engagement. Of course, we would not think it expense or burden; on the contrary, we enjoy it so much and even feel that we get more in return. This is a case that social ties can mobilize resource in a non-contractual way. That is the value of social ties.

However, a few interesting and important points naturally emerge, if we just reflect on social tie a step further. First, the value (strength) of weak ties, drew from aforementioned arguments, is contingent on the actual resources the ties connect. To put it more straightforward, for a weak tie to be of value, it has to connect non-redundant yet demanded resources. Second, the strength of a tie is a continuous measure of the tie and it is very hard to qualitatively distinguish a tie to be strong or weak. Third, as Williams (Williams & Durrance, 2008) pointed out that current studies of social capital related research were using egocentric network analysis, which usually concluded with values and resources accessible to individual social actors in a network.

Social network analysis and the focus on social ties gave us a very powerful tool to look at how resources flow among social actors and to grasp quickly of why an interaction happens. However, there are a few questions and challenges faced by social network analysis. First, social tie is never been defined scientifically and clearly; second and partially because of this unclear definition, social ties may be confused with other types of social relationship, when they appear to happen between two individuals.
**Shared Identity**

Social ties are conduits between acquaintances. However, there exists another type of social relationship – social identity, which is relationships built on connections between individuals and collectivities. Social ties create channels for resource exchanges between individuals. However, resources also flow among people not knowing each other. The fact that there is other channel than interpersonal relationships enabling resources mobilization is important to a community to operate as well. A more important task for us is to find and improve channels that enhance resource distribution in a community. A critical element that defines a community, or a social group in general, is social identities. Social identity theory (Brown, 2000; Stryker & Burke, 2000; Tajfel, 1974) suggested a social (self) categorization process (Turner & Onorato, 1999) by which social actors identify themselves with collectivities. Social identity implies memberships that many scholars (Bourdieu, 1985; Portes, 1990) stressed in discussing social capital.

Social identity effect on in-group behavior was well studied. Even arbitrarily assigned group identification can bring out in-group behavior (Billig & Tajfel, 1973). Two effects of social identity (theory) are relevant to my study: the in-group behavior and the perception of interchangeable members led by social identity (Brewer & Gardner, 1996; Hogg et al., 1995).

Social identity theory suggests a pro-social tendency of members of a group to choose group-favoring behavior, such as helping other members, obeying group norms and defending the group when own group is offended. Social identity theory also suggests a phenomenon that group members see each other as interchangeable during
interaction. This is caused by the de-personalization effect of social identity (Brewer & Gardner, 1996).

There are a few features of shared identity that make it different from social tie. First, shared identity stems from perceivable commonality among a group of people (Tajfel, Blament, Billig, Bundy and Flament, 1971); second, shared identity is both objective as in organizational image (Harquail, 1994) and subjective as in perceived social identity (Turner and Oakes, 1989); and therefore third, shared identity has both behavioral consequences over a social group and individuals (Brown, 1969; Tajfel, 1982).

Another feature of social identity is less cross context or situation. As we can see, shared identity is developed in social interaction, and it can be and usually are multiple identities for a single person. These multiple identities form a complex identity structure for a person. For example, a college student can have more than one academic identity, let alone many more other identities. A student, let say Douglas, belongs to a college, and he maybe takes on a second degree, then he has another academic affiliation; in his home department, he may works in a lab, and therefore he has a smaller academic identity; his college perhaps is associated with a university, so he also gets a university identity. In this very simple case, one has 5 identities and they are more or less connected, since all of them are under one, big, university identity. They present a case of hierarchical identities. In reality, people can form parallel identities, which means those identities are less connected. For example, the student in our example may also develop identities that
represent totally differ from those academic identities, such as former Boy Scout member and a current local fire fighter volunteer.

Enact of shared identity is usually context related. Although structure of shared identities of a person can become very complex, we usually can act upon proper identity corresponding to various contexts. Using our guy Douglas as an example once again, during a classroom meeting in college, he will probably act upon the academic identity but not upon the fire fighter identity. For example, he may use scholarly terms to communicate with peers and professor. On the contrary, in a fire-fighting or similar emergency situation, he cannot care less about enacting on identities other than fire fighter volunteer.

However, shared identity may be invoked when situation is not so strong, but contingent on some explicit cue. For example, when Douglas goes to a party and meet Jason first time. Jason was the hostess’s husband and he is a fire fighter from another town. It is more likely Douglas and Jason will build up a special bond.

**Integration and Hypotheses Generation**

Above literature review does not include every piece of work have been done on social capital, but it covers major theoretical contributions to this field. However, I found the following issues confusing and need to be addressed. First, social capital is still a compassing concept and the definition of social capital is not clear. As already stated by many scholars, the definition of social capital is too wide and varied a lot. This leads to the problems in conceptualizing its consequences and antecedents.
From reviewing key writers’ conceptualization, I want to redefine social capital as

*a meta-resource that mobilizes other resources among social actors*. This is a definition built up on existing thoughts. It also reflects the key and unique feature social capital. The most significant value of the redefinition is pointing to the common effect brought by different social systems. Trust, sanctioning, social norms all have the same ability to mobilize resources, among other idiosyncratic effects brought by these different types of social elements. However, all of them can improve resource exchanges. This featuring ability is defining character of social capital.

Second, social relation is a source of social capital, but different social relationships are built on different ground. Social ties and social identity may produce different effects on social capital. As I already touched upon, social ties and social identity are different in their formation and mechanisms that govern behavior of individual social actors. In current discussion of social capital, researchers agree upon that social relation is the major source of social capital, but there is no theoretical distinguish between this two with regard to social capital and no study has been done to explore and show possible difference.

Further, it seems social ties and network analysis spent significant effort in defining categories of social ties and their consequential outcome. The most terms we have seen are weak tie – strong tie, bonding – bridging, internal – external tie. These categorizations can be distinguished if we have comparable reference, but it let the value of tie be contingent on the actual resources it brings. Weak tie and strong tie is hard to tell by only looking at a tie itself, and strength is a continuum. It is hard or even impossible to
give a definitive mark to differentiate weak ties from strong ties. We may need to rethink the definition of social tie and its defining characters as I did for social tie in previous point.

Third issue is related to previous two and does with locus of social capital – the point where social capital is in effect. This is to do with the concept of competing resource distribution. When talking about social capital and its effect, researchers tend to only speak at one level, either a collective level or individuals who was benefited. The situation is actually more complicated than this. If we see social interaction and benefit received as resource distribution, then it is natural to have a view that looks at both levels.

In integrating the above literature review and reflecting on these masterpieces, I proposed to test the following three hypotheses from a social capital perspective.

Hypothesis 1 – group members will put more resource in group-favoring activity and they will have less unsuccessful exchanges/transactions. This hypothesis starts from postulating that in a social group, social identity can improve resource utilization towards favoring group. This is not a totally new thought, since in group research, helping behavior in groups and in-group behavior have been studied for decades. But this hypothesis pays attention to resource utilization and success of transactions in a social group. It can be seen as a special instance of in-group behavior.

Hypothesis 2 – in a social group, cooperation between people having ties will be higher than that between strangers. Second hypothesis, compared with first, pays attention to social tie effect on transaction in a social group. It suggests that social ties can keep transactions between connected persons and prevent resource reaching other
members (strangers) of a group. This is an extension of current view on social tie, with a special focus on resource flow and distribution.

Hypothesis 3 – In groups with social identity, transactions between connected persons and that between strangers will be closer than in groups without or with low social identity. This hypothesis points to an interesting idea that social identity can break the tie effect mentioned in hypothesis 2.

Chapter 3

Study Design and Methodology

Economic games are used very often in sociology, psychology and economic research to study human decision making behavior (Dawes, 1980; Dawes & Messick, 2000). It is because it captures the unsolvable conflict existing in the social system that economic games are so frequently used. Researchers have used it in different configurations to test how people make decisions under different conditions.

A social dilemma has two fundamental characters: (a) the social payoff to each individual for defecting behavior is higher than the payoff for cooperative behavior, regardless of what the other society members do, yet (b) all individuals in the society receive a lower payoff if all defect than if all cooperate (Dawes, 1980).

A concrete example is a classic prisoner’s dilemma game. In the game, two prisoners are asked separately if they are to cooperate (e.g., to confess). If one confesses and one defects, then the one who defects will be set free and the one who confesses will spend 10 years in jail; if both of them confess, then both of them will be in jail for 4
years; if both of them defect, then both of them will be in jail for 8 years. In this simplest form, the only rationale choice for both players is to defect, because defection will lead no worse result for a player regardless of choice of other player. This is where the social dilemma comes from, where rational choice of players leads to socially inferior result, when better result available for both players. Both player defecting is the only Nash equilibrium in a one time prisoner’s dilemma game, and so is for a simple repeated prisoner’s dilemma game, in which players make choice of their strategy for N-finite times and they will be informed about what their opponent’s choice is for each time, and only the last time result will count.

However, social exchange and interaction is far more beyond this simplified form of decision-making; rather, it is repeated and current status of exchange is influenced by the leftover of previous encounters and the conditions of social exchanges impose far more complex constraints over people beyond immediate profits or punishment. For example, studies (Fehr & Gächter, 2000; Rand, Dreber, Ellingsen, Fudenberg, & Nowak, 2009; Yamagishi, 1986) suggest that the game, if played repeatedly and the interim results counted (e.g., with punishment or reward), will reach a state in which both players tend to cooperate (confess).

In the society we are living in, social-technical mechanisms also help magnify the virtues of human beings and help establish better communities. Volunteering work and Time Banking are new ways of sharing resources and make better use of resources.

Besides economic games, other games are also used as research tools. For example, Bos and colleagues (Bos et al., 2006; Bos, Shami, Olson, Cheshin, & Nan,
2004) developed a shape-factory game in which players were asked to produce different primitive color-shape object and then were asked to trade their color-shapes such that they can assemble complex color-shape combination of their client orders. With this baseline design, the creators of shape-factory game studied cooperation and communication among people under different configurations (e.g., face-to-face vs. distributed).

To study the research questions and test hypotheses laid out in previous chapters, I also created a game that represents social dilemma, but with a focus shifted slightly away from studying how Nash equilibrium achieved, maintain and/or break to studying pro-social behavior, resource allocation and cooperation in a more complicated context. In other words, I created a game to study under more complex conditions, which include social identity and social ties. These conditions have not been studied with economic games.

**The Economic Game: Co-investment in Communities**

The game tells a story of human society development and civilization. In the story, a human habitat starts from its very primitive state, the Stone Age. A group of people lives in that habitat and they together form a small society. The same as any real human society, people in that fictional society interact with each and as their everyday life and activities go, the economy grows and the society evolves from lower level civilization (Stone Age) to higher level civilization and eventually develops to the highest civilization of human kind, the Gold Age. When the habitat reaches the Gold Age, the game will end. The same as our modern society that economic development and growth
drive the development of other aspects of societal development, the economic activities underpins the development of the fictional human society in our game.

To simulate the real world development, the major task for the players is to make investments on a wide range of projects. This is a place where a game component relates to resources—on what projects to invest, since to make investments a player needs to allocate his/her limited amount of financial resource. In modern society, to investment something is an action to pool resources together and make a project or products of an organization success.

In the game I designed, to make cooperation explicit and measurable, I created a situation similar to what we call venture capital investment in modern society, in which social entities (individuals or institutes) who possess large amounts of financial resources research and identify possible projects to investment. However, for many reasons (lack of resources, risk aversion, etc), it quite often requires joint capital to co-invest a project. The game I designed mimics this feature. This is another place where a game component relates to resource allocation—with whom to co-invest.

**Baseline design: basic rules and specification**

As mentioned in previous section, the storyline is about the origin and development of a fictional human habitat, in which a human race starts from its very infant stage (Stone Age), through middle stages (Browse Age and Silver Age), to its fully civilized era (Gold Age). The force of the habitat development comes from accumulation of gold, which depends on investments made by members of the habitat, the players. When the habitat evolves to the Gold Age, the game will end. Right after the game ends,
ranking of each player and the performance of the group will be posted. In the game, players initially are given equal amount of gold (500) as their personal funds, which is the resource possessed by individuals. With the gold they own, they can choose various projects to invest from a replenishing pool; players will gain profits as investments return, which will add to their personal funds. As their funds increase, their levels upgrade. At the same time, each returned investment will also put away part of its total return in the habitat’s treasury, so the habitat’s gold accumulates, which is the condition for the habitat to evolve.

In the game, each player needs to choose projects from a list to invest and they have to choose a partner to co-invest with. This is where cooperation is operationalized and the choices of a player are the measure of cooperation between a player and the co-investor one has chosen. When the chosen person agrees to co-invest, then the project is successfully invested. The partnership is investment-wise, not game-wise, so every time a player initiates a new invest request, he/she can choose a different player to co-invest with. Also, the available investments in the pool are varied in return composition. That is, some investments are high on the community return and low on investor return, and some are high on individual investor return but low on community return. Other than send requests, actions a player can also take include cancelling, agreeing and declining requests.

When one initiates a co-investment request, he/she and the co-investor share the cost of the investment and also share the return of investors. A player can only make investments one can afford, and when a co-invest request is issued, and before it returns
or gets cancelled or declined, an amount of gold, which equals half of the cost that request requires, will be on hold. When the investment returns, each co-investor will get half of the total return for investor and the amount on-hold will be released. If a request is cancelled or declined, the amount on-hold for the request sender who initiates the request will be released as well.

For a co-investment request receiver, when he/she receives a request, there will be zero gold on-hold for the receiver. However, once he/she agrees to co-invest a project, there will be the equal amount of gold on-hold as the requestor does until the investment returns, which is half of the total price of the investment.

For example, let us say we are at the initial state of the game and each player has 500 piece of gold. Player A spots a project, developing fishnet for fishing. This project has 70 gold for individual investors’ return and 50-gold return for the habitat and it asks for 120 gold to invest. If player A initiates a co-invest request on this project with player B, then immediately after player A sends the request, he/she will have 60 gold (120 / 2) on-hold. At that moment, player A still have 500 in his personal fund, but only 440 (500 – 60) he/she can use on other investments. On player B’s side, when player B receives the request, nothing will change on his/her end in terms of the fund he/she has. When player B agrees to co-invest, 60 gold in his/her pocket will be on-hold as well, and then player B at that time can only spend 440 (500 – 60) on other investments. When the fish net project returns, the amount on-hold for both players will be released and 35 gold will be added to each players’ personal fund, then each of them has 535 gold. 50 gold will go to community fund.
Experiment development – two studies

For some reasons will be discussed in the following, the study was conducted in two periods of time and a few changes have been made so that the study was actually divided into two studies.

I originally designed the game to be played by three people. Figure 3-1 (a) shows the configuration of players. The figure only shows what configuration I want to create in the experiment, and the actual manipulation to achieve this configuration will be introduced in later section. I started to collect data in the fall of 2010. I recruited student participants from our college. However, when the time approaching the final week, many groups dropped their scheduled sessions, so I ended up with 12 groups received group treatment and 5 groups without.

I gave a halfway report to my committee in 2011 spring, and they gave me many valuable suggestions. One that influences the development of the study was that in the study of 2010 I had a pair and a stranger in the study (Figure 3-1 (a)). Even though the 3-person version did confirmed my hypotheses, we were concerned that the stranger, the person who had no connection to any other players prior to the game may introduce noise to the experiment, since he/she can randomly select co-investor. It may create disturbed dynamics in a group. For this reason, I decided to change the game configuration. I revised the study design to add one more person in the game such that I can have two pairs in a session. Figure 3-1 (b) shows the configuration of study 2.

As a consequence of this configuration change, I modified the manipulation in the game as well. In the first study, I as the experimenter need to assist the face-to-face chat
for priming social ties, and since I am the only person who conducts the study, I can serve only one pair in a session. In study 2, I decided to use a collaborative game to prime personal tie, so my assistant of the experimenter on this matter was no longer needed and the manipulation can operate at the same time for both pairs.

With the added person to form a second pair, for each player in the game, he/she will have one connected person and two strangers. In study 1, for the two players with social tie, each of them has one connected person and a stranger to choose, but the stranger has only two strangers to choose. So in this sense, the game configuration is more balanced in study 2. I started the second phase data collection in 2011 fall and ended up with 6 groups with shared identity treatment and 5 without.

*Experiment Manipulation and measurement*

The purpose for manipulation in the experiment is to create a desired condition for observation and at the same time to have a baseline against which a researcher can compare the effect brought by difference between or among different conditions and eventually be able to draw conclusions of causality among variables. In my study, I am interested in social identity and social tie and their relationship with cooperative behavior, a form of social capital. In this spirit, social identity and social tie are the independent variables in my study; and cooperative behavior is the dependent variable that I hypothesize to be influenced by social identity and social tie.

In order to see the effect of the independent variables on the dependent variable, I have to create the condition in the experiment where I can have both low and high conditions on social identity and social tie, and then I will measure the difference of
cooperative behaviors operationalized as transactions between players. Two manipulations were employed and each targets on one independent variable. In principle, the social tie manipulation need to create interpersonal interactions between two players prior to the actual game. This manipulation intends to create personal perceptions among players as the social ties. The second manipulation is to prepare (prime) groups with social identity before the game.

In study 1, the 3-person version, to achieve the manipulation on social tie, I gave the first two players who came to the lab 5 ~ 10 minutes to chat face-to-face. As the experimenter, I assisted their conversation. For example, when the first participant arrives, I chatted with him/her to get some background information of the participant, and when the second participant arrived, I can introduced them to each other with some conversation starters. I usually sit in to join their conversation for a while and when they were familiar to each other, I can leave them and attend the third participant. Through the whole time, the third participant was kept in another room.

For social identity manipulation in study 1, right before the actual game, some groups were asked to have an online chat session to decide a name for their groups. I give them a list of name as example, and encourage them to come up with new names. By this activity, I try to invoke a feeling of ownership of members in the team.

In study 2, the 4-player version, I have two pairs in each group. I achieved the first manipulation by having paired persons to play a collaborative spot-the-difference game before the actual game. This collaborative game was played offline and two persons shared materials. In the offline game, two players in a pair were seated together
and they were given 10 sets of almost identical photos. They were asked to highlight the difference between photos of each set. For the second manipulation, I told some groups that they were representing our university against groups from other universities.

Figure 3-1: Player settings for study 1 and study 2

The Experiment and Data Collection

Participants

In study 1, I recruited 51 (3 * 17) undergraduate and graduate students from our university in the end of 2010; and in 2011 spring, we conducted another 11 groups for study 2, in which 44 (4 * 11) participants were recruited. All participants received monetary compensation. Most participants were enrolled in information technology or computer science and engineering majors, and a few of them came from College of Engineering, Psychology department and Liberal Arts. Before they participated a session, we made sure they do not know each other.

The original plan of the study was to give equal compensation to participants, but it turned out that this mechanism did undermine the design to a considerable degree. In a few early pilot studies in early 2010 fall, I offered all participants equal compensation in
which no matter what they did and how well they did in the experiment, everyone of
them gets $10 for their participation. However, we found that participants did not engage
in the game very much under this condition. Some participants reported that when they
were playing the game, they just randomly selected people to co-invest with, since no
matter what their project and co-investor choices were, the game would eventually end
and it makes no difference to them even if they did not think of a strategy for the group or
themselves.

To make the game more appealing and engaging, we decided to compensate them
based on how well they did in the game. The total compensation of each player is
constituted of two parts: individual compensation and group compensation. For the first
part, in phase 1, players who make highest personal fund gets $9, $7 for second place and
$5 for third place; for the second part, each group gains a group compensation, which
eventually is divided by three and added to players’ individual compensation. Group
compensation is based on the group performance as well, which is a function of number
of transactions a group takes to finish the game. The fewer transactions a group has, the
higher performance the group produces; low-performance groups gets $0, high-
performance group gets $9, and middle-performance group gets $6. Then for example, at
the end of the game, a player at first place in a middle-performance group will get $9 +
$6/3 = $11 in total. In phase 2, since we added one more person in the game, we changed
the amount accordingly, but the schema remains unchanged.
The experiment lasts about 60 minutes or less, depended on how quickly the habitat researches Gold Age. This one-hour experiment includes consenting participants, reading instruction materials, playing the game and post game survey and debriefing.

Some researchers have raised the issue that using performance to determine compensation may encourage competition and thus change the nature of game. It was actually the first thing I had thought about, and the reason why I originally only used equal compensation for thanking participants. However, participants not paying attention to what they do in an experiment will damage the study. Furthermore, in the compensation mechanism used, I included a collective part that can help offset the incentive for competition. Even it increases competition among participants, some statistics such as paired T-test can allow us to immune from this problem partially.

Data Collection

In study 1, I ran the study from late November 2010 to middle of December the same year. At the end of the semester (15 December, 2010) I collected data from 17 groups (51 individuals). I collected all transactions of each session. The transactions include players’ co-invest requests, cancelations, acceptances and declinations of invest requests. With these data, we know what types of investment (community-favoring vs. individual-favoring) they chose and to whom they co-invest with. Among these 17 groups, 5 groups did not receive chat treatment, and 12 groups had group chat sessions. For the second study, I have collected data from 11 groups, which included 5 groups without group chat session and 6 with.
Chapter 4

Data Analysis and Result

I will first show how my participants felt about the game they played. This is to show that participants were engaged in the game and what their experience is in the game. Since this is not the primary goal of the study, I will only show the aggregated data from all participants of both studies. Then, I will go at length to describe data preparation and data analysis on transactional data related to hypothesis testing.

Experience in the game

In the post-game survey, I asked participants about their general feelings during the game. With these questions, we want to check and make sure the game gave participants positive experience, not necessarily in favor of the study, but at least not getting in the way of data collection. Table 4-1 shows the items I asked. These questions are designed to gather information about participants’ experience and to see if the system and procedure have breakdown or pitfalls that may compromise the study.

Table 4-1: Table 1 Post-game survey: player experience

<table>
<thead>
<tr>
<th>Code</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understanding I understand the rule of the game very well</td>
</tr>
<tr>
<td>2</td>
<td>Making sense This game makes sense to me</td>
</tr>
<tr>
<td>3</td>
<td>Easy to play It is very easy to play</td>
</tr>
<tr>
<td>4</td>
<td>Enjoyment I enjoyed the game</td>
</tr>
<tr>
<td>5</td>
<td>Information I can easily find information I need to play game</td>
</tr>
<tr>
<td>6</td>
<td>Controlling I am in control during the game</td>
</tr>
</tbody>
</table>
Participants chose from a 1 to 5 (strongly disagree to strongly agree) Likert-scale for each question in table 5-1. Since it is not my focus in this study, I aggregated the players’ experience data into one graph. The result (Figure 4-1) shows that players had positive experience playing the game. I also collected open-ended responses about their general feeling about the game. It confirms that participants enjoy the game and had fun during their play.

“Better than I expected. The several seconds of pause during each investment session is quite reasonable and useful.” “The game was simple, fast paced, and interesting.” “It was pretty fun. Hard to work with other players without actually being able to talk to them, but it worked pretty well regardless.” “It was enjoyable, I would probably play again.”

Figure 4-1 signals to us that the players in the experiments in general had positive experience. For the first 5 questions, the number of participants who chose very agree and strongly agree is around 80% or more. The only item on which the participants showed some moderate rating is the question asking them if they felt they had control in the game. Although participants gave relatively lower rating on this, more than 50% participants chose either very agree or strongly agree. It is also understandable, since the
game requires two persons to cooperate so it is impossible for players to have total control. I believe this game experience survey reasonably reflects that the game did not get in the way of data collection.

**Study 1 data analysis**

I will describe the transactional data I collected and data analysis in study 1 in this section. I define transaction as any action taken on an investment, including sending a co-invest request, accepting a request, cancelling a request and declining a request. In my analysis, for those requests on community-favoring investments, I will call them CF requests, and for investor-favoring ones, I will call them IF requests.

Since I have unbalanced groups in the two categories: groups with social identity treatment and groups without social identity treatments, to have a balanced data set, I kept all data for groups without social identity treatment and randomly select 5 groups from the 12 groups with high shared identity. Or in other words, I randomly dropped 7 groups from the category of groups with social identity treatment.

One question I am interested in is that if groups with some level of social identity will do better than groups with low social identity or groups without social identity at all. In real world, it is hard to say if a group does better than another group only by one condition. However, efficiency is usually seen as a very important criterion to evaluate groups. The one I looked at is the number of transactions taken for each group to reach the Gold Age. That is, the smaller number of transactions a group has to achieve the Gold Age, the higher the performance that group has.
Table 4-2 shows a descriptive statistics of both total transactions and requests of 10 groups. The numbers indicate that groups of no shared identity treatment have larger numbers of total transactions as well as total requests. Means of both measures are much lower in groups with social identity treatment. The mean total transaction is 285.8 for groups without group treatment, and for groups with treatment, the mean decreases to 186.4 and both minimal and maximum are smaller in groups received shared identity treatment. In the following analysis, I will focus on requests sent in groups, because in real social interaction, to initiate a request carry more intentions than responding, so in my study, requests will be more representative of cooperative intention.

In terms of total requests sent in groups, table 4-2 also shows the same pattern that groups with shared identity treatments tend to have less co-invest requests. The mean of total requests in groups with shared identity treatment is 92.6 and 142.4 for groups without shared identity treatment. The reason for this huge difference can be largely attributed to the higher number of successful transactions in groups with shared identity treatment. Table 4-2 also shows us the comparison of the total unsuccessful transactions, and it suggests to us that groups with high shared-identity treatment waste fewer transactions to
achieve Gold Age. The mean of unsuccessful transactions for groups with social identity treatment is 116.2 and 183.8 for groups without.

T-test was performed on total transactions (t = 2.89; p < 0.05), total request transactions (t = 2.93, p < 0.05), and unsuccessful transactions (t = 2.69, p < 0.05). The test results confirmed the difference between the two categories. That is, for groups with shared identity treatments, the number of unsuccessful requests was smaller than that of groups without shared identity treatment, and groups with shared identity treatment used less total transactions and requests to reach the Gold Age.

I also postulated that groups with shared identity treatment will spend more of their transactions on CF investments than on IF investments, which also leads to fewer total transactions for groups with shared identity treatment to reach Gold Age. Table 4-3 shows the descriptive summary of the percentage of successful community-favoring transactions. However, T-test shows no significant difference between two categories (p > 0.05).

| Table 4-3: Summary of percentage of successful Community-favoring transactions of groups |
|-----------------------------------------------|----------------|----------------|----------------|----------------|
| N | Minimum | Maximum | Mean | Std. Deviation |
| L_Idnty_Total_CF_Requests | 5 | 0.106 | 0.553 | 0.2570 | 0.196 |
| H_Idnty_Total_CF_Requests | 5 | 0.307 | 0.841 | 0.4590 | 0.221 |

Above analysis shows that shared identity does have an impact on social groups in terms of their performance—better utilization of their resources. In groups with high shared-identity, total transactions are much lower than groups without shared identity treatment. From the data, one explanation is that in groups with shared identity treatment, requests are accepted more; and in groups without shared identity treatment, more requests were canceled or declined, so more requests are needed to reach the Gold Age.
From this perspective, shared identity does positively influence cooperative behavior in a social group.

To see if a personal tie has an influence on cooperation, I turn to the interaction between players who have ties and who do not. The plan is to see if the number of transactions between connected players is different from that between strangers. Since the numbers of transactions varied across groups, so to have a comparable data, I first turn the numbers of transactions into percentage by player. For example, if a player sent 10 request to the player he/she had a tie with, and 8 to the stranger, then this player had $\frac{10}{10 + 8} \approx 56\%$ requests to tied person and $\frac{8}{10 + 8} \approx 44\%$ requests to the stranger.

Again, in this analysis, I will focus on requests sent between players. Table 5-5 displays the percentages of requests sent by each player to other players. In table 4-4, column 1 is the marker to indicate if the pair in the row is from a group received shared identity treatment or not; column 2 is percentage of total request sent to player 2 by player 1; column 3 is percentage of total request sent to player 3 by player 1; column 5 is percentage of total request sent to player 1 by player 2; column 6 is percentage of total request sent to player 3 by player 2; column 4 and 7 are an index given to Player 1 and Player 2, and it is an integer number from 0 to 2. For each player in table 5-5, if a player has higher percentage of request sent to connected player, than I give it a 2; if the player has higher percentage of request sent to the stranger, then I give it a 0. Number 1 will be used in the 4-player situation, which indicates a connected player has middle percentage of request sent to his/her connected player. Columns with the * mark, column 2 and 5, are the percentage of requests sent to the connected player; and column 3 and 6 are percentage of requests sent to the strangers.
Table 4-4: Transactions between players

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chat</td>
<td>P1_P2 *</td>
<td>P1_P3</td>
<td>P1_tie_idx</td>
<td>P2_P1*</td>
<td>P2_P3</td>
<td>P2_tie_idx</td>
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<td>.5454545</td>
<td>.4545455</td>
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<td></td>
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<td>.4827586</td>
<td>.5172414</td>
<td>0</td>
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<td>.4871795</td>
<td>.5128205</td>
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<td>.4230769</td>
<td>2</td>
<td>.5172414</td>
<td>.4827586</td>
<td>2</td>
<td></td>
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</tbody>
</table>

Having these percentages calculated, a paired t-test between pairs with groups with high shared-identity and pairs from groups without was performed. The result shows significant difference between these two groups: percentages of request between connected players are higher (t = 2.53, p < 0.05), compared to that of requests sent between strangers, which means transactions between people having ties are significantly higher then people do not have ties. This supports our proposition 2. In our later analysis with Repeated-Measures ANOVA, the main effect of ties also is also significant.

To further test if connected people are more reciprocal to each other, I used a very simple techniques to measure reciprocity between players. In table 5-6, column 4 and 7 contains an index number for each player who has tie with another player. In the indexing system, number 2 means that the player sent more requests to his/her connected player and 0 indicate the other direction: the player sent more requests to stranger. From the table, it tells us that there are 5 rows with both column 4 and column 7 having number 2, which means 5 out of 10 cases connected players tend to send more requests to each
other. A further look tells us that 4 pairs of connected players with number 2 reciprocity are in groups not receiving shared identity treatment and only 1 pair falls in the groups with high shared-identity. This is a sign that shared identity may break the tie effect in lowering transactions between tied person in a social group.

The paired T-test above shows that the requests sent to an acquaintance are significantly higher than that sent to a stranger. To see if shared identity has an impact on social tie’s effect on cooperative behavior, I need to see if the difference between requests sent to acquaintance and requests sent to stranger is smaller in groups with shared identity treatment. To have an intuitive interpretation, I aggregated the numbers from each category and put them into a two-by-two (Connectedness * Social identity treatment) table (Table 4-5).

<table>
<thead>
<tr>
<th></th>
<th>Tie</th>
<th>No-Tie</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Identity Treatment</td>
<td>138 (n = 5) 27.6 (Avg.)</td>
<td>131 (n = 5) 26.2 (Avg.)</td>
<td>269 (n = 10) 26.9 (Avg.)</td>
</tr>
<tr>
<td>No Shared Identity Treatment</td>
<td>259 (n = 5) 51.8 (Avg.)</td>
<td>191 (n = 5) 38.2 (Avg.)</td>
<td>450 (n = 10) 45 (Avg.)</td>
</tr>
<tr>
<td>Total</td>
<td>397 (n = 10) 39.7 (Avg.)</td>
<td>322 (n = 10) 32.2 (Avg.)</td>
<td></td>
</tr>
</tbody>
</table>

First, table 4-5 shows a pattern described in hypothesis 1 and 2. That is, in groups with shared identity treatment, requests sent are fewer than that of groups without shared identity treatment; and requests sent between connected persons are higher than requests between strangers. My third hypothesis predicts that the difference between acquaintances and strangers is smaller in groups with shared identity treatment than groups without. Table 4-5 shows this pattern too.

With the data in Table 4-4, the requests sent to acquaintance by a participant and requests sent to stranger by the same participant can be treated as repeated measure, and
the shared identity treatment can be seen as a between subject factor. With regard to the effect of shared identity over social ties, I expect to see the interaction between social ties and shared identity. To test it, I ran a repeated-measure general linear model with social tie as within subject factor and shared identity as between subject factor. The result shows in table 4-6. The effect of social tie is significant ($p < 0.05$) and the interaction between social tie and shared identity is marginally significant ($p < 0.1$).

Table 4-6 Multivariate Tests on Requests between players

<table>
<thead>
<tr>
<th>Effect</th>
<th>Pillai's Trace Value</th>
<th>$F$</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Tie</td>
<td>.258</td>
<td>6.269$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.022</td>
</tr>
<tr>
<td>Wilks' Lambda</td>
<td>.742</td>
<td>6.269$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.022</td>
</tr>
<tr>
<td>Hotelling's Trace</td>
<td>.348</td>
<td>6.269$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.022</td>
</tr>
<tr>
<td>Roy's Largest Root</td>
<td>.348</td>
<td>6.269$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.022</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effect</th>
<th>Pillai's Trace Value</th>
<th>$F$</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Tie * Shared Identity</td>
<td>.154</td>
<td>3.278$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.087</td>
</tr>
<tr>
<td>Wilks' Lambda</td>
<td>.846</td>
<td>3.278$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.087</td>
</tr>
<tr>
<td>Hotelling's Trace</td>
<td>.182</td>
<td>3.278$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.087</td>
</tr>
<tr>
<td>Roy's Largest Root</td>
<td>.182</td>
<td>3.278$^a$</td>
<td>1.000</td>
<td>18.000</td>
<td>.087</td>
</tr>
</tbody>
</table>

Figure 4-2: Boxplot for total requests in groups
Figure 4-2 shows that on the high shared-identity (H-IDNTY) end, the percentages of request transactions among connected players (Tie) are smaller and they are close to the percentages among players are not connected (Non-Tie).

My interpretation of study 1 data analysis is that in a social group, social identity can improve interaction (transactions) within the group by reducing unsuccessful transactions and promote group-favoring behavior. Social ties in a social group on the other hand can concentrate transactions between connected people. The study shows that in social groups without social identity or with very low shared-identity, the effect of social tie is very strong; but in groups received social identity treatment, effect of social ties becomes smaller and transactions between strangers increase. An explanation of this moderator effect from social identity is that social identity makes group members see each other as more interchangeable, so to cooperate with anyone in the group should make less difference. When social identity breaks social tie effect or loosens it, transactions between connected players decrease, and the decreased portion goes to strangers. As a result, transactions between strangers increase when social identity presents.

**Study 2 data analysis**

Study 2 study collected 11 groups in total. 6 groups received shared-identity treatment and 5 did not. In data analysis, I use the same technique to eliminate one group from the category in which groups received social identity treatment.
Table 4-7: Summary of total transactions and total request transactions of groups

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L_Idnty_Total_Trans</td>
<td>5</td>
<td>163</td>
<td>272</td>
<td>215</td>
<td>39.3</td>
</tr>
<tr>
<td>H_Idnty_Total_Trans</td>
<td>5</td>
<td>109</td>
<td>185</td>
<td>151</td>
<td>31.8</td>
</tr>
<tr>
<td>L_Idnty_Total_Reqs</td>
<td>5</td>
<td>81</td>
<td>141</td>
<td>110.2</td>
<td>21.9</td>
</tr>
<tr>
<td>H_Idnty_Total_Reqs</td>
<td>5</td>
<td>55</td>
<td>96</td>
<td>75.2</td>
<td>19</td>
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<tr>
<td>L_Idnty_Total_UnSuccess</td>
<td>5</td>
<td>15</td>
<td>37</td>
<td>26.6</td>
<td>9.9</td>
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<tr>
<td>H_Idnty_Total_UnSuccess</td>
<td>5</td>
<td>13</td>
<td>33</td>
<td>19.2</td>
<td>8</td>
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</tbody>
</table>

Table 4-7 shows a descriptive statistics of transactions of the 10 groups. The numbers indicate that groups that were not received social identity treatment have larger numbers of total transactions. It also tells the same pattern about the total requests in groups. Means of both total transactions and requests are lower in groups receiving shared identity treatment. Similarly, total unsuccessful transactions are higher in groups without shared identity treatment.

In terms of total requests sent in groups, table 4-7 also shows the same pattern that groups with shared identity treatment tend to have less requests. The mean of total requests in groups with social identity treatment is 75.2 and 110.2 for groups without. The reason for this difference is largely attributed to the higher successful numbers in groups with social identity treatment. I performed a T-test on both total transactions ($t = 2.83; p < 0.05$) and total request transactions ($t = 2.7, p < 0.05$), the test results confirmed that the difference between the two categories is significant.

In Table 4-7, it also shows information of unsuccessful transactions, and it suggests to us that groups with social identity treatment waste fewer transactions to achieve Gold Age. The mean of unsuccessful transactions for groups with social identity
treatment is 19 and 26 for groups without, but the t-test shows the effect is not significant (p > 0.1).

Another reasons for the low total transactions and requests transactions is also due to the fact that groups with shared identity treatment had more community-favoring transactions going on and that will help groups reach the Gold Age faster than groups without social identity treatment, who engaged in fewer community-favoring transactions. T-test shows marginally significant difference between categories (t = 2.3, p < 0.1). Table 4-8 shows the descriptive summary of the percentage of community-favoring transactions in two categories.

Table 4-8: Summary of percentage of community-favoring transactions of groups

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L_Idnty_Total_CF_Requests</td>
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<td>0.042</td>
<td>0.164</td>
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<td>0.053</td>
</tr>
<tr>
<td>H_Idnty_Total_CF_Requests</td>
<td>5</td>
<td>0.127</td>
<td>0.487</td>
<td>0.302</td>
<td>0.161</td>
</tr>
</tbody>
</table>

Above analysis shows that social identity has an impact on social groups in terms of their performance. In groups with shared identity treatment, total transactions are much fewer than groups without shared identity treatment. From the data, one explanation is that in groups with shared identity treatment, requests are accepted more; and in groups without shared identity treatment, more requests were canceled or declined, so more requests are needed to reach the Gold Age. From this perspective, social identity does positively influence cooperative behavior in a social group.

To see if personal ties can have an influence on cooperation in study 2, again I turn transactions between players who have ties and who do not. I used the same techniques to convert the number of request transactions among players into percentages. For example, if a player sent 10 request to the player he/she had a tie with, and 8 to the
stranger, then this player had $10 / (10 + 8) \approx 56\%$ requests to tied person and $8 / (10 + 8) \approx 44\%$ requests to the stranger. Again, in this analysis, I will focus on requests sent between players. Table 4-9 displays the percentage of requests sent by each player to other players. In table 4-9, column 1 is the marker to indicate if the pair in the row is from a group received shared identity treatment or not; column 2 is percentage of total request sent to player 2 by player 1; column 3 is percentage of total request sent to player 3 by player 1; column 4 is percentage of total request sent to player 4 by player 1; column 6 is percentage of total request sent to player 1 by player 2; column 7 is percentage of total request sent to player 3 by player 2; column 8 is percentage of total request sent to player 4 by player 2; column 10 is percentage of total request sent to player 1 by player 3; column 11 is percentage of total request sent to player 2 by player 3; column 12 is percentage of total request sent to player 4 by player 3; column 14 is percentage of total request sent to player 1 by player 4; column 15 is percentage of total request sent to player 2 by player 4; column 16 is percentage of total request sent to player 3 by player 4; column 5, 9, 13 and 17 are an index given to Player 1, Player 2, Player 3 and Player 4 and it is an integer number from 0 to 2. For each player in table 5-12, if a player has highest percentage of request sent to the connected player, than I give it a 2; if the player has lowest percentage of request sent to the connected player, then I give it a 0; if the player has middle percentage of request sent to the connected player, then I give it a 1. Columns with the * mark, column 2 and 5, are the percentage of requests sent to the connected player; and column 3 and 6 are percentage of requests sent to the strangers.
Table 4-9: Summary of percentage of community-favoring transactions of groups

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<tr>
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<th>1</th>
<th>2</th>
<th>3</th>
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<td>0.411765</td>
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<tr>
<td>No</td>
<td></td>
<td>0.003</td>
<td>0.35714</td>
<td>0.57143</td>
<td>0</td>
<td>0.4</td>
<td>0.5</td>
<td>0.1</td>
<td>1</td>
<td>0.371429</td>
<td>0.257143</td>
<td>0.371429</td>
<td>2</td>
<td>0.244898</td>
<td>0.102041</td>
<td>0.653061</td>
<td>2</td>
</tr>
</tbody>
</table>
Having these percentages calculated, I ran a paired t-test between pairs with groups with high shared-identity and pairs from groups without. The result shows significant difference between these two groups: percentages of request between connected players are higher ($t = 4.8$, $p < 0.01$), compared to requests sent between unconnected players, which means transactions between people having ties are significantly higher than people do not have previous ties. This supports my hypothesis 2.

To further test if connected people are more reciprocal to each other, I used a very simple techniques to measure reciprocity between players. In table 4-9, column 5, 9, 13 and 17 contains an index number for each player who has tie with another player. In the indexing system, number 2 means that the player has the highest request percentage to his/her connected player, 0 indicates that the player has lowest request percentage to his/her connected person, and 1 means the player has moderate request percentage to his/her connected person, between the percentages of requests sent to the two strangers.

From the table, it tells us that there are 10 cases with either both column 5 and column 9 or column 13 and column 17 having number 2, which means 10 out of 20 cases that connected players tend to send more requests to each other; and 5 cases out of 20 are that either both column 5 and column 9 or column 13 and 17 have an 1 and 2. This result means that in study 2, 10 out of 20 pairs of connected players show high reciprocity and 5 out of 20 show moderate level of reciprocity.

A further look tells us that 5 pairs of connected players with number 2 reciprocity are in groups not receiving shared identity treatment, and 3 pairs has moderate number 1 reciprocity; and also 5 pair with number 2 reciprocity and 1 pair with number 1
reciprocity falls in the groups with high shared-identity. This is a sign that shared identity may break the tie effect in lowering transactions between tied person in a social group.

The paired T-test above shows that the requests sent to an acquaintance are significantly higher than that sent to a stranger. To see if shared identity has an impact on social tie’s effect on cooperative behavior, I need to see if the difference between requests sent to acquaintance and requests sent to stranger is smaller in groups with shared identity treatment. To have an intuitive interpretation, I aggregated the numbers from each category and put them into a two-by-two (Connectedness * Social identity treatment) table (Table 4-10).

<table>
<thead>
<tr>
<th>Table 4-10 Requests sent between players</th>
<th>Tie</th>
<th>No-Tie</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shared Identity Treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>158 (n = 10)</td>
<td>218 (n = 20)</td>
<td>376 (n = 30)</td>
</tr>
<tr>
<td></td>
<td>15.8 (Avg.)</td>
<td>10.9 (Avg.)</td>
<td>12.5 (Avg.)</td>
</tr>
<tr>
<td></td>
<td>No Shared Identity Treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>258 (n = 10)</td>
<td>293 (n = 20)</td>
<td>551 (n = 30)</td>
</tr>
<tr>
<td></td>
<td>51.8 (Avg.)</td>
<td>38.2 (Avg.)</td>
<td>18.4 (Avg.)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>416 (n = 20)</td>
<td>511 (n = 40)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20.8 (Avg.)</td>
<td>12.8 (Avg.)</td>
<td></td>
</tr>
</tbody>
</table>

First, table 4-10 shows a pattern described in hypothesis 1 and 2. That is, in groups with shared identity treatment, requests sent are fewer than that of groups without shared identity treatment; and requests sent between connected persons are higher than requests between strangers. My third hypothesis predicts that the difference between acquaintances and strangers is smaller in groups with shared identity treatment than groups without. Table 4-10 shows this pattern too.

With the data in Table 4-9, the requests sent to acquaintance by a participant and requests sent to stranger by the same participant can be treated as repeated measure, and the shared identity treatment can be seen as a between subject factor. With regard to the
effect of shared identity over social ties, I expect to see the interaction between social ties and shared identity. To test it, I ran a repeated-measure general linear model with social tie as within subject factor and shared identity as between subject factor. The result shows in table 4-11. The effect of social tie is significant (p < 0.05) and the interaction between social tie and shared identity is marginally significant (p < 0.1).

<table>
<thead>
<tr>
<th>Effect</th>
<th>Hypothesis</th>
<th>Error df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Tie</td>
<td>Pillai's Trace</td>
<td>.229</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td>Wilks’ Lambda</td>
<td>.771</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td>Hotelling's Trace</td>
<td>.297</td>
<td>23.1</td>
</tr>
<tr>
<td></td>
<td>Roy's Largest Root</td>
<td>.297</td>
<td>23.1</td>
</tr>
<tr>
<td>Social Tie * Shared Identity</td>
<td>Pillai's Trace</td>
<td>.001</td>
<td>.064&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Wilks’ Lambda</td>
<td>.999</td>
<td>.064&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Hotelling's Trace</td>
<td>.001</td>
<td>.064&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Roy's Largest Root</td>
<td>.001</td>
<td>.064&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Figure 4-3: Boxplot for total requests in groups in phase 2
Interpretation of results

In this section, I will try to interpret the analyses from both study 1 and study 2 in an integrated tone, rather than looking at them separately. I had three hypotheses: (H1) the stronger identity a community has, the higher social capital a social group has; (H2) in a social group, transactions between people having social ties will be higher than that between strangers and (H3) shared identity and social ties will off set each other’s effects on cooperation among members of a social group. Results from data analysis support the first and second hypotheses consistently and for the third hypothesis, it is only supported by study 1 study.

The experiment I have conducted contains two separate studies in different time. However, both studies use the same economic game as a platform for me to collect data. In both studies players play the same game with similar compensation schema. The difference is in study 2, I added the fourth person into the game. This change not only eases the need of my assistance to prime personal tie, but also adds valid data points. However, this change also modifies configuration of the game, which may alter the effect of variables of interest on the dependent variable.

The economic game study takes transactions among players as a major data source. At group level, I investigated the number of transactions taken place in groups. The evidence comes from the significantly higher number of transactions in groups not receiving shared identity treatments in the study. In each study, groups played the same game under the same conditions, so I can compare their performance by number of total transactions and of requests sent within groups. Since in each study of the study groups
play under the same condition, groups who reach the Gold Age faster – having less total transactions – can be considered to outperform groups more slowly. Study 1 and study 2 data both confirmed it. In study 1, the number of total transactions are different in two categories ($t = 2.89; p = 0.02$ in study 1, and $t = 2.83; p = 0.027$ in study 2) and so are the number of total request transactions ($t = 2.7, p = 0.022$ in study 1, and $t = 2.93, p = 0.019$). My interpretation of this difference is that it is because shared-identity can 1) promote pro-social behavior in a social group and 2) make less important with whom one is having transaction with, and shared-identity then help reduce the unsuccessful transactions within social groups (table 5-4 and 5-10).

Look at the transactions between players, both studies suggest that personal ties have very significant effect on transactions between players, especially the request transactions. Requests are initialized by a player, so it is representative of one’s choice of partner. I used the same technique to see if there is a systematic difference between requests sent between connected players and requests sent between strangers. Paired t-test confirmed that in both studies, requests sent to the connected person are significantly higher than requests sent to strangers ($t = 2.53, p = 0.02$ in study 1; $t = 4.8, p = 0.00$ in study 2).

I also looked at the reciprocity between players as well. In my case, I am looking at the relative position of requests sent to people with connection. In study 1 study, I assigned a number to a pair according to the relative position of requests sent to one’s connected player. If one sent most requests to one’s connected buddy, then I assigned number 2 on this pair; if one sent most requests to the stranger, and then I assigned number 0 to this pair. For example, in study 1, player 1 and player 2 are connected
players and player 3 is the stranger. If player 1 sent total 100 requests in the entire game and among these 100 requests, player 1 sent to player 2 60 requests, which is 60% of player 1’s total requests, then player 1 sent 40% of his/her total requests to player 3, the stranger, then I will assign number 2 to player 1’s record. Likewise, if player 2 has 55% of his/her requests sent to player 1 and 45% to the stranger, then I will also assign a 2 to player 2’s record. Thus in this example, both player 1 and player 2’ records got a 2 for each, then I will say the request transactions between them show number 2 reciprocity, which is a highest level of reciprocity in the group. The same technique is used in study 2 with additional 1 level reciprocity, since a player has one connected person and two strangers to have transaction with. Number 1 is an indicator of that the requests to the connected player by player X is not the highest percentage and not the lowest percentage either. This is a measure of reciprocity based on percentage of resources exchanged between players. In a sense, this is a more accurate measure than measuring reciprocity by the amount of resource exchanged, since in some cases the absolute amount can create a false impression that the exchange are similar in amount, but in fact it may be out of proportion considerably. This measure by percentage also allows me to show not only if two players reciprocate, but also show the level of their reciprocity. However, this may differ from case to case and it is also not a key point I am focusing in this study.

In study 1, I observed 5 out 10 number 2 reciprocity; in study 2 I observed 10 out of 20 number 2 reciprocity and 5 out 20 moderate level of reciprocity (4 pairs with 1 and 2 and one pair with 1 and 1). What I can tell from this result is that players with ties are not only reciprocate, but also trying to send more requests to each other in a reciprocated way.
To see if shared identity and personal tie will have joint effect on cooperative behavior, I performed a General Linear Model repeated measure analysis on study 1 and study 2 studies. As we can see in figure 5-3 and 5-5, the joint effect is significant in study 1 but not in study 2. First of all, I noticed that the request transaction percentage was in general 15% higher in study 2. This can be attributed to the fact that in study 1, I had 3 persons in a session, so there are 3 persons to partition the total value and in study 2, there are 4 persons to partition the total value, thus percentage for each player is smaller in study 2 than in study 1.

In study 1 analysis, a General Linear Model repeated measure analysis shows that the interaction effect is significant (p < 0.05) that shared identity can break the tie effect on concentrating transactions between connected people, and make the transactions (requests sent) more evenly distributed in a social groups. I suggest we see this effect as a moderate effect of shared identity on personal ties. Since shared identity in study 1 study does not show effect on request transactions alone, I would consider shared identity works in a way that personal ties have strong effect in keeping transactions between connected players and when shared identity presented, it allows the players see each other more equal and interchangeable, so part of the transactions can be brought out from the connected players and go to the stranger. This is the why we can see the request transactions are brought down between connected players and brought up between strangers. In other words, the effect of shared identity make the transaction evener is it break down the conduit effect created by tie and let part of the resource flow to the stranger.
However, in study 2, this effect disappeared. A General Linear Model repeated measure analysis shows that personal ties still have a big impact on request transactions between players, but the interaction effect of shared identity and personal ties almost none. From figure 5-5, we see that the percentage between tied players and between strangers are almost parallel. This means that in study 2, no matter in groups with shared identity or not, personal tie always has similar effect on request transactions. One explanation of the disappearing interaction effect is that in study 1 study, the game configuration involves three players, among which there are two connected people and a stranger. Thus the configuration is not balanced or not symmetric, since there are two players who has one connected person and one stranger to play together with and there is a stranger who has no connected people for him/her to play with. In study 2 study, four players are in the same session and each of them has the same number of connected people and stranger. This can be a factor that prevents shared identity working effectively to bring down the personal tie effect.

Chapter 5

Discussion

Revisit the problems

The study reported here tested and confirmed all three hypotheses proposed in earlier chapters. Although experiments were challenged in social science research because of its artificial setups and disconnection with real-world relevance, they in fact, contradictorily, are major source of social research data (Falk & Heckman, 2009). My study aims to show
the difference between social identity and social ties from a social capital aspect, and the 
game I designed represent certain elements of social dilemma and social-relational 
complexity that we are experiencing in day-to-day interaction with outer world.

Another validation of the study is that in the study, we invite people to play the 
game and the game was actually designed as an actual game with a civilization 
background story. In real world, people indeed participate in all kinds of online (social) 
games such as World of Warcraft (Wikipedia contributors, 2012b) and Age of Empires 
(Wikipedia contributors, 2012a), in which players form allies with people they know or do not know, and they manage and exchange artifacts and resource. This is the schema I took to design my game. The post-game survey also shows that participants display high 
level of enjoyment playing it. It is far more realistic than a simple prisoner’s dilemma 
game.

The game embodies a situation in which personal gain competes with collective 
gain; and the setting of the game mixes both social identity and social ties.

In this section, I will reflect more on the understanding of social capital, taking 
into account findings from my study. One argument I want to raise is regarded to two-
dimensional understanding of social capital, namely range and readiness for resource 
mobilization.

I would argue that both social identity and social tie nurture social capital but root 
in different ground and have different influences. Social identity, besides its in-group 
behavior effect that may help a social group, can broaden the range of potential recipients
of resources located in a social group; and differently social ties results in increasing readiness of resource access.

I will further argue that many forms of previously identified social capital can be analyzed through this lens. For example, social norms and sanctioning are to serve more people than just two; and trust is like social tie, which will make transactions between trusted people less costly.

I will also reflect on the understanding on social ties. I will argue that it is not easy to qualitatively specify the characteristics of social ties in terms of its strengths. Instead, I’d like to propose a functional view of social tie, which suggests the value of a tie be a function of the value of resource it connects and its strength. Basically, a tie’s value is larger when the resource is more critical and larger when its strength is stronger. This functional understanding of social ties taking two aspects into consideration and it unifies the weak-strong tie argument and bridging-bonding argument as well. Furthermore, it allows us to practically compare values of social ties.

Reflection on the study, I will argue that even in a weak manipulation context, the effect is significant. The manipulation in my study is rather weak. For the social tie manipulation, in study 1 the participants were given a few minutes to chat before the game and the groups were asked to chat online to decide a name for their group; in study 2 the paired participants played a simple collaborative game and the groups were simply told they were representing our university against other universities. These manipulations are weaker than social ties and social identities established in long history of interactions.
However, even though they are very weak, the effects of both bearing on social capital are significant in the game.

The findings of the study not only enrich our understanding of social capital and social relations. They inform research in community informatics and relevant fields. Scholars have identified components critical to communities: identity, connections, and community network (Carroll, 2011). For a community to grow, participation and engagement should be fostered. To participate in community activities and engage with others, a member needs to spend time and attention. Considering these resources, we will find the study is closely related.

The Internet becomes a carrier of online communities and it reduces the transactional costs for participation and engagement. However, for the same reason, the Internet also tops up participation options even more. When a person has limited time and attention, where and what amount he/she allocates them is critical. For a community, recruiting new members are also vital to its success.

The findings from my study can shed light on these issues. First, for example, to promote participation and engagement in terms of rate and quality among members, we can cultivate community identity, because social identity can help members who do not know each other personally interact, socialize and help each other.

Our three propositions are drawn from existing theories and studies. Proposition 1 specifies positive effect of shared identity on social capital in that shared identity will encourage group favoring actions; proposition 2 is about social ties and its concentrating effect on resource allocation; proposition 3 postulates an effect of shared identity over
social ties on reducing social ties’ concentrating effect described in proposition 2. Data analysis in previous section confirmed all three propositions.

Social groups, from small teams that contain only a few people to large entities that represent nations, unavoidably operate on interactions of social actors on day-to-day basis. Social relationships that influence how people interact with each other have impact on cooperation among people. Cooperation and willingness to cooperate is a form of social capital that I can see in everyday life. From intense collaboration in small social groups in real time to construction of culture and norms in large community over time and space, sharing resources and taking part in collective actions of different kinds is so important that it sometimes determines their success. Cooperation can take many forms. Sharing resources with others for public goods, observing social norms (not littering, not line jumping) and volunteering in community, all these can be considered as cooperation in various forms.

Resources a social actor possesses in any form are limited. Physical and financial resources have limited amounts; other resources such as intelligence and emotional energy, even though they are considered reproducible over time, at any given period or moment are very limited. If one gives one’s attention to something or someone, one cannot give it to other things or people at the same time. With the limitations imposed on the resources that I can allocate, how social actors allocate resources becomes extremely important and of interest, and finding out what factors can influence our resource allocation behavior can give clues to both researchers and social practitioners to better understand and build communities and information technologies for communities.
The game I designed in this study is a public good game with a more complex social relation setting and background story. The game is designed to simulate a social context where multiple social relationships co-exist and people can have various choices that may conflict with each other. Economic games such as prisoners’ dilemma and public good game are often used in sociology and economics to help researchers to understand human behavior in different conditions. Many public good games have been created to simulate situations where selfish choices are detrimental to public well being, such as preventing global warming and air pollution. In these cases, collective and individual interest may compete. For preventing air pollution and saving non-reproducible resource, immediate benefit can be very little and may not directly affect action takers; and at the same time, actions that go against public good (i.e., producing more carbon dioxide) may give irresistible immediate returns. This is the tension that public good games try to simulate. Public good games have been used to test under different conditions: if the transaction is repeated or just one-shot choice; if the identities of players are revealed in the game or not; and if punishment or reward is presented, contingent on the choice players making (Rand, et al, 2009).

It is true to a community, no matter online or offline, that the same tension exists between the (immediate and long-term) public goods and benefits for the certain individual members of the community. Since the resources—financial, mental, emotional and other—that a person possesses are very limited, where and what amount I put our resources to can have subtle but deep consequences upon the development of communities I participate in or even those I are not part of. If I consider it in a larger
context in which social groups in a connected ecology, the distribution of resources become a zero-sum game where if one put something in one sub group, then other groups lose it. For individual I face similar dilemmas. Should I go to the town hall meeting this evening or play tennis with my friends? Should I give my opinion on a research topic that a colleague posted on the discussion forum or write one more section of my own article? Questions like these are hard to answer without context and it may be trivial at times for individuals, but they contribute to how the larger social context, the community, gets to build.

In the game I designed, besides the tension between public goods and individual benefits, I also brought in another element, social relations, which in real social exchange always play a role in how social exchanges are materialized. This component was manipulated to form a personal tie and shared identity in groups. I found supports for all three propositions. The analysis I employed is very simple.

The first proposition focuses on the effect of shared identity in social groups with social ties. Our experiment pointed out that groups with shared identity (groups having a pre-game chat session to determine a group name) show higher performance in terms of significantly fewer total transactions ($p = 0.014$) and fewer total requests sent ($p = 0.014$) against groups without the treatment. Groups with high volume of community-favoring investments will reach the Gold Age quickly and high rate of successful investments also helps increases group performance by reducing incomplete transactions, such as canceling and declining requests. In real world social exchange, transactions can be costly. Unsuccessful social exchange will waste a social agent time, financial, physical,
mental and emotional resource, so keeping transactions successful at a high rate becomes critical especially in a world where resources scarce.

In the data I collected, the fastest habitat reaches the Gold Age spent only 98 total transactions, and the lowest one produced 339 total transactions, which is more than three times of the former. In this setting, I consider willingness to cooperate and endorsement of community-favoring investments are forms of social capital, which lead to fast growth of public goods and high rate of successful transactions. Critics have commented that high volume of transactions in groups without chats prior to the game may be led by the possibility that players in these groups need more transactions to create a social climate and reciprocity, while groups with chats already established a stage of reciprocal understanding and strategy. Social interaction history can add on to the interactions that follow. I totally agree and that is what I am arguing for. However, I doubt that the chat in our design can add an impact significant enough to create strategic guidance for the players to carry out. I explicitly asked the players to discuss a name for their group and their actual conversations took very short time. As soon as they reached a name, the chat was shut down. Some of chats only took about 30 seconds with less than 20 messages exchanged. I did not see any conversation related to the tasks at hand. The higher number and percentage of community-favoring investments in groups with chat sessions also points to the fact that high performance of these teams are not only due to reciprocity, but also due to their pro-social choice.

The second proposition postulates that personal ties can constrain resource exchange between connected persons and thus limit its externality (Coleman, 1988). This
is also supported by our study in that players have significantly higher ratio of requests
sent to the person whom they have ties with than to the stranger whom they are not
connected with. In existing studies, many already pointed out benefits brought by social
ties such as job searching, information flow and career advantage in a given social
network. In our study, I consider social ties in collective settings, and the experiment I
conducted confirmed that social ties tend to concentrate resource exchange between
connected social agents, but more importantly, in a collective setting social ties can lock
resource exchange in social ties. Social ties are important and our study shows that the
influence of ties is very significant in terms of enforcing the transactions on social ties.
However, in our analysis, I did not analyze the reciprocity between connected persons
(e.g., P1 to P2) and between strangers (e.g., P1 to P3). A social tie can be either
symmetric or asymmetric. Our analysis did not look into if transactions in a given group
between player 1 and player 2 show higher reciprocity. Nevertheless, from the
perspective of individuals, our study did suggest a person tends to exchange with
someone one knows.

Our third proposition is supported by the fact that in groups with shared identity
(groups with pre-game chat session) the difference between a player’s requests sent to the
connected person in percentage and to the stranger is significantly lower than in groups
without shared identity (p = 0.0122). This means that shared identity can help a social
group or a community more evenly distributed its social exchange among members.
Another way to say it is that shared identity can reduce the effect of personal ties in
keeping exchange between connected persons. In real life unevenly distributed social
exchange can lead to serious consequences. Shared identity can increase the likelihood that members are perceived as interchangeable, and thus exchanging with whom will matter less. This can be a reason why shared identity can help resource reach people without ties. This effect of shared identity in social groups is different from the one I mentioned the first proposition, which is the pro-social effect led by identifying and committing to a social group one belongs to.

These three propositions give us a lot more to think about social capital and social relationships. Social relations do bring benefits to people. In the past, research and studies have been arguing for positive outcome of social relations. The result of our study suggests that social relations of different kind can lead to different distribution of resources in a social group. This will enrich our understanding of social capital with a more refined lens, a view that looks at possible different consequences brought by social relationships different in nature.

It does not downplay the importance of social ties in social life. No one can escape from being in interpersonal relations with others. But the study does remind us to think deeper about social relationship in creating social capital or benefits in other terms. When I take all results of this study into consideration and put them into a more integrated picture, I find that shared identity and social ties as social relations both generate social capital, but in social interactions shared identity tends to increase the externality of resources one processes – making resources easily accessible to more people; social ties works on another dimension, which is the activation of resource – making resource access more stable for people are connected. Put it another way, shared
identity increases resources availability to wide range of people in a social setting; and
social ties make resources available to connected persons with high probability.

This study is an empirical exploration of how shared identity and social ties, as
two distinctive social relationships, can influence social capital distribution in different
ways. Although experiment is criticized for its lack of social relevance, I want to
emphasize its ability to help researchers test relationship, even causal relationship,
between variables. Rothstein and Eek (2006) stressed the same rationale for using
experiment in their trust related experiment. The analysis is rather simple and
straightforward. The findings I reported here are drawn from a lab study I conducted. The
study did show validity and the results did supported our propositions. However, social
relations and social capital are much more complicated than the study presented in this
paper. The study reported does not claim it describes a comprehensive view of social
capital and social relationship; rather it is intent to invoke attention and interests of
related research communities and ask for more studies exploring social relationship in
detail. Only when more future studies are carried out, then I will be able to possibly draw
a better picture of refined relationships among these components that underpin social life
and social structures.

Social capital rethinking

The study I conducted shows the different mechanism that shared identity and personal
tie has on cooperative behavior, an important form of social capital. Back to my previous
discussion about the collective and egocentric perspective of social capital, my study
reminds me the existence of benefit for individual and collective brought by social relationship of different kinds. In a social group, my study (study 1) partially provides evidence that shared identity can increase accessibility of resources possessed by individuals; on the other hand, personal tie can constrain resource mobilization in a limited boundary, although it also realizes the resource flow from one social actor to the other. The accessibility of resource endued by personal tie was at the same time limited by the tie itself. Shared identity does not have this limit.

However, if I think it from another angle, a readiness of use angle, then personal tie does have its own advantage that it can insure the availability of resource to the connected persons. This ability of tie is confirmed by both study 1 and study 2 study. That is, players tend to initiate transactions with players they are connected to.

If I consider both shared identity and personal ties are forms or sources of social capital, which is drawn from the ability to mobilize resource between social actors, I need to notice the difference of the two at the same time. On the one hand, shared identity can help social capital by increasing resource availability to a wide scale of people in a social group. That is increasing accessibility. On the other hand, personal ties help social capital by enhancing readiness and insurance of resource access between people. Thus, the two types of social relations benefit social capital in different way and different aspects.

To further develop our understanding of social capital, following the above discussion, I tend to argue that social capital is a meta-resource that helps social actors mobilize the resources they possess and gain access to resources of others’ possession. Drawing from the different effect on resource mobilization and access, I also argue for
classifying social capital into two categories: some types of social capital increase the possible beneficiary of actions and/or consumption of resources, and some types of social capital increase the readiness of access.

There are a few examples of social capital can fall into the first type social capital. Shared identity is one example. And social norms and sanctioning system, once they exist, they effect on everyone, given the systems work. Insurance system is another example, only most insurance systems are commercialized and designed with flaws, but the idea is for individuals to pool small part of their owned resource together and when any unfortunate happens, the victim can use part of the fund, which is usually larger than what he/she has been pooling, to get one’s life back on track. Personal tie belongs to another category, the category that insures accessibility of resources. Another example of this kind is trust between individuals.

<table>
<thead>
<tr>
<th>Table 5-1: Social capital classification</th>
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<tr>
<td>Wide beneficiary</td>
</tr>
<tr>
<td>Definition</td>
</tr>
<tr>
<td>Meta-resource that helps increase</td>
</tr>
<tr>
<td>the accessibility of certain</td>
</tr>
<tr>
<td>resource to a wider beneficiary</td>
</tr>
<tr>
<td>Example</td>
</tr>
<tr>
<td>Social norms, sanctioning system,</td>
</tr>
<tr>
<td>shared identity</td>
</tr>
</tbody>
</table>

However, from a perspective of an individual, given the resource of interest being the same, having a tie is better. From an angle of a social group, the situation is more complex. If the group forms a network closure and especially if everyone has connections
with everyone else, then it perhaps does not differ very much from if it has an extra shared-identity. However, if the group is composed of asymmetric ties, then having high shared-identity may make a bigger difference in terms of resource accessibility in the group.

**Implications for IT**

The results from the study and discussion above shed light on information technology and designing and supporting communities with IT. Since the study focuses on resource allocation and cooperation, the findings may inform fields of knowledge/expertise management, online community and virtual organizations.

LISTSERV is an example of shared-identity applied in IT design. I am not saying LISTSERV is derived from the results or findings presented here, but it Ill represents the ideas. Results from the study suggest that personal ties may restrict resource from being accessed by strangers, so if I have a message I want to disseminate to people with the interests, I can go through the people I know by sending them emails and ask them to forward it to people they know, and this process repeats. The same message can disseminate to all people have similar interest if sent to a list-server, which is in fact a technological representation of social identity, and IT provides an affordance of mass dissemination of information.

Research in knowledge management field has spent some effort in exploring social capital and knowledge management and expertise sharing in organizational context (Wasko and Faraj, 2005; Huysman and Wulf, 2004; 2006;). Wasko and Faraj (2005)
studied if social capital has an impact on knowledge contribution in organizations and they tested a few forms of social capital including reciprocity, which is a measure of personal tie. Their findings suggest that reciprocity does not predict knowledge contribution. “Directly contrary to expectations, the results suggest that high levels of relational capital do not predict knowledge contribution… One possible explanation is that …, and direct reciprocity is not necessary for sustaining collective action” (Wasko and Faraj, 2005, p 51).

However, when strict reciprocity does not work in online knowledge management environment, a generalized reciprocity (Ekeh, 1974) may work better (Wasko and Faraj, 2000; 2005) and social identity does help build generalized reciprocity (Yamagishi, T., and Kiyonari, 2000). From a user or a help-seeker’s perspective, as designers of online community or knowledge management system, we need to think of users who do not have established ties in that online community or on that system. Otherwise, the value of online communities and knowledge management/expertise sharing systems are considerably limited, and even the development and sustaining the social-technical systems are questionable. If new users with no ties cannot get helped in a timely way, the social-technical systems lack efficient way to increase user adaptation, and it may threaten the development and survive of the community. Ren, Kraut and Kiesler (2007) discussed the problem of new users, and they proposed that socializing newcomers is necessary and different strategies can be applied in different types of communities: identity-based or bond-based communities.
For an online community, participation is critical. Koh, Kim, Bulter and Bock (2007) discussed how social identity can be promoted and thus to encourage members’ participation in online activities. Ren, et al (2007) reviewed literature on common identity and bonding. The former is a very similar concept as shared identity or social identity I described in my dissertation; and the latter is a concept very close to personal tie I am discussing here too. They (2007) argued that designing a community should consider the type of that given community. In their discussion, they are very clear about the difference between, and strengths and weakness of, common identity and bond; but it seems to me not very convincing when they talked about designing features for these different types of community. First, when it is a community, it has to have a shared identity and quite often there are bond or personal ties established in it; second, and related point is that some of the examples of bond-based community they gave are actually not communities.

My study can contribute to their discussion by arguing that when designing social-technical system for a community, we need to analyze the purposes of the community and choose designs that favor shared identity and/or personal tie accordingly. Drawing from the implication of the result of my study, for example, if we are working with a professional community (e.g., teachers’ community) and part of the function of the social-technical system is to bring introducing new technology to the teachers in that community, then we naturally want information of this kind can reach our target members as quickly as possible and as many as possible. To serve this purpose, a method or feature that works in favor of social identity or works as a function of shared identity
can be applied, such as LISTSERV or public message board in combination with open discussion forum that features new technology, rather than private chat room.

Another example is to create an online system to community tennis players. Similar requirement can emerge as in above case, only this time it is to share tennis related news and local events such as community tournament information. So we can design similar technology to support it. However, local players even those amateurs like me, they used to have a smaller group of people (4 ~ 6) to practice every often. They form a special relationship. They are not like very close friends that one can share many life experience with them, but when playing tennis they are the go-to guys. So they need something to help them share some information about tennis, especially their availability for playing. However, they also want to have control over this type of information and keep it within this small group of people. To support this, adding a shared calendar function with access control to will do. This can be an example of designing a system for local tennis community, supporting both shared identity and personal tie.

Chapter 6

Limitation, Future Study and Lessons Learned

The study reported here confirmed my hypotheses to a varied degree. However, the study itself is limited in a few aspects and there are many directions I can do to improve it and expand it to further study with more complex settings. The study is an experiment, which tests a very simple relational configuration, namely social tie vs. social identity. And the social tie created in my study is a short term result of simple
social interaction. Many social relations are formed in long-term interaction, so it will be of great interest and value to see how personal relationship formed in real-world can shape cooperation. Also, it is similar to social identity. Although the manipulation in my study is valid, but social identity established in long term, real-world settings can have more significant influence on cooperation. These limits can be improved by designing similar study to test.

Another limitation of my study is that the independent variables are treated as ordinal value, but a refined measurement can improve the analysis and results. In my study, social identity and social ties are simply marked as Yes or No. This simplified measure impedes the analysis. As a result in my study, I can use only simple significant test to verify my hypotheses. With more sophisticated measure, we can use more powerful statistic tools to analyze data and possibly to find other interesting findings.

The study was designed to eliminate communication during the game. This is another big limitation. Although this is not rare in reality, communication usually happens along side transactions. So an improvement of the study is to allow communication during the game. However, this will simultaneously add noise to the measurement and analysis.

A more appealing extension of the study is to access to real-world organizations and be able to collect transactional data of the members. By transactional data, I mean requests and answers of different kinds. It can be a question asking for help and corresponding responses; or a request of joining a birthday party and the RSVP responses, etc.
During the design of the study and throughout the process, I also learned some critical aspects in studies with human participants and especially those studies with multiple participants. In the study design and data collection chapter, I have already told my story. I want to iterate it again as the lesson I learned. It will be a good idea to schedule participants as early as possible, especially the participants will be from college student population. I also benefited from meetings with my advisor and committee members. I would say that communicating with them and update them often will be a very good idea, because it will give your committee more information along the way and they also can help you as much as possible to correct some possible mistakes and steer you on the right track.
References


Carroll and Jing, 2011


Hardin, G. The tragedy of the commons. Science, 1968, 162, 1234-124


Appendix A

IRB for experiment with human participants

Informed Consent Form for Social Science Research
The Pennsylvania State University

Title of Project: Exploring cooperative behavior in economic game

Principal Investigator: Hao Jiang, Graduate Student
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(814) 865-9838; hzj12@psu.edu

Advisor: Dr. John M. Carroll
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University Park, PA 16802
(814) 865-2476; jmcarrillo@psu.edu

Other Investigator(s): Dr. Mary Beth Rosson
330D, IST Building
University Park, PA 16802
(814) 865-2476; mrr13@psu.edu

Shaoke Zhang, Graduate Student
316C, IST Building
University Park, PA 16802
(814) 865-9838; szx114@psu.edu

1. Purpose of the Study: This study aims to explore cooperative behavior in online environment, such as online economic game.

2. Procedures to be followed: You will 1) play a simple, online, economic game with other two players; 2) fill out a survey about your demographic information and personality; 3) short debriefing after the game.

3. Discomforts and Risks: There are no risks in participating in this research beyond those experienced in everyday life.

4. Benefits: You, as participant in this study, will experience new online application and learn to use it to make decision on investment. This research might provide insights and implications for designing information technologies and online games for mult-user groups.

5. Duration: It will take about 60 minutes to finish the experiment, including the survey and the tasks and debriefing.

6. Statement of Confidentiality: Your participation in this research is confidential. The data will be stored and secured at Room 315 IST Building at University Park in a locked file and the digital form of data will be secured by password protected files. Your confidentiality will be kept to the degree permitted by the technology used. No guarantees can be made regarding the interception of data sent via the Internet by any third parties. The Pennsylvania State University’s Office for Research Protections, the Institutional Review Board and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this research study. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared.

7. Right to Ask Questions: Please contact John M. Carroll at (814) 863-2476 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed you. If you have any questions,
concerns, problems about your rights as a research participant or would like to offer input, please contact The Pennsylvania State University’s Office for Research Protections (ORP) at (814) 865-1775. The ORP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

8. **Payment for participation:** The final payment will be varied from $5 – $14, based on your score at the end of the experiment. Payment will be determined as follows:
   a. You will receive $5 for simply taking part in the study
   b. You will receive an individual payment depending on where you place (i.e., 1st, 2nd, 3rd)
      - 1st place: $6
      - 2nd place: $4
      - 3rd place: $2
      - 4th place: $0
   c. Your group will receive payment based on group performance. The amount the group will receive will be divided by 3, which is the number of members in the group.
      - High: $12 group / 4 group members = $3 per individual
      - Middle: $8 group / 4 group members = $2 per individual
      - Low: $0 group / 4 group members = $0 per individual

   **EXAMPLE:** To receive the minimum amount of $5. You would receive $5 for taking part in the study, $0 for placing 4th individually, and $0 if group performance was low.

9. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer. Refusal to take part in or withdrawing from this study will involve no penalty or loss of benefits you would receive otherwise.

You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.

You will be given a copy of this consent form for your records.

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<th>Participant Signature</th>
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<th>Person Obtaining Consent</th>
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Appendix B

Questions to test game knowledge

Test Questions

1. In the table above, how much it will cost you to invest the first item “Tribe Totem”?  
   A. 102 (204/2)  B. 204  C. 61  D. 132.5 (265/2)

2. If the investment “Tribe Totem” successfully returns, how much net-gain you will get as a co-investor?  
   A. 30.5 (61/2)  B. 61  C. 265  D. 132.5 (265/2)

3. If the investment “Tribe Totem” successfully returns, what the amount will be added to the community fund?  
   A. 30  B. 265  C. 61  D. 15 (30/2)

4. From the “My profile” screenshot above, what is the amount player John Locke has been held?  
   A. 103  B. 253  C. 3  D. 11

5. At this moment, what is the amount player John Locke can spend to invest a new project?  
   A. 150 (253-103)  B. 253  C. 77  D. 12

6. What is name of group you are presenting?  
   A. PennState  B. Michigan state  C. Purdue  D. Ohio State
Appendix C

Manipulation Check

Rank players' names (not including yourself) from relatively most familiar to most unfamiliar. Please use the number only and one number for one spot.

1) Darth Vader   2) Tony Stark   3) Michael Scott   4) Jack Sparrow

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<th>Most familiar</th>
<th>Familiar</th>
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Appendix D

Post Game survey

1. Section I -- about the game

If the page freezes, please wait for a few minutes. It will come back. We experience this problem when more than one people working on the same survey. Thank you!

Please let us know how you feel about the investment game you just played. Choose how true the statements below are. (1—absolutely not true; 5—absolutely true)

**1. Session Code (On your name tag)**

**2. I understand the rule of the game very well.**

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**3. This game makes sense to me.**

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**4. It is very easy to play.**

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**5. I enjoyed the game.**

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**6. I can easily find information I need to play game.**

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**7. I am in control in the game.**

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**8. I am proud of be in this team.**

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**9. I very much want to know what rank this team made.**

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</table>
2. Section II – Experience and Strategies

The questions below intend to collect your experience of playing the game and how you play it.

1. What is your general feeling about the game? (e.g., how do you like it? why? Do you think it is hard to play, and why?, etc)

2. Do you have a goal when playing the game? What it is?

3. Is your goal changed along the way? How?

4. When I make an investment in the game, I am VERY concerned of the composition of community return (the return for the habitat) and investor net gain of an investment. (1—absolutely not true, 5—absolutely true)

5. Please explain your concern about the composition of different return of an investment. (e.g., what are the factors influence your concern? etc)

6. When I make an investment, I am VERY concerned of with whom I am co-investing. (1—absolutely not true, 5—absolutely true)

7. Please explain your concern of choice of co-investor.

8. Is your strategy of choosing investments and choosing co-investor changed? Why?
### 3. Individual Check (Section I)

**1. Gender**
- [ ] Male
- [ ] Female

**2. Age**

**3. PSU ID**
(e.g., abc1123. This item is only used to match your information and the game you played. It will be REMOVED from data analysis. It WILL NOT be used and revealed to a third party!)

**4. Major**

**5. How many years you have been using computer?**

**6. Have you ever made any investment, such as stock?**
- [ ] 1 (never)
- [ ] 2 (a little)
- [ ] 3 (sometimes)
- [ ] 4 (quite a bit)
- [ ] 5 (very often)

**7. Have you ever played an online economic game?**
- [ ] 1 (never)
- [ ] 2 (a little)
- [ ] 3 (sometimes)
- [ ] 4 (quite a bit)
- [ ] 5 (very often)
4. Individual Check (Section II)

Please answer following questions. Please choose how true the statements below are. (1—absolutely not true, 5—absolutely true)

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<tr>
<td><strong>1. I am the life of the party.</strong></td>
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<td><strong>2. I sympathize with others' feelings.</strong></td>
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<td><strong>3. I get chores done right away.</strong></td>
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<td><strong>4. I have frequent mood swings.</strong></td>
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<td><strong>5. I have a vivid imagination.</strong></td>
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<td><strong>6. I don't talk a lot.</strong></td>
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<td><strong>7. I am not interested in other people's problems.</strong></td>
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<td><strong>8. I often forget to put things back in their proper place.</strong></td>
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<td><strong>9. I am relaxed most of the time.</strong></td>
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<td><strong>10. I am not interested in abstract ideas.</strong></td>
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<td><strong>11. I talk to a lot of different people at parties.</strong></td>
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<td><strong>12. I feel others' emotions.</strong></td>
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13. I like order.
   1  2  3  4  5

   1  2  3  4  5

15. I have difficulty understanding abstract ideas.
   1  2  3  4  5

16. I keep in the background.
   1  2  3  4  5

17. I am not really interested in others.
   1  2  3  4  5

18. I make a mess of things.
   1  2  3  4  5

19. I seldom feel blue.
   1  2  3  4  5

20. I do not have a good imagination.
   1  2  3  4  5
### 5. Individual Check (Section III)

Thinking about yourself and how you normally feel, to what extent do you generally feel:
(1 — Never, 5 — always)

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<tbody>
<tr>
<td><strong>1. Upset</strong></td>
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<td><strong>2. Hostile</strong></td>
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<td><strong>3. Alert</strong></td>
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<td><strong>4. Ashamed</strong></td>
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<td><strong>5. Inspired</strong></td>
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<td><strong>6. Nervous</strong></td>
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<td><strong>7. Determined</strong></td>
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<td><strong>8. Attentive</strong></td>
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<td><strong>9. Afraid</strong></td>
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<tr>
<td><strong>10. Active</strong></td>
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</table>
6. Thank you!

Thank you very much for your time!

One last activity: please go to the document titled "User Interface evaluation" in the pile of paper given to you. Thanks!
Appendix E

Experiment instruction

Instruction

CSCL Lab
Prepared by Hao Jiang
Background and team setting

- All of you are **Pennstater**, and you represent Penn State. Your group name is Penn State.

- You will be compared with all the other teams, including non-pennstate teams. A rank will be given during the game.

Real institutional identity removed from original document
Background story

An overwhelming flash strikes you ...
• Without knowing how long you have been sleeping, you wake up in a primitive society
• Looking around, you find yourself living in an ancient habitat with several other cavemen.
• You try to recall what happened, but the only thing you can remember is a lighting strike
• You can’t go anywhere. There is no way to escape...
• ...

• After many years of search, you disclosed one by one three other fellow who had the same strange experience

• Trying to figure things out and survive, you four made ally...
• At the end, you begin to enjoy the life you are living... and help the society step into civilization
• **Your task**
  Make investments of various projects critical to the society
How-to

• Initial setting
  – Each of you will receive 100 gold at start
  – The habitat, the PennState community, will have 500 gold at start

• Co-investment
  – Pick projects from a project pool
  – For each project, pick another group member to invest together
  – When an investment returns, a part of its return will go to individual
    investors (personal fund) and another part (community return) will go
    to the society (the habitat you are living in)
  – Co-investors share both the price and return for each investment
  – Before an investment return, the money you invested will be on held

• Projects vary in price and return
  – Some projects have high return for the community
  – Some projects have high return for individual
Development

- The Penn State society will step into civilization from stone age to gold age; the quicker the community fund grows, the faster the society evolves.

- Individual level will move from level 1 to higher level as your personal fund grows
Investment breakdown: a rope making example

Rope making (3rd row) is a project of how to make rope, which is a very important technique in primitive society. Ropes can be used to count and to record events, etc.

Its price is 128 gold and this price will be shared equally by two co-investors.

The community return of this investment is 40, which means it will give 40 gold to the habitat;

The investor net gain is the profit given to the investor when the investment returns. In this case, it is 3. It also shared by the co-investors.

Investor return is the sum of price of the investment and the investor net gain.

Note: This is only an example. In the actual game there are many other projects you can invest and you can invest the same project multiple times, if it is still shown on the list.
Startup

• Now, we introduce the tool you will be using.
Login to the system

User name and password can be found on your name tag
Game play page

Information about your group

Project pool, updated periodically

It will display a description of an investment when you hover the mouse on its title

Transaction history

Event window shows a list of events, such as habitat upgrade

Progress bar of invested items

Your profile

Group member list

Co-invest requests sent

Co-invest requests received
To invest

1. Go through the project list;
2. Decide which one you want to invest;
3. Click on the "Invest" button;
4. From the list, select a player whom you want to co-invest with;
5. Click "Send" button.
To invest (3)

After you send a request, it will appear on the “Transaction history” panel. Your fund_on_hold will be re-calculated.

After the co-invest request is made, it will appear on the pending request panel, where you can cancel it by clicking the “cancel” button.

Cancelling a request requires a few seconds too.
To invest (2)

Please allow a few seconds for the system sending request.

During this period, the system won’t take your input. The project pool will update during this blocking time.
Receiving co-invest request

If a group member sends you a co-invest request, you will receive it in the "Request Received" panel, where you can agree or decline to co-invest the project.
Agree to invest

Please allow a few seconds for the system to process the investment. During this period, the system won’t take your input. Your fund_on_hold will be re-calculated.

The invested project will be seen on the “Investment in progress” panel.

It will take varied time for a investment to return
Investment returns

The community fund increases after investment returns.

The personal fund increases after investment returns; fund_on_hold will be recalculated.
Group watch

This community fund will increase during play.

When the blue bar reaches the top, the society evolves to the Gold Age.

The Penn state society will upgrade from stone to gold age.

The ranking will change during the play, depending on how well your group play at the moment.
# Habitat event

Events such as team upgrade will show up here! Events inform you what is going on in the habitat.
Check group members’ status

Click on the name of the group member you want to check, a pop-up window will show up.

You can find the level of the member, how much gold they made, etc.
Please go to the test questions in the stack of paper given to you, and finish 6 questions.

Please wait for the experimenter to collect it.

Thank you!
Test drive it

Before we play the actual game, let’s have a test drive of the system. The purpose of the test drive is to help you get familiar with system.
Go Penn State!

Click here to start
VITA

Hao Jiang

Hao Jiang, graduated from Beijing University in 2001 with a Bachelor degree in Library Science. After graduated from college, Hao spent 5 years in software industry in Beijing. In 2005, he began his quest of a doctoral degree in College of Information Science and Technology at Pennsylvania State University. Hao is interested in Human-Computer Interaction, Computer-Supported Collaborative Work and Community Informatics.

In 2005, Hao joined the Computer-Supported Collaboration and Learning (CSCL) Lab at the Pennsylvania State University. Since then, Hao followed and worked with Dr. John M. Carroll, one of the founding father of the area of human-computer interaction. Through 7 years studying and working in this lab, Hao developed strong interests and methodology in sociology, learning and design science, and community informatics.

Hao Jiang actively participated in HCI related research and presented research findings in international forum. Hao focuses on both theory development and application. He believes that as an applied science domain, research of information science and technology should contribute to science community as well as real-world practice. This philosophy is well presented in his dissertation study, in which theoretical foundation was criticized and developed, and at the same time pragmatic conclusions are drawn. Hao is also interested in developing systems that support live user interaction and community engagement.