SOCIAL CONFLICTS AND MOVEMENTS: A NETWORK APPROACH

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Dedication

To my family...

Declaration

I hereby declare that except where specific reference is made to the work of others, the contents of this dissertation are original and have not been submitted in whole or in part for consideration for any other degree or qualification in this, or any other university. This dissertation is my own work and contains nothing which is the outcome of work done in collaboration with others, except as specified in the text and Acknowledgments.

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Abstract

For a long time, the world experiences a permanent increase in wealth inequality. While the bottom half of the world's population shares less than 1 percent of the world's wealth, the top ten percent owns 89 percent of the total assets in the world (Suisse, 2016). Among many other things, widespread poverty and starvation are just two consequences of this fact. Unfortunately, the concentration of the wealth causes many other socioeconomic problems. For instance, as competition increases, producers reduce the cost of production in return of unemployment and poor working conditions. Young unemployment leads to depression which constitutes a major threat to the young generation. On the other hand, each day more workers have been losing their lives due to the lack of measures in the workplaces. Another example is the armed conflicts spread worldwide. Although it is hard to find the real owners of the armament manufacturers, according to Stockholm International Peace Research Institute(SIPRA) Arms Industry Database, the leading companies are based in USA, Russia, UK, and France. Due to the armed conflicts, millions of people have forced to leave their homes, squeezed between borders and many died on the way. Even worse, 'developed' countries which host the producers of weapons handle this fact just as a migration problem.

These are only a few of the many problems experienced in the world today. Day after day, the system generates deeper social, political and economic destructions.

Until now, I have described only one side of a coin. On the other side, since Hegel, it is explicitly known that each fact or situation reveals its own contradiction. Social processes are not exceptions. In this sense, destruction can only exist with opportunities for recreation. Almost in all regions, local or extensive protests emerge against several problems. Some are taking the form of political reaction, others are as movement organizations or spontaneous street movements.

The literature on social movements or relevant issues is dominated by the discussions on why and how these movements emerge and survive or fade.

In such a world filled with inequality, a world becoming more destructive for crowds on behalf of a few group of people's interest, there is another relevant aspect of the same discussion: Why the crowds are not able to change this situation? Although there are many organized movements today, why are these organizations poor in stopping this destructive process? Accordingly, not only the existence of movements but also the absence of them is significant. Moreover, a broader analysis of social movements requires to examine them as complementary. Although the structural conditions are significant to compare these two, I prefer to focus also on relational aspect. In this sense, I use micro-structural approach. Communication processes are bridging perspective for micro and macro levels and network theory is at the center of the discussions in this thesis. Correspondingly, social movements are considered as products of communication processes.

The network mechanism has been criticized being local in construction. On the contrary, previous studies show the capacity of this mechanism in explaining many global phenomena. Several examples are discussed in the first chapter. Also, the basic definitions and representations used in the rest of the study are introduced in this chapter.

The second chapter turns to social movements. The traditional theories of the social movements are reviewed from a critical perspective. The current developments on the subject are discussed. In fact, the necessity of a new perspective has been discussed in the plenty of current studies. The search of a new perspective is also the main motivation of this thesis. In the light of this, the second chapter discusses why network theory is promising as a new methodology for social movements. The existence of conflicting identities rests at the heart of the analysis. At the end of the chapter, a general perspective is introduced.

I construct two different models in the following two chapters so as to study different aspects.

The first one examines the possible network structures in case of the interaction of conflicting identities. In the third chapter, a standard communication network is modified by including heterogeneity in benefits received from direct connections. Moreover, benefits of indirect connections also modified. The extension includes the differentiation on benefit one gets from an indirect connection depending on the type of connector. It is found that, like standard connection model, the network externalities generate discrepancy between stability and efficiency.

The fourth chapter is an application of the mechanism described in the second chapter. I discuss the structures under which agents are willing to use interaction as a resource for action against opposition. Information dominance and size dominance are introduced as two main tools for the decision-making process. Whenever various and complex identity structures exist, multilayer analysis is necessary. The network structures generating mobilization acts are examined under the definition of mobilization as a value transfer between opposites.

The thesis is concluded with a brief summary of main findings and a discussion on further analysis.

This thesis is an attempt to contribute to growing literature using a network approach to analyze social movements. In this sense, I present a general mechanism on how to use the network approach to analyze social conflicts and movements. Furthermore, as far as we know, it is one of the few studies working network theory with a dialectic methodology.

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Chapter 1

Definitions and a Review of Network Theory

1.1 Introduction: Why Networks Matter?

Humans are social entities. A person's contacts influence on the formation of her identity, determination the opportunities she faces and choices she makes. Social networks describe these relations. The structure of these relations generates significant social and economic outcomes while the opportunities one faces through these relations reproduce these outcomes. In many contexts not only the random ties but also the strategic relations are significant. Accordingly, these two are complementary in the decision-making process.

The literature has constructed upon the earlier empirical works. The empirical findings show the importance of social contacts in socio-economic spheres (Granovetter, 1995; Milgram, 1967; Rees, 1966; Lazarsfeld *et al.*, 1948) and the changes in outcomes as a result of different network structures (Moore, 1990). Later, several network models have been developed to explain these significant facts (Jackson & Wolinsky, 1996). Examples contain the role of networks in labor market (Calvo-Armengol & Jackson, 2004), information gathering (Galeotti & Goyal, 2010) and knowledge diffusion (Cowan & Jonard, 2004), public goods provision (Bramoullé & Kranton, 2007), crime decisions (Calvó-Armengol & Zenou, 2004), construction of friendship (Currarini *et al.*, 2009) etc. Some scholars criticize these network analysis by being local. Contrary, others claim that networks provide "the most fruitful micro-macro bridge (Granovetter, 1973, pp1360)". Several studies use network theory to explain social phenomena in such a global world. Inequality (Calvo-Armengol & Jackson, 2004; Kets *et al.*, 2011), Small Worlds (Jackson & Rogers, 2005), Core-Periphery Structures (Galeotti & Goyal, 2010), Homophily and Segregation (Currarini *et al.*, 2009) are some of the relevant examples and are reviewed in the second part. This thesis takes a stand on the latter view. Accordingly, it becomes relevant to understand the way networks affect behaviors and the structures more likely to emerge in societies (Jackson & Rogers, 2005).

This thesis attempts to use network theory on social movements while social conflicts are the main pillar on the emergence of these movements. Before that, I clarify fundamental definitions and notations in the following parts of this chapter.

1.2 Review: How Network Theory Matters?

In this section, I review outstanding studies demonstrating that social networks are not only explanatory for short run or local situations, but have significant long-run effects and capable of explaining global regularities.

The empirical studies in labor market demonstrate that significant percent of the employees find their job through social contacts and it is robust across race and gender (Myers & Shultz, 1951; Granovetter, 1995). Moreover, it is found that employers also rely on the social contacts in hiring process (Rees, 1966). Based on these empirical findings, several scholars focus on the role of social contacts and network structures on the labor market outcomes. Accordingly, several network models have been constructed. Calvo-Armengol & Jackson (2004) build a model in which agents gather information about job opportunities through their social contacts. Given network structure, it is found that pre-existing differences are able to explain the significant part of the inequalities in wage levels and employment status. Calvó-Armengol (2004) develops a strategic network formation model and characterizes the clash between stability and efficiency. The model shows that pairwise equilibrium networks always exist and they are generally inefficient in terms of wealth generation. In a similar vein, endogeneous job contact model is developed by Galeotti & Merlino (2014) to examine the impact of labor market conditions on decisions of network formation. The model finds that as the possibility of unemployment rises, the investment in connections increases in order to access information about available jobs. The prediction of the model has been supported by UK labor market data. Montgomery (1992) examines the strength of the weak ties in job finding process and demonstrates a correlation between network composition of an agent and the minimum acceptable wage she sets. Additionally, networks are not only used to explain inequality in earnings and employment status. In a general sense, Kets *et al.* (2011) construct a model showing that how network structure constraints the level of inequality that can be sustained among its members. Especially, this study sheds light for further works on explaining inequality increase and the corresponding evolution of network structure.

Travers & Milgram (1969)'s experiment is a well-known example examining the small world problem. This experiment finds that even if the distance between two agents is high one can reach others within only small steps. In fact, this is a significant property frequently experienced in real life structures. In this direction, Jackson & Rogers (2005) construct a connection model where individuals benefit not only from direct contacts but also from indirect links. The findings support the emergence of small-world features for a wide variety of parameters. Another significant but less cited finding of Milgram (1967) is based on the composition of the relations. While small worlds are experienced, it is also found that people prefer to communicate through same sex individuals. In other words, there is a high rate of homophily in terms of network formation. A supporting finding on the differentiation of women's and men's personal networks is pointed in Moore (1990). Moreover, any social network structure is found to has perpetuating effect through constraints it generates in different spheres. In the same line with these facts, Currarini *et al.* (2009) develop a friendship model that sheds light on the segregation patterns observed in social and economic networks. When there are different groups within a society, the relations of all groups are found to be biased towards same-type. Furthermore, larger groups tend to form more same-type ties which have significant implications on segregation of minorities. Since larger groups tend to form more ties per capita, this structure may generate inequalities in a variety of situations.

The emergence of Core-Periphery structures is well discussed in the literature. Information gathering is a relevant example examining such structures due to the fact that a significant portion of the information has been flowing through a small subset of the people. Hojman & Szeidl (2008) develop an information exchange model showing that under directed relations when the cost of information acquisition is personal, a core-periphery structure emerges as an equilibrium. Similarly, whenever link formation necessitates mutual contest bearing the cost for both and if the surplus from connecting an agent monotonically increases in the number of her neighbors, then star structure is still equilibrium. A similar result about directed networks holds in Galeotti & Goyal (2010). Differently, when a mutual contest is necessary for link formation, it is shown equilibrium exists when everyone acquires the same amount of personal information. Collaterally, Bramoullé & Kranton (2007) examine the amount of contribution of agents to a public good given a fixed network structure. The model suggests that individuals who have active social neighbors spend less cost in return of high benefit due to the network effects. In other words, the individuals who have relatively favorable positions bear less cost and rely on others' contribution. In fact, this is the situation defining Free Riding Problem.

1.3 Definitions

Let $N = \{1, 2..., n\}$ defines a finite population consists of n agents[1]. The network relations of these agents are defined by a graph. A graph consists of nodes and links. In social networks, each node in the graph represents an agent. Agents are context-bounded and represent individuals, firms, societies etc. depending on the design. Each link in the form of a tie or an arc represents a relation between two agents. Links are also context-bounded and represent information, trade, reference, friendship etc. depending on the focus of the study.

Based on the characteristic of the relation, there are mainly two types of graphs. The undirected form is used for the situations whenever any link necessitates a joint agreement. Partnership, friendship, alliances are examples of this form of relations. The directed form is used for the situations whenever one is able to tie without other's permission. Citing or twitter follow-up relations are examples of this form. Moreover, relations can be weighted if it is necessary to emphasize on the difference between the intensity of the relations. For instance, if the frequency of the meeting is significant for the strength of friendship, links can be weighted depending on the time spend together. If the relation is anonymous, then unweighted links are appropriate and more simple to use. Although it is not common at all, mixed forms can be used whenever necessary.

There are two alternative ways for representing an undirected graph; a matrix form or a set notation. A graph (N, g) contains a set of nodes and a real-valued $n \times n$ matrix g. Each entry of the matrix, g_{ij}, represents the relation between i and j. An undirected graph is symmetric in the sense that $g_{ij} = g_{ji}\ \forall\ ij \in N$. In unweighted form, all entries take one of two values

[1]This part is mainly based on Jackson *et al.* (2008). A detailed discussion on each concept can be found there.

where $g_{ij} = 0$ represents the absence of a relation and $g_{ij} = 1$ represents presence of a relation between i and j. The intensity of relations can be shown in weighted forms in which entries can take more than two values. g_{ii} represents a self-link and generally takes 0 or 1 for all $i \in N$. Alternatively, links can be listed as a subset of the population of size 2 such as $g = \{ij\}$. Accordingly, $g_{ij} = 1$ or $ij \in g$ are two equivalent ways of saying "i and j are linked under the network g". $g + ij$ denotes the network obtained by adding a link between i and j to an existing network g and $g - ij$ generated by deleting the link ij from the network g.

$N(g) = \{i | \exists j \text{ s.t } ij \in g\}$ denotes the set of nodes that have at least one link in g. $G(N)$ is the set of all undirected and unweighted networks on N. Given a subset of nodes $S \subset N$, $g|_S$ denotes the network which restricted to the nodes of S such that

$$[g|_S]_{ij} = \begin{cases} = 1 \text{ if } i \in S; j \in S \text{ and } g_{ij} = 1 \\ = 0 \text{ otherwise} \end{cases}$$

Following concepts are relevant in the network analysis. For an undirected graph, a *walk* between i and j is a sequence of links $i_1 i_2 ... i_{K-1}, i_K$ where $i_k i_{k+1} \in g$ for each $k \in \{1, 2, ..., K-1\}$ and $i_1 = i$, $i_K = j$. A *path* is a walk where each of the node in the sequence of $i_1, ..., i_K$ are distinct. A *cycle* is also a walk where $i_1 = i_K = i$ and all other nodes are distinct. The *geodesic* between i and j defines a path involves minimum number of links between these two nodes, *the shortest path*. The *distance*, l_{ij}, between two agents is the length of the shortest path. If there is no path between two nodes, the distance is infinite. The *diameter* of a network is the largest distance between any two nodes. Any node can be reachable by all others in *a path connected network*. An undirected network g is connected if for each $i \in N$, $j \in N$ there exists a path between these two agents in g.

In general, a network is composed of *components* that are the distinct maximally connected subgraphs of the network. A component can be denoted as $g' \subset g$, such that
1. $\forall\ i \in N(g')\ j \in N(g')$ and $i \neq j$ there exists a path between i and j;
2. for any $i \in N(g')$, $j \in N(g)$ $ij \in g \implies ij \in g'$.

A *clique* is a maximal completely connected component of a given network.

In social network analysis, the neighborhood of an agent is significant. *The* *neighborhood* of any node in g can be defined as $B_i(g) = \{j : ij \in g\}$. We can also define the extended neighborhood of a node which defines the nodes that can be reached by the neighbors. For instance, two-neighborhood of a node defines the set of neighbors and neighbors of neighbors and is denoted by

$$B_i^2(g) = B_i(g) \cup \left(\bigcup_{j \in B_i(g)} B_j(g) \right)$$

In an undirected graph, the *degree* of a node is the number of the links one involves in. Equivalently, it is the number of neighbors a node i has such that
$d_i(g) = \#\{j : \ ij \in g\} = \#B_i(g)$.
The maximum possible number of the degree of any node is $n - 1$. Lastly, the *density* of a network is the relative fraction of links in a given structure.

1.4 Methodology

The empirical studies state the importance of the social structure in significantly many interactions. Accordingly, more focus has been paid to the network formation processes.

In the literature, there are two main approaches to the network formation. The first one uses random graph theory where networks are arising stochastically and links are drawn based on some probabilistic rule. The second one uses a game-theoretic approach where links represent social and economic relationships. The link formation is a strategic decision-making process based on the cost and benefit analysis. In this study, I take a stand on the latter approach.

Under this approach, one should describe the utilities of the agents and the value of the network. The utility function of an agent i, $u_i(g)$, shows the benefits net of costs she experiences as a function of the network g. The specification of the utility function depends on the context of the application. Any utility maximizer agent is assumed to know the change of her utility in case of constructing a new link or destructing an existing one. A value function, $v : \{g | g \in g^N\}$, represents the value generated by a graph g where g^N denotes the complete graph. The set of all these functions is denoted by V. In many applications, the total value of a network is regarded as the summation of individual utilities $v(g) = \sum_i u_i(g)$. An *allocation rule*, Y, specifies the way of value distribution among agents. $Y_i(g, v)$ denotes the payoff to each node from network g through value function v.

Efficiency and stability are two main tools characterizing networks.

A network g is *strongly efficient* if $v(g) \geq v(g') \; \forall \; g' \subset g^N$. If there are finitely many networks, there exists at least one efficient network structure.

To discuss which networks emerge and persist under different conditions, we should specify a stability condition. Since link formation in undirected network structure requires consensus, one of the cases obtained as a Nash equilibria are excluded by construction (Jackson & Rogers, 2005, pp.204). On the other hand, it is relevant for directed network structures which relax this assumption. Instead Jackson & Wolinsky (1996) introduce *pairwise stability* concept for standard network games using undirected interactions.

A network g is pairwise stable respect to v and Y if none of the agents benefits from severing an existing link, and any new link doesn't generate a higher value for the tied agents. These conditions can be formalized as:
i. $\forall \; ij \in g$, $Y_i(g, v) \geq Y_i(g - ij, v)$ and $Y_j(g, v) \geq Y_j(g - ij, v)$
ii. $\forall \; ij \notin g$, if $Y_i(g, v) < Y_i(g + ij, v)$ then $Y_i(g, v) > Y_j(g + ij, v)$.
Note that, in the absence of side payments we can take $Y_i(g) = u_i(g)$.
In fact, pairwise stability is a relatively weak notion since it only considers deviations on a single link or at most a pair of players at a time (Jackson & Rogers, 2005, pp.205). In general, these are simplified assumptions and should be extended depending on the other necessities.

1.5 Concluding Remarks

This brief introductory part aims to show how networks and related models are significant in explaining several social phenomena. Social network theory has already used to explain the emergence of several social structures and their outcomes. The main aim of this thesis is remolding social movement approach with network perspective to build a new approach to social movements. In fact, the rest of the study built on the existence of conflicting situations between individuals and emergent structures. I will discuss the use of network theory for social conflicts and resultant movements from several aspects. Before that, this chapter clarifies the definitions, the founded methodology, and notations that will be used and discussed in the following chapters.

Chapter 2

Social Movements: A Critical Review and a Network Approach

2.1 Introduction

In the first chapter, I indicate the explanatory power of the network theory for a wide range of social phenomena. Along the same line, I use social network theory to analyze social conflicts and resultant movements. This chapter aims to show that network theory is a promising approach to study social movements. First of all, I discuss the necessity of a new approach for social movements analysis. Then I respond to the questions of why network theory is relevant and how can we use it?

In the contemporary societies, social movements are central actors pointing to major problems in the economic, social and political environment. They have the capacity for reshaping these environments.

In the literature, capitalist societies are regarded as domains where social movements have arisen. It is argued that capitalist developments such as state building, urbanization, proletarianization and war constitute the necessary conditions for movements to occur. Still, this definition does not cover some early movements. For instance, Manuel Castells defines Castalian city revolts in 1520-22 as the most important urban social movement (Castells, 1983, 4).

Such a conceptual limitation can be comprehensible for practical reasons.

In addition, it wouldn't be wrong to say social movements experienced in capitalist societies have specific features. Nevertheless, this limitation causes significant fallacies. In a very narrow sense, implicitly it assumes no conflict emerged in other forms of societies. In a broader sense, it is equivalent to claim that capitalist societies are eternal. One of the significant implication of this fallacy is the main claim of the European literature. According to this view, the changing nature of the movements experienced after World War Two is due to the "shift of the main conflict". In fact, classes and related conflict are direct consequences of the private property (of means of the production) dominated in slavery societies and deepening to this day. As long as private property exists, all the conflicts are reflections of the class conflict. Although this discussion is beyond the scope of this study, one way to overcome this fallacy is accepting the traditional analysis on social movements as a special form of collectivity which realized in the capitalist societies.

We can develop the existing analysis through furthering the limits of this conceptualization. To this end, one should specify the defining elements of any movement. Current literature already sets the conflicts and the interactions as the constituent elements of the social movements. However, this specification needs further clarification. On the one hand, since Hegel, it is well known that each fact or situation reveals its own contradiction. Accordingly, the existence of conflicting situations is not explanatory at all. On the other hand, humans are social entities. Similarly, it isn't explanatory alone. In fact, the determining factor is the interaction of conflicting agents; especially when, where and under what conditions this interaction takes place. Correspondingly, I define social movements as outcomes of interaction process of conflicting agents. On the basis of this definition, this chapter attempts to present a broader perspective on the use of networks of social movement analysis.

Previous to this, I will review two dominant streams of the literature on social movements. The first stream is American tradition and the second one is European tradition. The second section reviews the leading arguments of these two traditions. Actually, these two traditions have been updated due to the changes in the nature of the social environment since 1970s (Crossley, 2002) and the angle between them has increased. Currently, a lot of effort is being made to converge them and some scholars already suggest network theory as a promising candidate. With this motivation, the third part discusses the role of network theory for social movement analysis mainly through three channels: (1) as a Resource (2) as a Context Provider and (3) as a Policy Tool. Furthermore, I show that these discussions are already supported by growing literature on the issue. This chapter is concluded with a brief discussion on boundaries of this perspective.

2.2 Literature Review

The literature on social movements has developed through mainly two traditions. The first one is American tradition that focuses on the collective behavior. The other is European tradition build upon the core conflicts within societies. Fundamentally, the differentiation is shaped by the historical patterns experienced by two regions and the theoretical basis influences the scholars.

The eighteenth century was the time when both the Americas and the European region had experienced a reconstruction process. Since the fifteenth century, the time European powers had invaded the Americas, the region had faced with wars of these powers for colonization. None the less, the ongoing anti-slavery and anti-colonial struggle has a strong impact on reconstruction process[1]. These movements were essentially influential in strengthening the partnership and the opposition between the leading powers. At about the same period, two main events had an impact upon the Europe. The first one was the French Revolution of 1789 and sequent Napoleonic Wars. Thereupon the monarchy had defeated and the region has witnessed to the struggles for independence. In fact, nation states have established upon these movements. The second one was Industrial Revolution that has caused a major transformation in the production process. Centralization of the production in the workplaces and the factories had an impact on the following movements. While the base of these two processes was same such that the few were seizing the assets of the others, the appearance was different. In the United States, nation-based struggles were dominant, while class-based features characterized the movements in the Europe by the middle of the nineteenth century [2]

As expected, differentiation of patterns two regions has experienced causes distinction of the theories. This can be observed from the description of the scope of the social movements. In general, American tradition considers any protest event even including negotiable issues whereas European tradition

[1] American Independence War and Haitian Revolution is among the most known movements. See Martin (2008) for the impact of Haitian Revolution on this process.

[2] In fact, these processes are highly interactive and complex. The main purpose of this simplification is to show how important historical models are for theoretical developments.

interests only actions that challenge the systemic mechanisms (Diani, 1992, pp.10). Thus, while the former focuses on "what brings people together," the latter interested in "what constitutes the main conflict in the society". On the other hand, both agree on a transition in the social, economic and political environments in the mid-twentieth century, as well as accept inability of the earlier explanations to explain social movements by the 1970s (Buechler, 2011, pp.111). Inherently, the two continents experienced the transition process in a different way. In the United States, the organizations emerged during the protests quickly restructured as interest groups, while the antagonistic movements were marginalized. In the Europe, the inheritance of workers' movements had an influence on the developing movements (Della Porta & Diani, 1999, pp.2-3). This divergence over different theoretical heritages has increased the gap between the two traditions over the next decades. Theoretically, American tradition explains the transition with the increase in resources and political opportunities, while European tradition accounts a great change in social formation and the core conflict of the society.

2.2.1 American Tradition: From Collective Behavior to Mobilization Theories

American literature has constructed upon the classical structural-functional theory. There are mainly three phases in the development of the literature.

The first phase includes the early studies. These are highly inspired by psychology. The social psychological factors are presented as the main motivation behind the action. In fact, the action is described as the reaction. Among others, relativity is the dominant argument used to explain movements. James C. Davies and James A. Geschwender are two significant theorists on this approach. Davies (1962) claims that revolutions and protests come after a sharp decline following a long-term economic and social improvement. Anxiety and fear are accounted for the main motivation of the reaction. On the other hand, Geschwender (1968) finds the arguments of Davis as incomplete. Instead, he introduces several hypotheses that change the motivation of people to react. First, when circumstances continuously improve the expectation of individuals increase. Accordingly, the motivation of people rises as the gap between real and expected rate increase. Second, people derive their standard of satisfaction relative to others. As the gap between own experiences and observed circumstances rises, motivation increases. Third, people get disappointed with a reduction of a gap between them and previously inferior ones. Thus relativity may mobilize people even if there is an improvement. In short, the main argument of the early studies is that relative deprivation of individuals makes them react in the form of protest or revolutionary act.

The second phase starts by the mid-twentieth century with a replacement of "psychology" and "reaction" by "behavior" and "change" (Della Porta & Diani, 1999). Besides, the main focus shifts to collective behavior. Ralph Turner and Lewis Killian are two leading scholars who conceptualize social movements as a form of *collective behavior*. According to this approach, norms are the main guide of the behavior. Whenever existing norms are unable to provide satisfactory structure for behavior, new norms emerge. Hence the former is propagated as irrational and the structure is accused of being unfair. Thereby, movements aiming to transform existing norms are legitimized (Turner & Killian, 1987). Meanwhile, extraordinary events and pre-existing ties are regarded as two factors promoting collective behavior. Some classical studies also emphasize the role of group identity and solidarity. While several studies discuss social classes and organizations as the main support of the movements; Seymour Martin Lipset emphasis on the destructive role of the organizations. According to Lipset, institutions including unions and other voluntary organizations have high tendencies of becoming oligarchic (Lipset *et al.*, 1956). Instead, he claims subgroups should interact within broader organizations to avoid the emergence of such a structural deficiency.

The last phase of this tradition comes up by the end of the 1960s. The emergence and rise of the movements in a relatively prosperous period are forced a theoretical change. Scholars of the period are inspired by new developments in economics and political sciences. After the 1970s, constructive criticism of early studies results in new developments in the theory. Research Mobilization Theory and Political Process Theory are the two main streams stemming from similar objections. Within this context, a significant contribution comes from an economist. Mancur Olsun's works on rational choice theories shift attention from behavior to action. While masses' reaction was central to the previous analysis, it is replaced by decision-making process on participation and mobilization.

First, resource mobilization theories (RMT) define the collective movements as purposeful and organized actions. It is claimed that in a society there is always sufficient discontent and grievances for encouraging a movement (McCarthy & Zald, 1987). Whenever the conditions become appropriate, dissatisfaction turns to a collective action. Mainly, these studies examine the conditions and processes. The distinguishing point of these theories is the role attributed to resources in this process. The capacity of a movement is correlated with the material resources (work, money, concrete benefits etc.) and non-material resources (authority, friendship etc.) available to the group (Della Porta & Diani, 1999, pp.8). In that vein, Oberschall (1973) introduces significance of social structure on the possibility of mobilization. Vertical segregation and horizontal integration are introduced as significant resources increasing the likelihood of mobilization.

As stated above, protests often result in the emergence of well-structured organizations in the United States. Therefore the analysis of organizational forms is popular among American scholars. John McCarthy and Mayer Zald are two leading scholars emphasizing on the organizational forms. Highly inspired by mainstream firm theory, movements are described as sectors in which different industries representing different preferences(McCarthy & Zald, 1987). Like firms, social movement organizations compete to define the terms of social movement actions. By the mid-twentieth century, the increase in resources enhances the competition between these organizations. As a result of this, mobility is promoted. Moreover, various interaction within social movement sectors causes different forms of movements. McCarthy & Zald (1987) conceptualizes current movements as "professional movements" so as to highlight the preference structure and participants. These movements differentiate from classical ones with higher durability (diversification in issues) and higher vulnerability (existence of external resources). While entrepreneurial leaders and resource availability are outcomes of the classical approach, they are independent variables for professional movements.

Second, political process theories explain movements based on the differentiation of groups in terms of political power. There are several theories based on this approach. One of them focuses on the "political opportunities". In a population, not all groups have equal access to the political sphere. Especially, some groups of people have already constrained and implementation of any political strategies is useless for these people. Empirical studies use several variables as a proxy of political opportunities; like the degree of openness of the local political system by Peter Eisinger, electoral instability by Piven and Cloward, the availability of influential allies by Gamson, tolerance for protest among the elite by Jenkins and Perrow (Della Porta & Diani, 1999, pp.9-10). Another one is "protest cycles" developed by Tarrow (1983, 1989). Empirically cycles are examined through the effect of openness and closeness of formal political access, the degree of stability and instability of political alignments, the availability and strategic posture of political alliances and political conflicts between and within elites on the mobilization in Italy. The most effective organizations are found to be autonomous and interdependent social networks linked by loosely coordinated mobilizing structures. Polity theory of Charles Tilly is another significant contribution (Tilly, 1978). According to this approach, there is a clearly bordered polity sphere within the population. Polity members and the government are allowed to access this sphere while the others are excluded. Similar to the first approach, these outsiders are not able to influence policies with any political strategies. As a result, they tend to engage in collective action. Political opportunities, the emergence of external threats and pre-existing organizations are presented as the main forces of mobilization. The significance of interaction clearly revealed in this approach. It is observed that, even in the presence of major threats and new opportunities, poorly connected groups rarely act collectively. In the light of this, McAdam focuses on the "right circumstances" for movements. Three main factors for achieving *right circumstances* are counted as political opportunity, local organizational structure and cognitive liberation(McAdam, 1982). The last factor is presented as the main contribution for explaining movements. Isolated agents are unable to communicate which is necessary for cognitive development. On the other hand, Social ties support the process of cognitive liberation through the generation of network and social supports. Accordingly, interaction is claimed to increases the likelihood of the movements.

2.2.2 European Tradition: From Marxist View to New Social Movements

As pointed above, European tradition is built upon the Marxist theory. The main characteristics of the social movements are regarded as a direct outcome of the social structure. As the social structure changes, the form of the movements expected to change. Unfortunately, several studies misconstrue this claim and attribute changing the form of the movements to a gradual change in social structure.

Marxist literature classifies societies based on the productive forces, production relations and their interaction. Productive forces have a strong tendency for development, whereas production relations constraint the development and resist to change. This progress generates the conflict which society shaped around. The central conflict for industrial societies is the conflict between working class and bourgeoisie. Throughout the nineteenth century, movements of the working class were central and the European literature developed to analyze these revolutionary challenges.

By the mid-twentieth century, a series of social movements emerged in different forms. Especially student movements in France, Berlin, Italy and even in the US and their demands concerning the quality of life constitute a new challenge for the European scholars. This change has forced them to restructure the old theory in order to explain emergent forms. The literature is enlarged with critiques of Marxist arguments about social conflict. For instance, Bush & Morris (n.d.) claims that labor organizations and political parties pave the way of workers for accessing polity sphere. Accordingly, these organizations remove the primary *raison d'etre* of these movements. In a similar vein, Touraine (1971, pp.17) suggests that the conflicts between these two groups shifted from power relations to decision-making. As a result, he claims that the exercise of the power isn't central in the working places anymore. Although there are major differences within the new social movements approaches, in general, these theories are agreed on a grand change in social structure and core conflict. Frequently, theorists link the changing forms of social movement to the rise of post-modernity.

Allain Touraine, Jürgen Habermas, and Alberto Melucci are leading scholars explaining the change with alteration in the social structure.

In general terms, Touraine proposes a shift from a materialistic world to a post-materialist one (Touraine, 1971). According to Touraine, since the 1970s the economic decisions and struggles are not as central as in the earlier societies. Instead, the changing nature of production process integrates all spheres of the social life into this process. Correspondingly, economic mechanisms are not distinct elements even though economic growth is more important than ever. He suggests social relations as the main explanatory factor of the new social structure. It is the alienation, not the exploitation that motive people to react. Society is segmented into two: ruling classes and people working for the interests' of this class. Accordingly, the main clashes emerge in the base of ruling not in production base. As a result, the main conflict is no longer between capital and labor but among these segments of society (Touraine, 1971, pp.4-10).

Jürgen Habermas claims that new forms of movements are reflections of the demands on living space. In his theory, the communicative rationalization differentiates from traditional rationalization(Habermas, 1987). He claims European culture has been dominated by "representational" culture until the eighteenth century. Development of liberal ideas by that century causes the emergence of a public space where people interacts outside of the control by the state. Whenever this space is intervened by the economic or political spaces, people react to defend their own space[pp.392]. Accordingly, it is claimed that the new social movements are rooted in the problems on life styles with a purpose of the liberation of the life styles rather than economic distribution.

Alberto Melucci left the production at the center of the analysis with extending the boundaries of the concept [3]. Production goes beyond the conversion of nature into a commodity. It also includes the production of social relations, social systems even the biological and interpersonal identity of the individual (Melucci, 1980, pp.218). In that vein, the base of social resources is extended to social and personal identity. In a broader sense, classes are defined as the groups struggling for social production. Based on this conceptual modification Melucci (1980, pp.212) sets the antagonism of classes as the main determinant of the social structure and the source of collective actions. The target of collective action becomes the right of people to claim their own identity. The emergence of the new forms is accepted as the reflection of the changing nature of the production structure. New conflicts arise through the identities mobilize the groups which are most directly affected by the manipulation of the socio-economic environment. Despite these changes, Melucci indicates that the lack of a particular leader group did not lead to the disappearance of class-based features. The common characteristics of new movements are counted as (i) end of separation between public and private sphere, (ii) emergence of marginality and deviance as a result of domination of daily life, (iii) directed at autonomy or independence rather than access to political power, (iv) placing solidarity as an objective and (v) direct participation and rejection of representation (Melucci, 1980, pp.219-221).

There are many other studies stand for the change in the social structure. For instance, Lash & Urry (1987) defines a shift from national, regulated markets to increased internalization of production, capital, and markets. As a result, the occupational structure has changed in favor of an expansion of the service class. It is claimed that this is the class that is partly responsible for producing new movements Lash & Urry (1987, pp.195). Unlike Lash and

[3] Production is defined as "the formation or transformation of objects, within the framework of certain social relations, by the application of certain means to a primary material (Melucci, 1980, pp.210)." Accordingly, social production is used to emphasize its social character.

Urry, Offe (1985) insists on the inadequacy of class-based system. The extension of social base - new middle class and de-commodified social groups- is accepted as an evidence of the emergence of new political organizations which are not class-oriented. As others, Offe characterizes these new forms of personal autonomy and identity; opposition to centralized control mechanisms; informal and non-hierarchical forms of internal organization and ”protest politics” (Bagguley, 1992, pp.31-32).

2.3 Replacing Networks to Right Place

Up to now, I review the literature on the leading arguments and scholars of each tradition. In fact, these two approach differs in their focus (Melucci, 1980, 1996) and each tradition derived theoretical framework that excludes the main focus of the other (Cohen, 1985, pp.664). American tradition examines the manifestation of the movements while European tradition analysis the formation of processes by which movements are generated. Currently, rather than accepting them as rivals more attention has paid to complementary features of these two approaches. For instance, a conceptual synthesis is provided by Diani (1992). Moreover, Crossley (2002) criticizes 'new' American tradition in terms of its weakness on agency and structure and discuss the possibility of a new kind of synthesis. Last but not least, Opp (2009) makes a theoretical contribution to this area.

One way or another, current studies point the possibility and necessity of synthesizing these two approaches. Recognizing this, I focus on the common explanatory base of these two rather than discussing the weaknesses and strength of each theory.

In fact, one way or another interaction is emphasized in almost all studies. In the rest of the chapter, I attempt to derive a more general perspective with a conceptual extension on social movements and focusing on the communication networks in terms of three main dimensions (1) as a Resource (2) as a Context Provider and (3) as a Policy Tool.

2.3.1 Scope of the Social Movements

The scope of the social movements is modified based on the two significant approaches already discussed in the literature.

First of all, the conceptual boundaries are extended. As stated above, the traditional literature constrained the analysis to movements experienced in capitalist societies. This perspective squeezes the literature to a comparison between industrial and post-modern societies. In here, a dialectic methodology is suggested as a solution. Actually, Vander Zanden (1959)'s critiques on contemporary studies shed lights for a more a broader perspective.

> "Movement frequently begets countermovement. Between the two a dynamic interrelation occurs (Vander Zanden, 1959, pp.313)."

Secondly, network theory is promising in analyzing the common bases of the two. Diani (1992)'s three-fold conceptualization is a significant contribution. In his study, the main components of the collective movements are presented as the networks of relations between a plurality of actors, collective identity, and conflictual issues.

On this basis, I define social movements as the outcomes of the interaction process between conflicting agents or opposites.

2.3.2 Social Links as Resources of Mobilization

There are various studies emphasize on existence or absence of the ties as a resource of mobilization. While classical American tradition defines isolation as the main motivation behind the collective behavior, empirical studies falsify this hypothesis (McPhail, 1971). Instead, it appears that socially connected people are more likely to mobilize (Oberschall, 1973; Snow *et al.*, 1980).

Actually, links can appear within an organization, between organizations or non-organizational/ personal. As discussed by Oberschall (1973), mobilization is more likely not only in the cases of horizontal integration but also in the existence of vertical segregation. If there is a horizontal integration such that dominant and subordinate groups frequently interacts, this may generate cross ties and discourage mobilization. If on the other hand there is vertical segregation such that groups are segregated, this fosters the group identity and encourage mobilization. Similarly, Tilly (1978) defines an organization (CATNET) as a product of two components (Catness x Netness). Netness describes the intensity of networks among group members while Catness refers to the strength of shared identities in a group. Groups with densely linked and shaped around a collective identity (sexuality, ethnicity etc.) are more prone to mobilization compared to other forms of interacted relations. Empirical studies support such a distinction about the roles of different interaction processes. For instance, physical opportunities of campuses generate horizontal integration with facilitating communication and creating vertical segregation by separating students from other personal and professional ties (McAdam, 1988). Not only mobilization theories but also new social movement theories frequently refer to face-to-face interaction on the formation of collective interest and identities (Hannigan, 1985, pp.449).

Even this summarized findings shows that personal and organizational contacts play a significant role in the emergence of and one's participation in movements. Inherently, individuals take part in many and various types of interactions. However, the analysis on pre-existing ties is not enough to understand the role of the networks in social movements(Della Porta & Diani, 1999, pp.115).

Instead, we should focus on the conditions under which individuals willing to and capable of using their personal network as a resource of mobilization. Up to a certain point, I stand with relativeness approach. However, dialectic says, in the case of any action there is a possibility of a counteraction. Only if one interacts with an opposition may make the links a resources. Otherwise, she isn't aware of any conflict.

Therefore, I claim that an agent is willing to use her links as a resource of mobilization if she is aware of a conflict and she believes movement can generate a benefit or avoid any risk of counter-movement. If she believes the reaction (counter-movement) would be more powerful in response to an action (movement) , she would prefer status qua even everything is getting worse.

2.3.3 Spatial Dimension of the Networks as Context Providers

Although relations may be described depending on the focus of the study, one or another type ?f information flow is a leading relation through interaction.The different spheres where interaction taking place materializes different type of relations and accordingly different contexts of the information flowing. For instance, interaction in family, neighborhood, working place or school specifies the information people sharing. Therefore, I claim that spatial dimension of the relations can give significant insights on the differentiation of the forms of movements.

Snow *et al.* (1980) is one of the leading studies emphasizing on socio-spatial

settings of movement participation. The study uses a broad dataset on participants of different forms of movements. In terms of student movements, 70% of the students participate through their pre-exist personal relations whereas public channels motivate 30% of them. Supportively, Oliver & Myers (2003, pp.177) defines three dimensions of networks relevant to study social movements:
(1)Spatial: The movements are space-bounded which are already socially organized areas;
(2) Organizational: There are different links between and within spaces that coordinate the actions of individuals and organizations;
(3) Other social: Friendship, employment, kinship-like personal ties may create external links to the movement organization. In addition, they diversify node-to-node and broadcast interaction in specifying the information shared [pp.183].

On this topic, one of the most challenging analyses is done by Gould (1993). Gould criticizes the studies that assess the Paris Commune in terms of its participants. While the traditional approach focuses on the role of close-knit professional groups, the data indicates that the participation rates of these groups are low. Instead, the mobilization emerged through neighborhood networks. Gould explains this as a transition from trade to neighborhood networks in the organizational framework of mobilization.

On the basis of these discussions, I suggest that while participants are significant for movements, it is the *place* characterizing the movement. Actually, this is compatible with McAdam & Paulsen (1993, pp.659) who claim that ties are significant as much as they developed in organized circles. Otherwise, neither organizational embeddedness nor strong ties to another volunteer are strongly predictive factors for the likelihood of mobilization. The analysis of Castells (1983) on the Glasgow Rent Strike also supports this claim. Although the participants of the strike were workers of the region, the interaction was not through worker identity. Instead, links were developed in the neighborhood and the movement was mobilized through housing crises [pp.27-37] (Castells, 1983).

Therefore, we should also examine the spheres where interaction between opposites taking place. Furthermore, the multiplicity of relations (McAdam & Paulsen, 1993) and multilayer network structure presents promising perspective so as to represent spatial dimension.

2.3.4 Existence and Absence of Links as Policy Tools

Crossley (2002, pp.95) states that "Networks are as much products as producers of social movements." On the one hand, social movements restructure social relations, on the other hand, social relations motivate movements.

As discussed in the first chapter, in many social context link formation is a strategic network formation process. In this process, individuals decide on forming a new link or breaking an existent link based on the cost-benefit analysis. However, there is another face of the coin. If this is so than the boundaries of the communication channels are open to intervention. This claim is consistent with the discussion of Melucci who states that:

> "The necessity of controlling conflict obliges the system of domination to intervene constantly at the different levels of the social structure in order to hold conflict on them within limits compatible with the fundamental class relations Melucci (1980, pp.214-215)."

In "modern democracies" direct intervention is the last resort for the dominant class. Instead, they have several mechanisms to produce "compulsory volunteering". At this point, the two dimensions discussed above are significant policy spaces.

There are several real life examples supporting this claim. For instance, around the 1900s plantation owners in Hawaii keep labor movements under control by employing workers who speak different native languages (Takai, 1984). By doing so, owners deter workers from using interaction as a resource of mobilization. Besides, mass media is a significant mechanism to design context of the information flow. For instance, the news media are intentional actors who choose "stories" to be propagated (Oliver & Myers, 2003, pp.184). Similarly, the social media creates the "trend topics" of the day and mobilize collective action in the form of twit-storm. The closure of television channels, the prohibition of newspapers, the blocking of social media tools and even the interruption of the Internet are indicators of the use of link-removal mechanisms as preventive policy tools.

Another mechanism is the formation of countervailing networks by oppositions. Snow *et al.* (1980) discusses that existence of countervailing networks decreases the likelihood of mobilization. In a similar vein, Zald & Useem (2009, pp.266) describes six different cases for the role of authority in movement vs. counter-movement interaction.

Moreover "modern democracies" accepts the authority as an intermediary. Both movement and counter-movement are assumed to be in a fight to convince and convert authorities. However, in reality, the movements generally against policies of authorities which forces them to take action. In this case, authorities are either direct counter-movements or sponsors of a counter-movement. For instance, flexible labor market policies can be classified in the latter case, while war policies may be included in the former one.

While the first dimension takes the interaction process between two agents, this one points to the exogenous interventions to personal links. Therefore we should not omit the fact that communication links may serve as a control mechanism for policy makers. In some cases, links may be used to discourage possible movements. In some other cases, they may be used to motivate people to choose one form of the movement to another.

Therefore, we should examine the social conditions under which interaction is taking place. At this point, positional heterogeneity among agents can reflect a significant aspect of this issue.

2.4 Concluding Remarks

In this chapter, I review the two dominant stream of the literature on social movements. The main aim is showing the necessity and possibility of a new approach that synthesizes these two approaches. Network theory is suggested as a promising methodology for bridging these two approaches as well as improving previous arguments.

First of all, any theory should get rid of the fallacy constraints social conflicts and collective behavior with capitalist societies. Instead, conflicts emerge and spread as an outcome of the interaction process. Secondly, movements and counter-movements exist together. Such a **dialectic methodology** overcomes several shortcomings of previous arguments. The scope of the social movements can be described as follows.

Definition 2.4.1. Social movements are outcomes of the interaction process between opposites.

The existence of oppositions necessitates acceptance of **heterogeneity in identities** of individuals.

This approach is closer to American tradition in terms of proposing interaction as a resource of mobilization. However, it differentiates in terms of the conditions that makes individuals use interaction as a resource. Awareness of a conflicting situation and belief on a collective success are two factors motivating individuals. Under incomplete information, the communication structure determines the people one is able to contact. Accordingly, not only pre-existing ties but also network structure is relevant. Furthermore, the sphere interaction taking place characterizes the movement. Therefore, the network structures of different spheres have a significant influence on the emergence of one form but not another. As a result, a broad and consistent theory should introduce **multiple layers** so as to represent different spheres. Lastly, if links and network structure can be used as a policy tool, then incentives can discourage or encourage a possible movement. In this point, determining the individuals or groups who have the capability to intervene to links formation process becomes a relevant issue. As a result, a broad and consistent theory should introduce **social conditions** and **positional heterogeneity**. The main proposition of this chapter can be summarized as follows.

Proposition 1. A broader and consistent theory on social movements should answer three main questions:
1. *Who* are willing to use interaction as a resource of mobilization?
2. *Where* do these taking place and under which *structure*?
3. Under which *rules* and *conditions* the interaction takes place?

Obviously, this approach constitutes a broad perspective however the implication of the proposition is complex. For implications, more detailed and purposeful data should be constructed. Nevertheless, a simplified analysis is still able to explain several phenomena. These are discussed through two simple examples constructed in the following chapters.

Chapter 3

Connection Model for Conflicting Agents

3.1 Introduction

In the second chapter, social movements are described as the outcomes of an interaction process between opposites. In addition, awareness of a conflicting situation is presented as a necessary condition motivating any individual to act. Once individuals face a conflicting situation, using interaction as a resource of mobilization is a strategic decision.

In this chapter, I set up a modification of the connections model of Jackson & Wolinsky (1996) to examine possible network structures in the existence of conflicting nodes for a specific issue.

In this network model, nodes represent individuals with different attitudes on a specific issue. They may be classified as supporters, opposition or neutral about this issue. Individuals communicate their attitudes through personal networks and the links provide information flow. The flow is assumed to be reciprocal.

Standard models proposed that people benefit from communication with others. There are two main reasons. First, it is an opportunity to extend their own base. Second, it is a way to decrease uncertainty. It is also assumed that the benefits decay with distance. In other words, as the distance between two agents increases the benefit from this relation decreases. Differently, this model extends the standard model with containing the interaction between opposites. Accordingly, the utility function of the linking modified with taking participants' identity into account. This characterization based on a basic assumption that people enjoy from a contact with a similar agent whereas they dissatisfy from a relation with opposites. In this sense, this model is a modified version of a standard connection model where the identities of contacts are variables in the utility function of an agent. In fact, this is a highly stylized model in which an agent gets extra benefit from similar identities and extra loss from opposition once she learns the identity of her contact.

The connections models use distance- based utility functions in the calculation of costs and benefits. In a given network, the utility of each individual is determined by the number of direct and indirect contacts. The total value generated by the network is the summation of the payoffs of all individuals.

There are several studies using connections model for endogenous network formation analysis which can be classified into two. Jackson & Wolinsky (1996) represents the first group while Bala & Goyal (2000) is a leading example for the second group. The main difference appears in the formulation of link formation. The first group assumes two-sided link formation in which a link between two people requires investments of both. On the other hand, the second group includes one-sided and non-cooperative link formation where an individual is able to form a link with another by incurring some costs. The difference of formulation is reflection of the difference in the focuses of these studies. The former interested in the tension between stability and efficiency. For instance a Jackson & Wolinsky (1996) shows that there are stable networks which are inefficient. Inefficiency can be eliminated through redistribution of the resources including the individuals who are not taking part in the value generation process. On the other hand, the latter interested in the relation between equilibrium and efficiency. For instance, Bala & Goyal (2000) finds that the star structure is a uniquely efficient and strict Nash network in a range of values.

This model takes the side of the first groups. The link formation is assumed to be a two-sided information flow. Actually, most of the case an agent hesitate to share her type if she doesn't know the others' type. Accordingly, it is not an unrealistic assumption. Although this is out of the scope of this thesis, the model can be extended by including directed relations. The main aim of this chapter is the characterization of networks in terms od stability and efficiency.

I conclude this section with a brief review of the discussions of the standard model and its extensions.

Jackson & Wolinsky (1996) introduces a model in which individuals get utility from both costly direct links and indirect contacts. The benefits deteriorate as the distance between individuals increases. Accordingly, the actions of others affect the benefits of an individual which creates positive externalities. The symmetric version of the model demonstrates the contradiction between efficiency and stability due to the externalities. However, the standard model has three main critical assumptions (Jackson *et al.*, 2008, pp.209). First one is homogeneity. The standard model assumes that actors are homogeneous and have same utility functions. Second, the benefits from indirect connections only depend on the minimum path. The last one is the complete information. These assumptions are the main departure points in the construction of extensions of the model.

There are various studies extending the standard model so as to discuss the first assumption. Heterogeneity in the utility can be introduced through differentiation in benefits as well as in costs.

The extension of the standard model on the cost side exhibits significant results. Johnson & Gilles (2000) introduce a spatial cost topology with placing agents in a line. Links costs are assumed to be proportional to the distance between agents. As in the standard model, each individual gains benefit from contacts that decay with distance. Under high costs, empty networks emerge as stable and efficient structures. Under relatively low costs, chain structure emerges but it isn't stable. The star network appears whenever the decay is high enough but it is pairwise stable only when the decay is not too high. Similarly, Jackson & Rogers (2005) model variation of cost with replacing agents in different "islands". In this model, the benefits are truncated such that individuals benefit from indirect contacts which are not placed more than distance D. The linking cost is lower between agents living in the same island compared to the connection with an agent placed on a different island. The island-connections model generates small diameter and high clustering, resulting in small-world networks. Moreover, studying a connection model with variation in cost structure, Galeotti & Goyal (2010) generates contradictory results. In contrast to former models, it is assumed that the decay of benefits is negligible. The model generates networks with a high degree of centrality and short average distances like star-sponsored structures. Accordingly, it is claimed that any equilibrium network is minimally connected and these networks don't exhibit clustering. Lastly, using non-cooperative link formation perspective, Galeotti *et al.* (2006) models value heterogeneity as well as variation in the cost structure of relations. The model found that value heterogeneity is relevant for the connectedness of the network while cost variation is significant for both connectedness and structure of the relations.

As far as we know, there is no extension on the second assumption. In other words, current literature lacks any other specification on indirect benefits aside from the minimum path. I attempt to extend this assumption by differentiating the utility one gets from indirect connection through different agents.

Another significant assumption of the standard model is the complete information. Individuals are assumed to know network structure and the utility functions of others. McBride (2006) presents an example relaxing this assumption. The model accounts for players' observational limitations and constructed under the imperfect monitoring. The equilibrium is efficient under perfect monitoring or when people can observe at least half of the population. It is shown that imperfect monitoring resultant in many inefficient equilibria. As the capability of observation decreases over-connection occurs and it is replaced with under-connection with a further decrease. Inefficiencies can be eliminated under different assumptions. Whenever individuals are able to calculate marginal benefits of each link independent of the network structure, inefficiency resultant form over-connection is eliminated. Whenever the rationality is a common knowledge, inefficiency resultant from under-connection is eliminated.

In this model, I relax these three assumptions with introducing heterogeneity in benefits, specifying the benefits from indirect contacts other than the minimum path and introducing local knowledge on network structure and identity codes.

I discuss the standard connections models and its extensions at the beginning of the second section. Then I introduce a modified version of the model capturing the interaction between opposites. I construct several examples to make the main points of the modified model in the third section. The chapter is concluded with a brief summary and further discussions.

3.2 Model

3.2.1 Connections Models

The connections models are developed for social connections (Jackson & Wolinsky, 1996). Standard version uses unweighted undirected relations. The links represent social relations between agents. The direct relations offer some benefit in return for some amount of costs. Moreover, through these links, agents also benefit from indirect relations. The value obtained from others decays by the distance. The utility of each agent i from the network structure g is formalized by

$$u_i(g) = w_{ii} + \sum_{j \neq i} \delta^{d_{ij}} w_{ij} - \sum_{j:ij \in g} c_{ij} \tag{3.1}$$

where $w_{ij} \geq 0$ denotes the inherent value of individual j to i where w_{ii} shows the intrinsic value from one-self; c_{ij} denotes the cost to i of maintaining the link ij; d_{ij} is the number of links in the shortest path between i and j; $0 < \delta < 1$ describes the idea that the value that i derives from connection to j depends on the distance between i and j and decays by distance. Less distant connections are more valuable than more distant ones, but direct connections are costly. In a population size N, the total value of network g is the summation of utilities of all individuals:

$$v(g) = \sum_{i \in N} u_i(g) \tag{3.2}$$

The symmetric case assumes (1) no intrinsic value from one-self such that $w_{ii} = 0$, (2) the homogeneity between the benefits of all links and it is normalized to 1 such that $w_{ij} = 1$ and (3) linking cost is fixed and homogeneous such that $c_{ij} = c$. Under these assumptions, the utility of an agent i can be reformulated as follows:

$$u_i(g) = \sum_{j \neq i} \delta^{d_{ij}} - \sum_{j:ij \in g} c \tag{3.3}$$

Under this basic model, pairwise stability is applied to predict which forms may emerge and the study examines the efficiency of these structures. The model shows that there exists different cost ranges where the complete graph, the star containing all agents and the empty network emerge as uniquely efficient structures. Moreover, it is shown that pairwise stability requires at most one non-empty component. Whenever $c < \delta - \delta^2$ the complete network is uniquely efficient and pairwise stable structure. For $\delta - \delta^2 < c < \delta$ star encompassing all agents is the uniquely efficient but not uniquely pairwise stable structure. Lastly, for $\delta < c$, empty network is the uniquely efficient structure but we can find non-empty pairwise stable structures which are inefficient. Furthermore, Jackson & Wolinsky (1996) shows that even in an extension of the model capturing side payments there is a discrepancy between efficient and stable structures.

As stated in the first section, cost heterogeneity is a well-discussed extension of the standard model. For instance, in the islands-connections model, the cost structure within and across islands differentiates (Jackson & Rogers, 2005). For simplicity, they constraint the benefits of the indirect links such that whenever the length of the minimum path between two individuals is higher than some D, they don't receive any value from each other. The utility function is defined by

$$u_i(g) = \sum_{j \neq i: d_{ij} \leq D} \delta^{d_{ij}} - \sum_{j:ij \in g} c_{ij} \tag{3.4}$$

where $c_{ij} = c$ if i and j are in the same island and $c = C$ otherwise. Moreover, it is assumed that the cost of connection with closer agents is lower compared to connection with the agents placed in more distant ones such that $0 < c < C$. The model finds that for a variety of parameters, networks are characterized as small diameter and small average path lengths which are main characteristics of "the small worlds".

Similarly, Johnson & Gilles (2000) modify connection model so as to present *a spatial cost topology*. The cost heterogeneity may be caused by several issues such as geographic, social or individual differences. Cost topology is assumed to be linear such that agents are placed in a real line $\mathbb{R}$. The number of all players spatially in between i and j including i and j defined as n_{ij} and the length of this set is defined by l_{ij}. The utility function is defined by

$$u_i(g) = \sum_{j \neq i} \delta^{d_{ij}} - c \sum_{j:ij \in g} l_{ij} \tag{3.5}$$

The model finds that empty network is both efficient and pairwise stable for high costs. For low costs, the chain is efficient but not pairwise stable. The efficiency and stability of the star structure doesn't only depend on the cost but also depends on the rate of decay. For stability, decay should be higher than $\delta = \frac{\binom{n}{2}}{n-1}$ but for large values of the decay rate, star is not efficient.

3.2.2 Connections Model with Conflicting Agents

As stated in the previous chapter, the main concern of the study is the interaction between opposites. Accordingly, I modify the connection model including the conflicting agents.

For simplicity, I will consider the case when each agent has either positive or negative view on a specific issue. For instance, if the specific issue is war then there are people who support for some reason and who oppose for another reason. In other words, there are two types of people concerning each specific issue. The value one receives from being connected to other depends on the type of each agent. The total value of the communication structure can be considered as the value of the interaction about that specific issue. For simplicity, I denote the people with same views as "allies" and people with opposite views as "enemies".

Unlike Jackson & Rogers (2005)'s islands connection model and Johnson & Gilles (2000)'s spatial connection model, I introduce heterogeneity in intrinsic function. In this model, the efficiency of the network structure depends on how people value the allies and the enemies.

In reality, people are not able to know the attitudes of each agent in the society. Instead, they have a limited knowledge depending on their communication network. In the light of previous studies, each agent is assumed to know the types of agents with a given distance. For simplicity, I assume this distance is 1. In other words, each agent knows only the types of her direct contacts. Moreover, the value one receives from indirect connections not only depends on the minimum path but also the type of the bridging neighbor. It is assumed that the path through an ally gives higher benefit compared to the path through an enemy.

The benefits one receives from any contact can be separated into two parts. First part stands for the standard benefit from a connection which unlocks connection to others and reduces the uncertainty. Second part stands for the extra gain or loose due to the type of the connected agent. As in the standard model, the benefits decay with the distance while only direct links are costly. The utility of person i from network g can be written as

$$u_i(g) = \sum_{j \neq i} (w + w_{ij}) \delta^{d_{ij}} - \sum_{j: ij \in g} c \tag{3.6}$$

where w_{ij} shows the extra gain or loose of i depending on the type of the neighbor j; d_{ij} is the shortest path. w and c represents the homogeneity among agents and fixed. As in standard models, $0 < \delta < 1$ and shows the proportion of decay of benefit by distance.

As a result, the main assumptions of the standard model stated in the previous section are extended. First of all, people decide based on the local knowledge. Second, heterogeneity introduces for the benefits from connections. Lastly, in addition to minimum path aspect indirect benefits specifies the type of the bridging neighbor. This last point needs a further discussion. If an agent is able to reach other through two different paths with the same distant, she should decide which one she is willing to use.

Assumption 3.2.1. [Rationality Condition]: Consider a network g in where $k, z \in B_i(g)$ but $j \notin B_i(g)$. Moreover if $i_1 = 1$ and $i_K = j$, suppose $k, z \in \{1, 2, .., K-1\}$; $v_{ij}(g)$ denotes the utility i receives from j and l_{ij}^k denotes the distance between i and j through k. If $l_{ij}^k = l_{ij}^z = d_{ij}$ then $v_{ij}(g)$ can take two values: $v_{ij}(g)^1 = (w + w_{ik})\delta^{d_{ij}}$ or $v_{ij}(g)^2 = (w + w_{iz})\delta^{d_{ij}}$. i chooses the path with k if $v_{ij}(g)^1 > v_{ij}(g)^2$ and the path with z if $u_{ij}(g)^2 > v_{ij}(g)^1$. If $v_{ij}(g)^1 = v_{ij}(g)^2$, she is indifferent.

Assumption 3.2.1 represents the role of the bridging agent in an agent's relations. Actually, this assumption means that even I don't know the identity of an agent, I prefer to contact through my friend as long as it is possible.

Let $N = \{1, 2, .., n\}$ be the set of individuals in a given population. Suppose Group 1 (S_1) includes positive views and Group 2 (S_2) includes negative views according to a specific issue. The extra value generated from a connection can be specified as:

$$w_{ij} = \begin{cases} = w_1 \text{ if } i, j \in S_1; \text{ OR } i, j \in S_2 \\ = w_2 \text{ if } i \in S_1 \text{ and } j \in S_2; \text{ OR } i \in S_2 \text{ and } j \in S_1 \end{cases}$$

Note that, agents learn the types of each other only after interaction takes place. Based on the type of the contact, each get/loose extra value. Note that, if $w = 1$ and $w_{ij} = 0 \; \forall \; i, j \in N$ the model becomes standard symmetric connection model.

Another significant assumption is about the specification of these benefits.

Assumption 3.2.2. $w_1 > 0$ and $w_2 < 0$.

Assumption 3.2.2 represents the idea that agents get extra value from interaction with allies, but loose some value from the enemies. In fact, the specifications of w_1 and w_2 reflect how a society values consensus and conflicts.

In below there are two example presenting then implications of these assumptions.

Example 3.2.1 examines a basic case to show the role of the second assumption with presenting a comparison between a standard and modified model.

Example 3.2.1. Suppose $N = 3$ such that $\{1\} \in S_1$ and $\{2,3\} \in S_2$. Consider two different network structure: $g = \{12, 13\}$ and $g^{'} = \{13, 23\}$ which are represented in Figure 3.1. Under standard model the $u_2(g) = u_2(g^{'})$ and the total value of the network is same.
Under the modified version $u_2(g) = (w - w_2)(\delta + \delta^2) - c$ and $u_2(g^{'}) = (w + w_1)(\delta + \delta^2) - c$. Under Assumption 3.2.2, $u_2(g^{'}) > u_2(g)$. Moreover the total value of the networks will be $v(g) = 4\delta(w - w_2) + 2\delta^2(w - w_2) - 4c$ and $v(g^{'}) = 2\delta(w-w_2)+2\delta(w+w_1)+2\delta^2(w-w_2)-4c$. $v(g)-v(g^{'}) = -2\delta(w_1+w_2)$. As a result, in the modified model the value of second structure is greater than the first structure.

Figure 3.1: The Significance of The Bridge's Identity

Example 3.2.1 proposes that the total value generated by a network influenced by the density of same type and opposite type connections.

Example 3.2.2 presents the idea behind Rationality Assumption.

Example 3.2.2. Suppose there are 4 nodes where each group has two members such that $S_1 = \{1, 2\}$ and $S_2 = \{3, 4\}$. Consider the network structures $g = \{12, 23, 34\}$ and $g'\{12, 13, 34, 24\}$ which are shown in Figure 3.2. Denote the value of a link $ij \in g$ for i $v_{ij}(g)$ and for j $v_{ji}(g)$. Then,

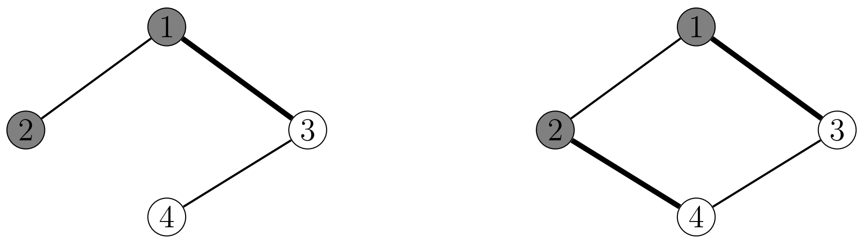

Figure 3.2: Rationality Assumption

$v_{31}(g) = (w - w_2)(\delta + \delta^2) - c$ and $v_{31}(g') = (w - w_2)\delta - c$. While node 3 should interact with node 2 through enemy in the first structure, connection between 2 and 4 make her to reach 2 through an ally. As a result, this increases the utility node gets from agent 2.

Before further analysis on the model, I examine the values of several structures to deepen the understanding of the model.

Values for Different Network Structures

Suppose there are two groups such that $|S_1| = n_1$ and $|S_2| = n_2$ where $i \in S_1$ and $j \in S_2$. The values of the basic structures can be calculated as follows.

Complete Network

The complete network, g^N, is the one in which each node connected to all others such that $g_{ij} = 1\ \forall i, j \in N$ and $i \neq j$. Each agent has $n-1$ links and in total there are $\frac{n(n-1)}{2}$ links.

The utility of agents i and j are calculated through:
$u_i(g^N) = [(n_1 - 1)(w + w_1)\delta + n_2(w - w_2)\delta] - (n - 1)c$
$u_j(g^N) = [(n_2 - 1)(w + w_1)\delta + n_1(w - w_2)\delta] - (n - 1)c$

The total value of the graph is
$v(g^N) = n_1(n_1-1)(w+w_1)\delta+n_2(n_2-1)(w+w_1)\delta+2n_1n_2(w-w_2)\delta-n(n-1)c$

Circle

The circle is the one where each agent has exactly two neighbors and in total there are n links.

In this structure, the network can be partition into two for each agent. Suppose j is the neighbor in left hand side and k is the neighbor in the right

hand side of agent i.
If <u>n is odd</u>, agent reaches $\frac{n-1}{2} = D$ members from each side. Then for each agent $u_i(g) = (w + w_{ij})[\delta + \delta^2 + ... + \delta^D] + (w + w_{ik})[\delta + \delta^2 + ... + \delta^D] - 2c$
If <u>n is even</u>, for each agent through right or left has the same distance from the last member of the population. One trick is associated to the assumption of Rationality. Agent would prefer to connect through an ally whenever she is indifferent in terms of the shortest path. Then the utility of an agent i is $u_i(g) = (w+w_{ij})[\delta+\delta^2+...+\delta^{D-1}]+(w+w_{ik})[\delta+\delta^2+...+\delta^{D-1}]+(w+w_{it})\delta^D-2c$
$w_{it} = w_1$ if $w_{ij} = w_1$ or $w_{ik} = w_1$ and $w_{it} = w_2$ if $w_{ij} = w_{ik} = w_2$.

The total value of the network does not change based on the size of n such and in any case it is
$v_g = \sum_{i=1}^{n} u_i(g)$

<u>Chain</u>
The chain structure is the one in which everyone has at most two neighbors. In fact, chain is obtainable from a circle by severing a link between two agent. The total number of the links is $n - 1$.

In a chain, the values is similar to the circle except the first and the last members who has only one neighbor. Suppose i is the i^{th} member. Again, j is the neighbor on the left and k is the neighbor on the right. The utility of agent i is
$u_i(g) = \Big(((w+w_{ij}))(\delta+\delta^2+...+\delta^{i-1}\Big) + \Big(((w+w_{ik}))(\delta+\delta^2+...+\delta^{n-i}\Big) - 2c$
where $i \neq 1, i \neq n$.
For $i = 1$, the first part of the utility function will be zero and for $i = n$, the last part of the utility function will be zero.

The total value of network is
$v(g) = \Big((w + w_{ik})(\delta + \delta^2 + ... + \delta^{n-1})\Big) + \Big((w + w_{ij})(\delta + \delta^2 + ... + \delta^{n-1}\Big) + \Big[\sum_{i=2}^{n-1} \Big(((w + w_{ij}))(\delta + \delta^2 + ... + \delta^{i-1}\Big) + \Big(((w + w_{ik}))(\delta + \delta^2 + ... + \delta^{n-i}\Big)\Big] - 2(n-1)c$

Example 3.2.3 represents a possible extension of this representation to any chain-like structures.

Example 3.2.3. Consider the network structure in Figure 3.3 such that $N = 7$, $S_1 = \{1, 3, 4, 6, 7\}$ and $S_2 = \{2, 5\}$. The network structure is denoted as $g = \{12, 23, 34, 35, 56, 67\}$.

Unlike a standard chain, the network ramifies into two after node 3. In

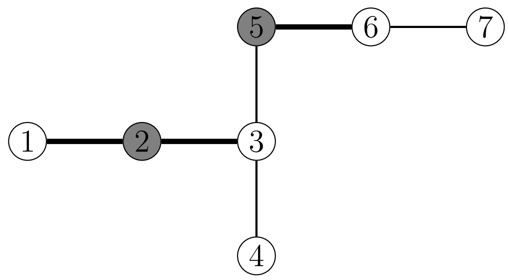

Figure 3.3: Conflict in a Chain-Like Structure

such cases, the nodes in each distance can be more than two. In this example, Node 1 has two other nodes with distance three. Node 3 has three direct neighbors, so have three branches instead of two. Accordingly, the utility functions of node 1 and node 3 can be calculated as
$u_1 = (w - w_2)(\delta + \delta^2 + \mathbf{2}\delta^3 + \delta^4 + \delta 5) - 2c$
$u_3 = (w - w_2)(\delta + \delta^2) + (w - w_2)(\delta + \delta^2 + \delta^3) + (w + w_1)(\delta) - \mathbf{3}c$
This method is useful to calculate the value of any agent placed in any kind of partially connected network structures.

Star
Star network is the one in which there is a central agent i connected to all others whereas i is the only neighbor of others such that $g_{ij} = 1\ \forall j \neq i$ and $g_{ik} = 0$ for $k \neq i$.

The star structure that encompassing all members of the society can be drawn as a chain. This case, each agent classifies the members into three, one includes the initial member including one element, the other includes the central member including one element and the last one includes the ends including $n - 2$ members. For instance, node 1 is the initial node, node 2 is the central node and the other 5 nodes are the ends in the structure shown in Figure 3.4.

Consider a structure where agent z is central such that $\underline{z \in S_1}$. Accordingly the utility functions can be written as:

$u_z(g) = (n_1 - 1)(w + w_1)\delta + n_2(w - w_2)\delta - (n - 1)c$
$u_i(g) = (w + w_1)\delta + (n - 2)(w + w_1)\delta^2 - c$
$u_j(g) = (w - w_2)\delta + (n - 2)(w - w_2)\delta^2 - c$

The total value of the structure is the summation of the utilities of the

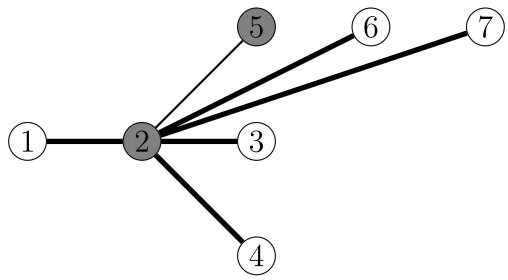

Figure 3.4: Conflict in a Star Network

agents such that:
$v(g) = u_z(g) + (n_1 - 1)u_i(g) + n_2 u_j(g)$
Moreover, this can be specified as:
$v(g) = 2(n_1 - 1)(w + w_1)\delta + 2n_2(w - w_2)\delta + (n_1 - 1)(n - 2)(w + w_1)\delta^2 + n_2(n - 2)(w - w_2)\delta^2 - 2(n - 1)c$

Note that, if agent y is central such that $y \in S_2$.
$v(g') = 2(n_2 - 1)(w + w_1)\delta + 2n_1(w - w_2)\delta + (n_2 - 1)(n - 2)(w + w_1)\delta^2 + n_1(n - 2)(w - w_2)\delta^2 - 2(n - 1)c$

Efficiency and Stability

In this part, the network structures are characterized in terms of efficiency and stability. Efficiency conditions and pairwise stability is used in characterization as describes in the standard connection models. Although these are not only tools in discussing efficiency and stability, the analysis can be improved in further studies.

The arguments are derived from a population where the sizes of groups are different. Suppose $|S_1| = n_1$ and $|S_2| = n_2$ where $n_1 > n_2$.

CASE 1: Complete Structure

Proposition 2. If $c < (w - w_2)\delta - (w + w_1)\delta^2$ the complete graph g^N, is the unique strongly efficient network. At this cost range, g^N is also the unique pairwise stable network.

Proof. Any agent receives at most $(w + w_1)\delta^2$ amount from an indirect connection. A direct contact benefits any agent at least $(w - w_2)\delta - c$ and at most $(w + w_1)\delta - c$. If the highest gain from indirect link is lower than the least gain from a direct link then any agent will gain with forming a link.

If $(w+w_1)\delta^2 < (w-w_2)\delta - c$, forming a link between two agents who are not directly connected will improve their utilities and accordingly increase the total value. Accordingly, the complete network is the unique efficient structure under these variables.
If a link between allies is destroyed within the complete network, the value changes by $2[-(w+w_1)\delta + (w+w_1)\delta^2 + c]$ and destruction of a link between enemies changes the value by $2[-(w-w_2)\delta + (w+w_1)\delta^2 + c]$. If $c < (w-w_2)\delta - (w+w_1)\delta^2$ this also implies $c < (w+w_1)\delta - (w+w_1)\delta^2$. Under this cost condition, deviation from a complete network by severing a link between any two agent decreases the utilities of both agent. As a result, complete graph is also the unique pairwise stable network.

□

CASE 2: Connected Allies

Lemma 3.2.1. Two allies benefit from a direct link if $(w+w_1)(\delta - \delta^2) > c$

Proof. The highest indirect benefit between two allies is connection through only one ally: $(w+w_1)\delta^2$. If the value of a direct link, $(w+w_1)\delta - c$, is higher than the highest indirect benefit, any two allies gain by forming a link.

□

Under this cost structure any efficient network contains connected allies. Which structures occur under efficiency and pairwise stability conditions depends on the relations between the interactions.

Lemma 3.2.2. If $(w+w_1)\delta^3 < (w-w_2)\delta - c$ any efficient network contains at least n_2 one-to-one inter-relations.

Proof. Let L denote the number of links between enemies. If $L < n_2$, then there is at least two individuals in both groups, who don't have direct connection with a member of other group. Connection increases each of them by at least $(w-w_2)\delta - c - (w+w_1)\delta^3$ which is higher than zero. This means connection increases the efficiency.

Table 3.1 shows the highest changes by formation of a second link. Note that under this cost range, the highest value is generated by connection of unconnected two agents. DC denotes the changes for the connected partners and IC shows the changes for others. # shows how many people affected by this change.

In this cost range, the summation of third column is higher than the summation of the second column. Moreover, the value of L^{th} link between unconnected two enemies is $(w-w_2)\Big[2\delta - (n-4L+2)\delta^2\Big] + (w+w_1)\Big[(n-$

	What	Replaced by	Nodes #	Effect
DC	$(w+w_1)\delta^3$	$(w-w_2)\delta-c$	2	$+$
DC	$(n_2-2)(w+w_1)\delta^3$	$(n_2-2)(w-w_2)\delta^2$	1	$+$
DC	$(n_1-2)(w+w_1)\delta^3$	$(n_1-2)(w-w_2)\delta^2$	1	$+$
IC	$(w-w_2)\delta^2$	$(w+w_1)\delta^2$	2	$+$
IC	$(w+w_1)\delta^3$	$(w+w_1)\delta^2$	n_2-2	$+$
IC	$(w+w_1)\delta^3$	$(w+w_1)\delta^2$	n_1-2	$+$

Table 3.1: The Effect of the Second Link Between Two Completely Connected Groups

$2)\delta^2-(2n-4L+2)\delta^3\Big]-2c$. The difference between L^{th} and $(L+1)^{th}$ link is $4(w+w_1)(\delta^2-\delta^3)$ which is higher than zero. As a result, under this cost range the efficiency necessitates at least n_2 one-to-one inter-group links.

□

Lemma 3.2.3. Any efficient network has more than n_2 links is not pairwise stable.

Proof. If $L > n_2$, some of the members in the second group have more than one links. The value change with an extra link will be
$\Big(2(w-w_2)\delta-2c-2(w+w_1)\delta^2\Big)+\Big(n_2(w+w_1)\delta^2-n_2(w-w_2)\delta^2\Big)$.
Under this cost structure, the left hand side will be negative while the right hand side is positive. If the positive side dominates, the value increases with extra links. On the other hand, the change of an extra link for an unconnected agent will be $(w+w_1)\delta^2-(w-w_2)-c$ which is lower than zero. An unconnected agent would be worst of with extra links since she can already reach to enemies with distance 2 through allies.

□

Lemma 3.2.2 and Lemma 3.3.3 can be summarized as:
1. In case the negative effect of the extra links dominates, n_2 one to one link is efficient and pairwise stable.
2. On the other case, n_2 one to one link is pairwise stable but inefficient.

On the other hand, if the highest value of the second link is lower than zero, any efficient network will contain at most one bridging links.

Lemma 3.2.4. If $(w-w_2)\delta-c<(w+w_1)\delta^3$ any efficient network that has more than one inter-connection is not pairwise stable.

Proof. Table 3.1 shows that if $(w - w_2)\delta - c < (w + w_1)\delta^3$, the direct change is negative that make connected agents worst off. However, if the benefit of indirect connections is higher than the loose of the connected agents, increase in total value is possible. For instance, if the size of the population is too high, network externalities may increase the value of the network while any improving change in terms of efficiency is not pairwise stable.

□

Lemma 3.2.5. If $c > (w - w_2)\delta + (n_2 - 1)(w - w_2)\delta^2$, totally polarized ally groups such that absence of any bridging link between two completely connected groups is the unique pairwise stable network.

Proof. Table 3.2 shows the highest changes with the formation of the first links between two completely connected groups.

	What	Replaced by	Nodes #
DC	0	$(w - w_2)\delta - c$	2
DC	0	$(n_2 - 1)(w - w_2)\delta^2$	1
DC	0	$(n_1 - 1)(w - w_2)\delta^2$	1
IC	0	$(w + w_1)\delta^2 + (n_2 - 1)(w + w_1)\delta^3$	$n_1 - 1$
IC	0	$(w + w_1)\delta^2 + (n_1 - 1)(w + w_1)\delta^3$	$n_2 - 1$

Table 3.2: The Effect of the First Link Between Two Completely Connected Groups

Suppose $i \in S_1$ and $j \in S_2$ such that $g_{ij} = 1$. Under the formation of a first link between two completely connected groups, the utility changes of any i and j can be calculated as:
$\Delta u_i(g) = (w - w_2)\delta - c - (n_2 - 1)(w - w_2)\delta^2$, and
$\Delta u_j(g) = (w - w_2)\delta - c - (n_1 - 1)(w - w_2)\delta^2$.

Whenever the lowest change in utilities is negative, the unconnected ally groups is pairwise stable even if it is inefficient. Under the assumption $n_2 < n_1$, if $\Delta u_i(g) < 0$ any inter-connected structure is instable. That is to say if $c > (w - w_2)\delta + (n_2 - 1)(w - w_2)\delta^2$, the pairwise stable network contains polarized ally groups. On the other hand, since connection necessitates mutual desire, $\Delta u_j(g) > 0$ is sufficient condition to claim the pairwise stability of the polarized ally groups.

□

Lemma 3.2.5 indicates that, a pairwise stable completely polarized ally groups occurs when the conflict is too high such that $\frac{c}{1-(n_2-1)\delta} > (w - w_2)\delta$.

On the other hand, if population is large enough even under high conflict, connection may generate stable outcomes. However, in terms of efficiency completely polarized ally groups can be efficient only for small groups. For large groups the efficient structure is inter-connection of two groups even if it is instable.

To sum up, the findings of this part supports the tension between efficient and pairwise stable structures whenever cost structure supports the efficiency of complete graph within allies.

Proposition 3. For $(w - w_2) - c < (w + w_1)\delta^2 < (w + w_1)\delta - c$

1. If $(w - w_2)\delta + (n_2 - 2)(w - w_2)\delta^2 < c$ the pairwise stable structure is complete polarization. In terms of efficiency, if $c < (w - w_2)\delta + \frac{n-2}{2}(2w + w_1 - w_2)\delta^2 + (n_1 - 1)(n_2 - 1)(w + w_1)\delta^3$ forming link increase the value so efficient structure should have at least a bridge. However if c is between these two values, then it is not pairwise stable. As a result, pairwise stable structure is inefficient.

2. If $(w - w_2)\delta - c < (w + w_1)\delta^3$, any efficient network which have more than one link is not pairwise stable.

3. If $(w + w_1)\delta^3 < (w - w_2)\delta - c$, the pairwise stable network contains n_2 one-to one inter-relation between groups and this is not necessarily efficient.

CASE 3: Broken Links with Allies:

Lemma 3.2.6. If $(w + w_1)(\delta - \delta^2) < c$ any efficient network contains a star within ally groups.

Proof. Within ally groups any member of a triangle has $u_i = 2(w+w_1)\delta - 2c$. Whenever a link between two allies is broke, the value of each agent placed in these ends changes by $(w+w_1)\delta^2 - (w+w_1)\delta - c$. Obviously, it is higher than zero at this cost range. In this case, the value of the center will not change. Moreover, as the diameter decreases, the value increases. As a result, any efficient structure should include stars within each group.

□

The bridge which brings highest total value is connection between two centers. Similar to Case 2, the benefit of the first link between two centers is the summation of third column in Table 3.2.

Lemma 3.2.7. If $(w - w_2)\delta - c < (w + w_1)\delta^3$ any efficient network that have more than one inter-connection is not pairwise stable.

Proof. In terms of the formation of a second link between two opposite groups is different for Case 2 and Case 3 and this is due to the externalities. Unlike Case 2, in Case 3 since the peripheral agents already reach to the members of the other group through the central agent and the diameter would not change with any other connection, the value they receive will not change. The only indirect change will appear on central agent due to Rationality assumption. Table 3.3 shows the changes in the value for each agent. Under specification

	What	Replaced by	Nodes #	Effect
DC	$(w+w_1)\delta^3$	$(w-w_2)\delta-c$	2	-
DC	$(n_2-2)(w+w_1)\delta^3$	$(n_2-2)(w-w_2)\delta^2$	1	-
DC	$(n_1-2)(w+w_1)\delta^3$	$(n_1-2)(w-w_2)\delta^2$	1	-
IC	$(w-w_2)\delta^2$	$(w+w_1)\delta^2$	2	+

Table 3.3: The Effect of the First Link Between Two Stars

of δ, any connection between two peripheral nodes makes them worst off. This time indirect benefit is much more lower. If direct losses dominates the gains of two central agents, then second link will be inefficient. Moreover if $c<(w-w_2)\delta-(n_1-1)(w-w_2)\delta^2$ the only one bridge is both efficient and pairwise stable.

□

Lemma 3.2.8. The polarized stars is the efficient structure if

$$(w-w_2)\delta+\frac{n-2}{2}(w-w_2)\delta^2+\frac{n-2}{2}(w+w_1)\delta^2+(n_1-1)(n_2-1)$$
$$(w+w_1)\delta^3<c<(w+w_1)\delta+\frac{n_2-1}{2}(w+w_1)\delta^2$$

Proof. The left hand side shows the highest possible value of the first link which is the summation of the third column in Table 3.2. If this is lower than zero, any bridge lowers the value of the structure. The right hand side shows the value of the star when $i\in S_1$ is the central agent. Under this cost structure the polarized stars is the uniquely strong efficient structure.

□

Combining with the argument in Case 2, we can conclude that under any cost structure, polarized structures which are pairwise stable is probably inefficient. The only exception can be obtained for small groups.

Lemma 3.2.9. If $(w+w_1)\delta^3<(w-w_2)\delta-c$, the network structure where all peripheral agents connected with hub of the enemy is a pairwise stable and there are $2n-2$ links.

Proof. A link between two hubs change the value for each of the central agent by $(w - w_2)\delta - c - (w + w_1)\delta^2$ and in this cost range it is lower than zero. Under Rationality assumption [1] the same is true for peripheral agents. If two opposition break the link, each will loose $(w + w_1)\delta^3 - (w - w_2)\delta - c$ which is also lower than zero. As a result, no one wants to change the structure and it is pairwise stable.

□

However this is not the unique pairwise stable structure.

Lemma 3.2.10. If $(w + w_1)\delta^3 < (w - w_2)\delta - c$, the network structure where all peripheral agents connected with all peripheral enemies but not hub, and hubs connected to each other but not peripheral enemies is also pairwise stable and there are $n_1 n_2$ links.

Proof. If two peripheral enemies break the link the value of each will change by $(w - w_2)\delta - c - (w + w_1)\delta^3$, and for two hubs breaking will cause an individual change by $(w - w_2)\delta - c - (w + w_1)\delta^3$. Both are lower than zero, so no one wants to severe the existing links. If a periphery and a hub from different groups construct a link the utility of each will change by $(w - w_2)\delta - c - (w + w_1)\delta^2$ which is again lower than zero. Similarly, no one wants to construct a new link. As a result, this structure is also pairwise stable.

□

The arguments under this cost structure can be summarized as follows.

Proposition 4. For $(w + w_1)\delta - c < (w + w_1)\delta^2$,

1. If $(w - w_2)\delta + (n_2 - 2)(w - w_2)\delta^2 < c$ the pairwise stable structure is completely polarized stars.
If $c < (w - w_2)\delta + \frac{n-2}{2}(2w + w_1 - w_2)\delta^2 + (n_1 - 1)(n_2 - 1)(w + w_1)\delta^3$ forming a link increases the total value. In this case, the efficient structure should have at least a bridge. However if c is between these two values, then pairwise stable structure is inefficient.

2. If $(w - w_2)\delta - c < (w + w_1)\delta^3$, any efficient network that have more than one inter-connection is pairwise stable.

3. If $(w + w_1)\delta^3 < (w - w_2)\delta - c$, there are several pairwise stable network structures.

[1] Note that even if one doesn't use the rationality assumption, if $(w - w_2)\delta < (w - w_2)\delta^2$,, a link between two peripheral enemies decrease their utility

CASE 4: Isolation

Proposition 5. If $c > (w + w_1)\delta + \frac{n_1-2}{2}(w + w_1)\delta^2$, the strongly efficient network is empty structure and this is pairwise stable.

Proof. The proof is straight forward. Under this cost structure, the ally-stars have negative values which can be increased to zero when all links are broken. Since this condition implies higher cost than the value of a direct contact among any two types, it is also pairwise stable.

□

3.3 Examples

As discussed above, specifications on w_1 and w_2 demonstrate how society values consensus and conflicts on a specific issue. Different valuation of opposition generates different stable and efficient structures.

In this part, I construct several examples for different specifications.

Example 3.3.1. ***[Change in Conflict]***
Consider a specific issue which society experiences conflict between several agents. Suppose each individual receives a value of 4 from each connections. If they have same view on that issue, the value will rise to 6. Moreover, suppose the cost of each link is 0.3 and the decay by %30.

Case 1: *[Low Conflict: Complete Structure]*
Suppose the conflict is not much relevant such that interaction with the opposition diminishes the value only by 1. In this case, the complete structure will be both uniquely strong and pairwise stable structure. Value from a direct connection is lower than the highest values of an indirect connection. As a result, the maximum value of the structure results in a complete structure. Moreover, if two allies destroy the link, each will loose $(1.5 - 0.54)$ and if two enemies destroy the link they will loose $(0.6 - 0.54)$. Accordingly, losses will be higher than zero. As a result, complete network will be the unique pairwise stable network.
If the conflict in that issue is not significant at all or people care opposition relatively lower than complete network will be stable as well as efficient structure.

Case 2: *[Mediated Conflict: One-to-One Connection]*
Suppose valuation of conflict rises to 1.5. Under rationality assumption, severing the link between two enemies will increase the value of the network

since $0.54 - 0.45 > 0$. However, total value of completely polarized ally groups is less than the complete structure. After some calculations, one can find that bridging two groups by one link increases the total value by $0.441n + 0.324n_1n_2 - 0.331$. For $n_1, n_2 > 0$ this is higher than zero. Moreover, the $L^{th} \geq 2$ one-to-one link between two groups values $0.441n - 0.282L - 0.27$. Any L^th link necessitates at least $2L$ size of the population which makes the value at least $0.6L - 0.27$ and which is higher than zero for any L. After n_2 one-to-one links established, the value of an extra link between unconnected agents from first group and the second link of any player from second group has a value of $0.045 + 0.315n_2 > 0$. The positive value is caused by a change in the path of the relations by people in the second group. While they have to connect through an enemy to any unconnected individual, one link give way for all to change the path and connect through an ally. As a result, the most efficient structure includes n_1 links. However, the utility of an individual from the first group changes by $(0.54 - 0.75 + 0.3)$ which is lower than zero. As a result, any extra link is not beneficial at all. Lastly, severing a link when there is one-to-one n_2 links diminishes the utlity of each at least $(0.45 - 0.162)$ which is higher than zero. Accordingly, the pairwise stable network contains n_2 one-to-one link which is inefficient.

Case 3: *[Higher Conflict: One Bridging Link]*
Suppose the valuation of the conflict rises to 4.5. The value of the first link between two groups is $0.216n + 0.324n_1n_2 - 1.146$ which is higher than zero for $n_1, n_2 \geq 2$. The value of the L^{th} link is $0.216n - 0.161L - 6.87$. A second link increases the value of the network structure if $n > 27$. For the second link, the bridging node will get $-0.15 - 0.612 + n_2 - 2(0.045 - 0.162)$ which is lower than zero. As a result, construction of a second link is not pairwise stable, although it increases efficiency.
The fist link increases the utility of each connected agents by $-0.15 + (n_1 - 1)0.045$, $-0.15 + (n_2 - 1)0.045$ which is higher than zero for $n_1, n_2 \geq 4$. Whenever $n < 28$ and n_2 is at least 4, bridging two ally groups by only one link is efficient and pairwise stable structure.

Case 4: *[High Conflict: Segregated Ally Groups]*
Consider the case in which involving in conflict quietly diminish the value such that $w_2 = 6$. The value of a bridge between two groups is $(0.036n + 0.324n_1n_2 - 2.196)$. It is higher than zero for $n_1 \geq 3$ and $n_2 \geq 2$. However, for connected agents the value of the link will be $(-0.6 - (n_2 - 1)0.18)$ and $(-0.6 - (n_1 - 1)0.18)$ which are lower than zero for any n_1 and n_2. As a result, polarized ally groups is pairwise stable network structure but it is inefficient whenever $n_1 \geq 3$ and $n_2 \geq 2$.

Example 3.3.2. ***[Structure of the Stars]***
Star structure is generated if an agent receive relatively lower benefits from connection with an ally.

Case 1: *[Connected Peripheral Agents]*
If the difference between the valuation of ally and enemy is low and the decay is high enough, the efficiency requires connection of the conflicting agents. Consider the case where the value of a link is 1 while extra gain and loss are both 0.1, cost of a direct link is 0.24 and the decay is high such that $\delta = 0.7$. In this case $(w + w_1)\delta^2 > (w + w_1)\delta - c$. Since the total value decreases with distance, the efficient structure includes a star within each group. Any link with hub, say a peripheral agent of group 2 connect to center of group 1, changes value by $(0.0637n_1 - 0.2637)$ and it is higher than zero. However the hub will loose value of 0.051 which is not pairwise stable.
The value of the first link between two conflicting peripheral agent is $(0.2254n + 0.7546n_1n_2 - 0.4254)$ and it is greater than zero for $n_1, n_2 \geq 1$. For each additional link $L \geq n_2$ the link will shorten the path for only connected agents and for the hub through changing the path she uses. Accordingly, each additional one-to-one link generates value of 0.3234. At $L = n_2$ the center of first group has already maximize extra benefit through changing the path. Then the value of each link up to $L = n_1$ is (0.1744) and for $L > n_1$ the value will be (0.025). After that a hub will loose of (0.149) with linking any peripheral agent. Accordingly connected peripheral agents generate a pairwise stable network.
Another pairwise stable structure is the star where all peripheral enemies connected to both central nodes. After some calculations it is clear that the total value generated by peripheral connections network is higher by amount of $0.596 + 0.298n$ compared to hubs-based star structure.

Case 2: *Bridging Hubs*
Consider the case where any link has a value of 4 and cost of a direct connection is 1.5. Connection of allies increase the value of a link by a value of 2 and enemy decreases it by a value of 1. The value of the link decreases by %60 by distance. Between two ally stars, the highest value of the first link is $(-3.288 + 0.48n + 2.592n_1n_2)$. This is greater than zero for $n_1, n_2 > 1$. However the highest value of the second link is $(-3.168 - 0.216n)$. Accordingly efficient network has only one bridging link.
Moreover, the first link increases the value of both hubs by $(0.3+1.08(n_2-1))$ and $(0.3 + 1.08(n_1 - 1))$. A link between hub and an opposite periphery will decrease the value by (-1.05). As a result, the structure where the hubs are bridging two groups is pairwise stable and also efficient structure.

Case 3: *Isolated Stars*
Consider the case in Example 1 and suppose the cost of any link rises a value of 1.3. Now a bridge between two hubs generates additional value of $(-0.184n + 0.324n_1n_2 - 0.756)$. This value is greater than zero for $n_1, n_2 \geq 4$. However the positivity of the total value is generated through externalities. The link brings negative values for two connected agents since $(w - w_2)\delta - c < 0$. As a result, polarized star structure is pairwise stable but it is inefficient.

Example 3.3.3. [Isolated Nodes]

Case 1: *Inefficient Isolation*
Now consider the case described in previous case with $n_1 = 10$ and $n_2 = 8$ and cost of any link rises to 2.5. The value of the stars will be 26.28 and 12.88. All these positive effect is generated by externalities. The utility of the hub will increase if she breaks any link. In this case, empty network is pairwise stable but inefficient. Another pairwise stable network is a circle containing at least seven allies. The total value of the network will be 0.028 where everyone gains small amount but greater than zero. Severing a link will make individuals worst off approximately (-1.4). Additional link will also decrease the value of any agent. As a result a circle can generate inefficient pairwise stable structure.

Case 2: *Efficient Isolation*
Consider the similar case with rise of the cost to 4. This cost structure will make the value of the star negative. Moreover, the cost of connection is higher than any kind of compensation through externalities. As a result, the empty structure is uniquely efficient and pairwise stable structure.

3.4 Conclusion

The main aim of this chapter is characterizing the possible network structures under the existence of conflicts between agents. For this purpose, I extend the standard connections model including heterogeneity in value received from different agents. The valuation differentiates based on the consensus and conflicts on a given issue. Individuals communicate their perspective through communication. For simplicity, I assume that each agent only knows the perception of neighbors. Communication is costly. However, indirect contacts also generate value. Since one doesn't know the perception of indirect contacts, the value received from them adjusted by the perception of the bridging agent. The possible network structures discussed under different sizes of groups.

The main findings are compatible with standard connection models. For a wide variety of variables, there is a discrepancy between efficiency and stability. Although it is a highly stylized model, the findings are explanatory for several social phenomena. For instance, polarization is found to be efficient and sustainable for only small groups. For larger populations full polarization is inefficient. In this point, sufficient transfer payments may be analyzed to get further results. Even if the conflict has a depressing effect in which case the utility decreases with a direct contact, a society may encourage some people for becoming a bridge in return to some transfers.

A more dynamic environment would generate more interesting results. For instance what if a change in perceptions is possible? Or the awareness of a conflict necessitates a direct contact such that the people who contact with allies would not get an extra value as long as they meet with an enemy and only after that they value allies higher.

Although the model is quite simple, it is flexible to consider many other aspects of the problem. Moreover, it is obvious that network theory has more to say about interactions under the existence of social conflicts. There are much more to say when we consider the possibility of collective action and mobilization which can be subjects of the further studies.

Chapter 4

The Role of Pre-Existing Ties in A Given Network

4.1 Introduction

This chapter aims to construct a simple model including the arguments presented in the last section of the second chapter.

In the second chapter, I discuss the importance of network analysis for several aspects of social movements. Actually, the role of pre-existing ties has frequently stated in previous studies. However, the necessity of a broader perspective is obvious.

In the literature, social movements have defined in various ways. Accordingly, the focus of the studies varies. As stated in the second chapter, in general, American tradition has interested in "how movements are mobilized" whereas European studies are dominated by the interests on "why movements occur". The studies within each stream also differentiate in their focus and the methodology they use (see Della Porta & Diani (1999) for a detailed discussion on the concept). Despite all differences, the network mechanism or its components appear as a common factor.

A relevant critique to existing literature is the Western dominance in the analysis. Discussing the ecological movements in Japan, Broadbent (2003) criticizes Western theories as being inadequate for different types of societies. In general, Western countries are assumed to be relatively individualistic and diverse. In such a thin social context, recruitment is motivated by individual ideological or moral convictions. Dense and centralized networks are frequently described as the source of movements. Although these are found to be relevant for Western context, material and cultural bases of the individual rationality are claimed to be inadequate for Japan's vertical society. For a thick social context like in Japan, the social network structure is significant than individual relations. Social control sustained through local vertical networks and the relation between normal people and the leaders are deterministic. In short, the role of the networks as well as the actors' are different for different types of societies. The study suggests a social context in the form of networks and attributed individual roles as bridging factors.

Diani (2003) defines social movements as complex and quite heterogeneous network structures. Although there are studies implicitly analyzing social movements as networks, Diani's explicit definition is stimulating. While preceding studies focus primarily on pre-existing ties (personal or organizational) subsequent studies find this perspective incomplete. The existence of pre-existing links is not a distinctive factor at all. In real life, there are many people who linked with members of movements organizations but not taking part in any action. Due to the fact that the analysis is made only for participants, this fact is undermined.

Analyzing the movement recruitment process, Snow *et al.* (1980) makes specifications in relations. Empirical data he has analyzed demonstrates that network linkages are important in counting the differences in movements' recruitment. With a parallel concern, McAdam & Paulsen (1993) introduces "countervailing effects" in his analysis on Free Summer School. The study shows that the multiplicity of the ties has different impacts on the participation of agents. In this sense, some of the ties encourage participation whereas others have a discouraging effect. This study states that pre-existing ties significant only if there is strong identity linked with the movement in question. Similarly, Passy & Monsch (2014) classify movements based on their costs and showed the different effects of ties on participation to different forms of the protests. On the one hand, there is strong evidence on the fact that strong identity alone may not effective to generate movements. The construction workers have a strong identity but the absence of ties discourage them to mobilize even there was huge mobilization within working class in 1860s France (Gould, 1991). On the other hand, pre-existing ties are irrelevant for some movements like Hare Krishna (Snow *et al.*, 1980). What all these studies demonstrate is that people are convinced to use interaction as a resource for mobilization under certain conditions.

This chapter is motivated by the emphasis on the necessity and possibility of a new methodology using the tools of network theory (McAdam, 2003; Krinsky & Crossley, 2014). Networks are not only the factors but also products of the movements (Crossley, 2002). In short, there is a more complex relation between interaction process and social movements than it seems. Then, can we construct a general mechanism to understand the differential effect of interaction on movements? This chapter attempts to construct a general mechanism focusing on the questions raised in the second chapter. First of all, the basic model is constructed to analyze the conditions under which individuals use interaction as a resource of mobilization. Then, the basic model is extended to cover where and under what conditions these interaction taking place. At this point, multiplexity and positional heterogeneity are introduced, respectively.

The basic mechanism has inspired by the definition of Diani (1992, pp.17). Three basic components of social movements are described as networks of relations between the plurality of actors, collective identity, and conflictual issues. These are discussed in the following part separately. In this chapter, the plurality of identities equalized with different types of agents in terms of attitudes. Conflictual issues occur whenever opposite types emerge about a specific issue. This turns to be a conflict if they interact and willing to mobilize. On the other hand, the collective identity emerges as the same type of agents interacts.

The discussion in here will be limited to local interaction processes where face-to-face interaction is the main base [1]. Individuals communicate their identities through personal communication channels. Whenever an agent faces a conflict through interaction, she makes a strategic decision on using interaction as a resource of mobilization. In this regard, *conflicting agents* compare extension capability of a movement and any possible counter-movement before deciding to act. Whenever former greater than the latter, interaction becomes a resource of mobilization. Explicitly this shows the willingness of individuals to spend special effort for struggle and for mobilizing others for that struggle. In other words, using interaction as a resource for mobilization means people are willing to invest on relations for mobilization purposes. However, the analysis on investment decision is out of the scope of this paper. Instead, the analysis is limited whether the network structure encourages or discourage agents from investing.

[1] A conflict may emerge through an exogenous attack to a specific identity. Although this thesis interested only in endogenous clashes, further studies may extend the model including exogenous interventions.

The extended version of the basic model attempts to contribute discussions on the "new" types of the movements. The spatial characteristic of the communication is central. The findings of the Apolloni *et al.* (2009) supporting the importance of spheres in the flow of different information. The simulation they construct demonstrates that shopping and recreational activities are relevant in the diffusion of informal topics; while home, work or school are found to be significant in the diffusion of other issues. A more specific studies of Gould (1991, 1993) also constitute complementary results. In the 1860s, France had experienced huge working class movements. At that period, construction workers, while large in size, could not be organized for a labor strike. However, they were main actors in 1871 Paris Commune which Gould describes as neighborhood movement. On the other hand, foundry workers had experiences the contrary. By that time, technical developments in industry cause some branches to loose their control over skills. Construction was one of these branches. Therefore interaction among construction workers has broken in workplaces and thus they have established residential links through the neighborhood. Meanwhile, foundry workers were still enjoy clustering and interact through their worker identities. As a result, they were participants of labor movements of the 1860s but were unattached to Commune due to the lack of residential interaction. Gould describes this situation as a shift of mobilization process from trade to the neighborhood. Similarly, the studies of Castells (1983) points out the significance of residential interaction in the context of social movements.

On the basis of these discussions, I extend the basic model with introducing a multi-layer network structure. Individuals communicate different identities through links established in different spheres. I suggest that although the participants are important, it is the sphere that characterizes the forms of the movements. Furthermore, if links are resources and networks structure defines the boundaries of the usage of these resources, then these two can be used as a policy tool for encouraging or discouraging possible (counter-)movement. To discuss this, I extend the model by introducing inequality in opportunities and positional heterogeneity.

This chapter is constructed as follows. The next section discusses the methodology and introduces the general mechanism. The model is extended to the third and fourth sections. The chapter is concluded with a brief summary and further insights.

4.2 Definitions and Methodology

As stated above, Diani (1992, pp.17) defines three basic components of social movements as networks of relations between the plurality of actors, collective identity, and conflictual issues. In a similar manner, in this section, I make further comments on nodes, network structures, conflicting situations and collective identity.

4.2.1 Nodes

The agents are individuals within a society with a finite population $N = \{1, 2, ..., n\}$. Individuals are characterized by their identities. Most of the identities are hidden information that can be communicated only through interaction.

In each category, there are various types that one describes herself. For instance, gender is a category. Man, woman and LGBTI are three types within that category. Religion is another category which consists different types like Muslim, Jew, Christian, Atheist etc. Addition to these each identity may generate its own opposition. For instance, a conservative may define herself also as an anti-Communist.

Putting together, we can describe a society with a matrix of identities. Suppose there are $K = \{1, 2, ..., k\}$ categories and within each category there are t types. Matrix of identities is $\mathbb{I} = (\Gamma_{is_r}) \in \mathbb{R}^{n \times kt}$.

$$\mathbb{I}_{nk_t} = \begin{bmatrix} \Gamma_{11_1} & \Gamma_{11_2} & \dots & \Gamma_{11_t} & \Gamma_{12} & \dots & \Gamma_{1k_t} \\ \Gamma_{21_1} & \Gamma_{21_2} & \dots & \Gamma_{21_t} & \Gamma_{22} & \dots & \Gamma_{2k_t} \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ \Gamma_{n1_1} & \Gamma_{n1_2} & \dots & \Gamma_{n1_t} & \Gamma_{n2} & \dots & \Gamma_{nk_t} \end{bmatrix}$$

In $\mathbb{I}$, each row characterizes agent i and each column belongs to a type in a specific category. Γ_{is_r} shows the identity code of person i on type r within category s. Each entry of the matrix can take three possible values.

$$\Gamma_{is_r} = \begin{cases} = 0 \text{ if } i \text{ doesn't have any tendency on the type r} \\ = 1 \text{ if } i \text{ defines herself as } s_r \\ = -1 \text{ if } i \text{ defines herself as } anti - s_r \end{cases}$$

Example 4.2.1. Consider a society which shaped by three main identity categories such as gender, religion and political view. Suppose three different types are defined within each category such that $K_1 = \{woman, man, LGBTI\}$,

$K_2 = \{Christian, Muslim, Jew\}$ and $K_3 = \{Nationalist, Liberal, Socialist\}$.
Matrix Notation
Identities of each individual can be listed as
$\mathbb{I}_i = \{(k_{11}, k_{12}, k_{13}), (k_{21}, k_{22}, k_{23}), (k_{31}, k_{32}, k_{33})\}$ such that

$$K_1 = \begin{cases} k_{11}, & \text{for } woman \\ k_{12}, & \text{for } man \\ k_{13}, & \text{for } LGBTI \end{cases} \quad K_2 = \begin{cases} k_{21}, & \text{for } Christian \\ k_{22}, & \text{for } Muslim \\ k_{23}, & \text{for } Jew \end{cases} \quad K_3 = \begin{cases} k_{31}, & \text{for } Nationalist \\ k_{32}, & \text{for } Liberal \\ k_{33}, & \text{for } Socialist \end{cases}$$

Consider two people who describes themselves as a Muslim and Nationalist Man who oppose LGBTI; a non-Muslims and Socialist and LGBTI who have no tendency on religion but oppose Nationalists. The identities of each person can be listed as:
$\mathbb{I}_1 = \{(0, 1, -1), (-1, 1, -1), (1, 0, -1)\}$ and $\mathbb{I}_2 = \{(0, 0, 1), (0, 0, 0), (-1, 0, 0)\}$.
Similarly, the identity matrix of these two people can be written as a 2×9 matrix such that

$$\mathbb{I}_{23_3} = \begin{bmatrix} 1 & 0 & -1 & -1 & 1 & -1 & 1 & 0 & -1 \\ 0 & 0 & 1 & 0 & 0 & 0 & -1 & 0 & 0 \end{bmatrix}$$

Additionally, each category can be defined with sub-matrix such that

$$\mathbb{K}^1 = \begin{bmatrix} 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix} \quad \mathbb{K}^2 = \begin{bmatrix} -1 & 1 & -1 \\ 0 & 0 & 0 \end{bmatrix} \quad \mathbb{K}^3 = \begin{bmatrix} 1 & 0 & -1 \\ -1 & 0 & 0 \end{bmatrix}$$

States of The World

Whenever the identities of the individuals affect the decisions and resultant pay-off, there is incomplete information problem.

Lemma 4.2.1. For each category with t types, there are $2^t \binom{t+2}{2}$ possible states a person can define herself.

Proof. Take the example of a category: Religion. First of all, for a person Muslim and Christian can not exist together while anti-Muslim and anti-Christian can. Moreover, one can not define herself both Muslim and anti Muslim.
Formally:
1. A type is exclusive such that a person has at most one 1 within a category.
2. Opposite and absentee is inclusive such that there may be many -1s or 0s within a category.
3. Inclusion of an identity and opposition is incoherent, and don't counted.

If there exist a type r such that $i_{1_r} = 1$, there are $t2^{t-1}$ possibilities. Furthermore, there are 2^t more possibilities in case of no $i_{1_r} = 1$. As a result, there are $(t2^{t-1}) + 2^t$ possible state for an individual define herself within a category.

$\square$

Lemma 4.2.2. If t_k shows the number of the types within a category k of total K category, then there are $\left[\prod_{k=1}^{K} 2^{t_k}\left(\frac{t_k+2}{2}\right)\right]^N$ possible states in a society with a finite population N.

In many cases, people get signals about identities of others. They may be strong or weak, true or false. Moreover, the observability of a specific characteristic is obviously contextual. For instance, individuals may not able to observe the employment status of people in the neighborhood, but it is probably common knowledge within a working place. On the other hand, several issues necessitate interaction. Social movements are frequently constructed around these kinds of issues consisting political view, religion, a specific idea on a policy etc. This leads to a simplifying assumption.

Assumption 4.2.1. Individuals communicate their identities through interaction.

Accordingly, network structure defines the information one can gather about other's identities.

4.2.2 Network Structure

As people learn other's identities through communication, links become a relevant source for gathering information. In fact, in most of the cases, the network structure limits the information base of each person.

The personal network of an individuals is represented by a graph $G(N, g)$ where $N = \{1, 2, ..., n\}$. $g = [g_{ij}]_{i,j \in N}$ is a square matrix where $g_{ij} \in 0, 1$ represents the availability of an edge from person i to person j. Directed form can be significant on analysis of mediated interaction. Since the thesis interested in local interaction through face-to-face communication channels, undirected networks are used. On the other hand, weighted form may be essential if for instance at least a certain amount of time is necessary for individuals to communicate their identities. Obviously, the time spends together to deepen the interaction among people and may increase the information about each other. In the case, where we split the characteristics of individuals into several pieces, the existence of a link indicates communication on a specific category. As a result, the unweighted form is also sufficient.

To sum up, identities of individuals in specific categories are communicated through unweighted undirected links. The relations within a society can be shown in a matrix form such that

$$G_{ij} = \begin{bmatrix} g_{11} & g_{12} & g_{13} & \cdots & g_{1n} \\ g_{21} & g_{22} & g_{23} & \cdots & g_{2n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ g_{n1} & g_{n2} & g_{n3} & \cdots & g_{nn} \end{bmatrix}$$

Assumption 4.2.2. Through personal network individuals are able to learn:
1. k_j for all $j \in B_i(g)$
2. g_{jk} for all $j, k \in B_i(g)$

The first part of the assumption 4.2.2 indicates that each agent learns the identity of direct contacts through personal network. Following Chwe (1999, 2000), the second one indicates that each agent also knows the relations among two neighbors.

Indifferent States
Denote the possible states for an individual by $\mathbb{K}$. When the actual state of the status is $\theta \in \Theta$, i only knows that the state of the world is in the set $\mathbb{P}_i(\theta) = \{(\theta_{B(i)}, \phi_{N-B(i)}) : \phi_{N-B(i)} \in \{\mathbb{K}\}^{n-\#B(i)}\}$. Taken together, the sets $\{\mathbb{P}_i(\theta)\}_{\theta\in\Theta}$ forms a partition of Θ, which we denote by $\mathscr{P}_i$. If two states are in same element of the partition $\mathscr{P}_i$, then person i cannot distinguish between them, and hence constructs same belief in either states (Chwe, 2000).

Example 4.2.2. [Incomplete Information]
Suppose $N = 3$, $K = 1$ which denoted by a and have three types such that $k_a = \{a_1, a_2, a_3\}$. Consider the actual state of identities and network are given by $\theta = \{(1, 0, -1), (-1, 1, 0), (-1, 0, 1)\}$ and $g = \{12, 13\}$, respectively. The network structure is shown in Figure 4.1, where $\mathbb{I}_i$ shows the personal identity of i.
Any Γ_{i1} have 20 possible codes so $|\Theta| = [20]^3$. Given the network structure, person 1 knows the actual state:
$\mathscr{P}_1 = \{(1, 0, -1), (-1, 1, 0), (-1, 0, 1)\}$. However $|\mathscr{P}_2| = |\mathscr{P}_3| = 20^2$ and they are unable to distinguish between these states.

In information sharing literature, frequently, it is assumed that people benefit from the connection with different identities. They use the advantage of flowing of information on different issues. However, the existence

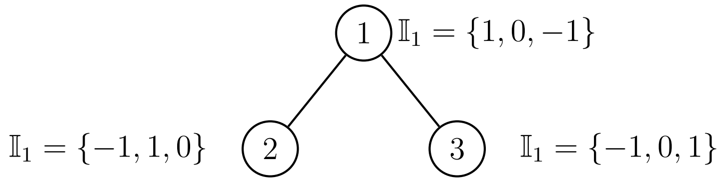

Figure 4.1: Network Structure with Different Identities

of conflicting situation alters the situation. Interaction between conflicting agents is not desired at all, since conflict may prevent the flow of any information and even lead to occurrence of the clashes.

4.2.3 Conflicting Situation

As discussed above, opposites may accompany each other. Since identities are contextual, opposites may not always meet in the same sphere. In this point, several concepts should be clarified.

Within a society:
1. *conflicting possibility* occurs if there are individuals with opposite identity codes within the same category.
2. *conflicting issue* emerges if at least one side is aware of this possibility.
3. *conflicting situation/ clash* necessitates awareness of both sides. [2]

Formally, conflicting possibility occurs if there $\exists\ i, j \in N$ such that $(\Gamma_{it})_k = -(\Gamma_{jt})_k$ where $k \in K$ and t denotes the type. Conflicting issue appears if $g_{ij} = 1$ or/and $g_{ji} = 1$ and a clash occurs if $g_{ij} = g_{ji} = 1$.

Alternatively, we can say that whenever $\Gamma_{it} \times \Gamma_{jt} = -1$ there is a conflicting possibility. Conflicting issue occurs if $g_{ij} = 1$ or $g_{ji} = 1$ and these two sides clashes if $g_{ij} = g_{ji} = 1$.

Outer product is used to characterize the conflicts. If $\mathbb{I}_s$ denotes the column vector of identity $s \in k$, the conflicting possibility can be derived from $C^s_{ij} = [\mathbb{I}_s] \otimes [\mathbb{I}_s]^T$. This equation shows conflicting possibility of any pairs i and j on category s. Note that conflicting matrix is a symmetric square matrix. If c_{ij} denotes the conflicting possibility of i with j; $c_{ij} = c_{ji}$. Conflicting issue appears for j if $c_{ij} g_{ij} = -1$ and clash between two individuals

[2]Note that, in this chapter, conflicting issue and a clash have the same meaning due to the usage of undirected relations.

will emerge if $c_{ij}g_{ij} = c_{ji}g_{ji} = -1$.

This chapter interested in the clashes emerges in a local environment. However, one should note that this is not the only way a clash may emerge. For instance, an attack to a specific identity or emergence of a new type opposing existing norm (Turner & Killian, 1987) can be a source for some kind of anti-systemic movements.

A clash is a necessary but not a sufficient condition for emergence of a social movement or participation of agent to a movement. Mobilization is a strategic decision defined by the boundaries of collective identity.

4.2.4 Collective Identity

Diani (1992, pp.9) defines *"the boundaries of social movement networks as the shared identities of actors involved in the interaction"*. This definition signs the importance of similar identities of individuals on the expansion of a clash to a movement. There are studies criticizing this perspective. For instance, Broadbent (2003) refers to the importance of the positions of individuals especially in vertical societies like Japan. It is claimed that collective identity may not be the summation of individual identities but something culturally shaped. In horizontal societies like Western countries, individual preferences and similarities may be deceiving while in vertical societies relational explanations are more powerful.

If it is the proportion of population sharing the same identity that defines the boundaries of collective identity, then the number of links are more relevant than positions. Otherwise, the positional hierarchy will be decisive. A broader theory should be explanatory for both cases.

In both cases, we should define a mechanism under which individuals decide to use interaction as a resource for mobilization. The existence of incomplete information force people to predict boundaries of the size of shared identities. In a dialectic environment, people should consider also the boundaries of possible counter-movement. If network conditions assure an agent that a counter-movement is more probable, she is discouraged to use interactions as a resource. In horizontal-like structures, the number of neighbors becomes significant in collective identity construction. In vertical-like societies, the identities of hierarchical advantageous groups become more significant.

The basic model will be constructed for anonymous nodes. The hierarchy among individuals is introduced in the extended version.

4.3 Analysis Under Incomplete Information

When two opposite agents linked, before considerations on mobilization each will measure the power of the other side. If one believes the opposite have relational dominance then she would prefer not to make any opposing behavior. At the same time if the partner believes the opposition is dominated, then she would like to act oppose to others.

However, agents don't have full information on others. As a result, each will construct beliefs on others based on their local knowledge.

Assumption 4.3.1. Individuals are identical except their identity codes and it is a common knowledge.

Ceteris paribus, identity codes of individuals are distinctive features. This assumption is relaxed when I discuss the positional heterogeneity.

4.3.1 Construction of Beliefs

Before any mobilization decision, agents should construct their beliefs on the dominance of the opposition. Denote P_{ii} as i's own-belief and P_{ij} as i's belief on j. These measures represent the possible size of the bases of each side. Whenever $P_{ii} < P_{ij}$, agent i thinks the base for opposition is larger. Accordingly she is not willing to use her interactions as a resource of any mobilization purposes. Otherwise, she believes her identity has a larger base and willing to use her interactions for mobilization purposes.

I specify this function as a product of two variables. One measures the proportion of information one is able to reach defined as informational dominance and the other stands for the numbers of possible allies and enemies defined as dominance in size.

Informational Dominance

Each agent aware of the fact that she has local knowledge and she makes decisions under incomplete information. At this point, I introduce link degree centrality as a modification of the degree centrality. Based on the second part of the Assumption 4.2.2, the degree centrality is not sufficient to measure informational dominance of an agent. Since dominance is a relative measure, it is important to know the relations of the others.

Definition 4.3.1. The link degree centrality can be formalized as $\zeta_i = \frac{\binom{\#B_i(g)+1}{2}+(N-\#B_i(g)-1)}{\binom{N}{2}}$ where $\#B_i(g)$ is the number of neighbors of agent i under network g.

Example 4.3.1. Suppose there are five individuals and the relations are shown in Figure 4.2. Agent 1 has information on the type of agent $2, 3$ and 4 and aware of the fact that she has no information about the type of agent 5. Moreover, she also knows that $3, 4$; $3, 2$ and $2, 4$ don't know the type of each other. In the case of the complete graph, where everyone knows each other, the amount of knowledge quantified by 10. Under this network structure, agent 1 knows 6 of these 10 quantities. On the other hand, agent 2 only knows agent 1 and aware that she doesn't know $3, 4$ and 5. Accordingly, she has knowledge of 4 over 10 quantities. As a result, the link degree centralities of agents 1 and 2 are calculated as $\zeta_1 = \zeta_{11} = 0.6$ and $\zeta_2 = \zeta_{22} = 0.4$.

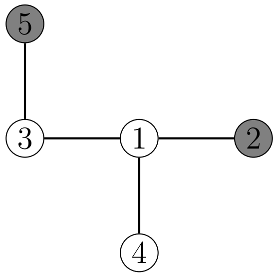

Figure 4.2: Calculation of Link- Degree Centrality

If link degree centrality is 1, the agent is completely connected and knows the identities of all others.

On the other hand, an individual may not know the real link degree of the others. Accordingly, if there exists $z \in N : g_{jz} = 0$, there are two options. Either $g_{iz} = 1$ or $g_{iz} = 0$. Agent i can predict the link centrality of agent j based on local knowledge about the network structure. The belief of agent i on the link centrality of j is denoted by ζ'_{ij}.

Dominance on Size

The first component interested only in the information on the interaction but not with the types of the others. The second component is a function of the size of allies and enemies within a society.

Definition 4.3.2. [f function]
Suppose $A = |j : k_j = k_i|$ and $B = |j : k_j = -k_i|$ such that $A + B \leq N$, then the size dominance can be defined by $f(A, B)$. f is derived as an increasing function of supporters and decreasing function of the threats such that $f_A > 0$ and $f_B < 0$. In other words, these inequalities holds:

1. $f(A', B) > f(A, B)$ if $A' > A$.
2. $f(A, B') < f(A, B)$ if $B' > B$.

Again, agents calculate f for both a movement and a possible counter-movement. f_{ii} represents the belief of i on own size dominance while f_{ij} shows the belief of i on j's size dominance.

Definition 4.3.3. [Beliefs on Dominance]
Whenever $ij \in g$ and $k_i = -k_j$;

$$P_{ii} = \zeta_{ii} f_{ii} \tag{4.1}$$

$$P_{ij} = \zeta'_{ij} f_{ij} \tag{4.2}$$

Risk Aversion

Consider a conflicting partner such that $k_i = 1$, $k_j = -1$ and $g_{ij} = 1$. Moreover suppose $\exists z : k_z = 1$ and $z \notin B_j(g)$. Figure 4.3 shows the agent j's belief on z and her beliefs on beliefs of i on z . Actually, agent j is unable to differentiate between 12 cases shown in the Figure 4.3. Then how will she decide?

Table 4.1 shows the beliefs of j for each cases when both i and j are connected with others except z. For each case, j compares the possible dominance of own and conflicting partner. When there are many agents that are not connected with any of the conflicting nodes, things are getting complicated. Instead, an commonly stated assumption will simplify our analyzes.

Assumption 4.3.2. Individuals are risk-averse such that when they could not distinguish the states, they behave as if they are in the worst case.

Under this assumption, agent j compares the lowest P_{jj} with the highest P_{ji} among possible states. Accordingly, Case 1 generates the lowest value for P_{jj}. Under this case the highest $P_{ji} = f(a+1, b)$. This is another way to say that, if there exists $z \in N : g_{jz} = 0$ then j will assume that $k_z = -k_j$ and $g_{iz} = 1$.

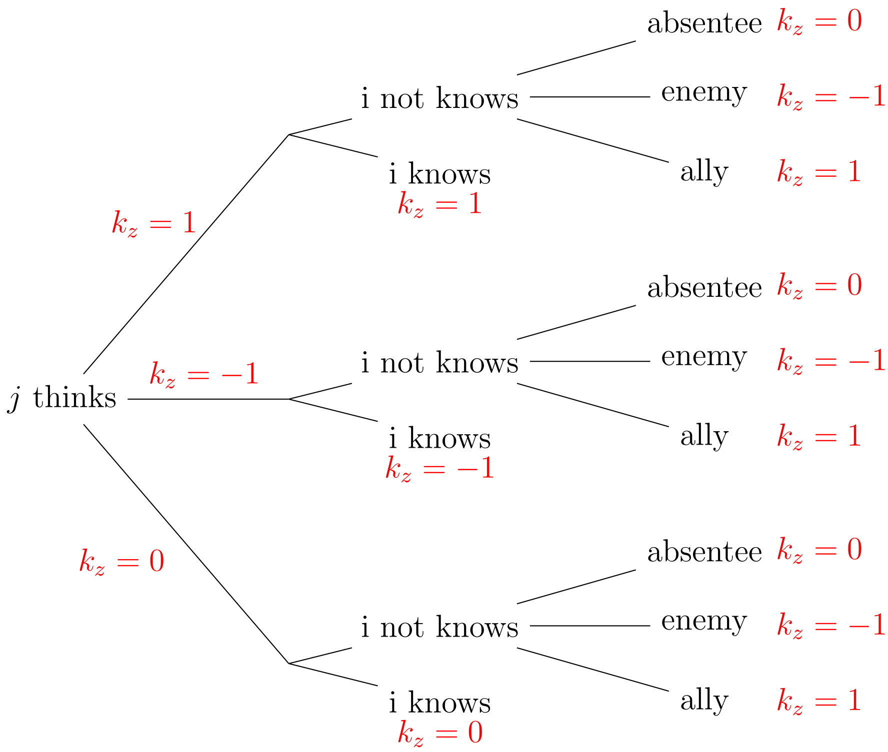

Figure 4.3: Construction of Beliefs, actual state $k_z = 1$

Definition 4.3.4. [Decision Making]
An agent would not prefer to use pre-existing ties as a resource for mobilization if $minP_{ii} < max(P_{ij})$.

Dominance Under Risk-Aversion

Now, we can make a more concrete definition about the beliefs on dominance of each agent.
Suppose there are N people in a society. Person i and person j have a conflict such that $k_i = -k_j =$ and $g_{ij} = 1$. Denote the relevant variables such that:
1. $n_i = \#\Big(B_i(g)\Big)$,
2. $n_{ij} = \#\Big(B_i(g) \cap B_j(g)\Big)$
3. $n_{ii} = \#\Big((B_i(g) \setminus B_j(g)\Big)$
4. Lastly, put * for ally and $^\circ$ for enemy such that n_i^* shows the number of the same identity neighbors of i and n_i° shows the number of the opposite identity neighbors of i.

Cases	P_{jj}	P_{ji}
CASE 1: $k_z = 1$	$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(b, a+1)$	$f(a+1, b)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a, b)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a, b+1)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a+1, b)$
CASE 2: $k_z = -1$	$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(b+1, a)$	$f(a, b+1)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a, b)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a, b+1)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a+1, b)$
CASE 3: $k_z = 0$	$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(b, a)$	$f(a, b)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a, b)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a, b+1)$
		$\frac{\binom{N-1}{2}+1}{\binom{N}{2}} f(a+1, b)$

Table 4.1: Comparison of Dominance by Agent j

Then:

$$P_{ii} = \left(\frac{\binom{n_i+1}{2} + (N - n_{i)}}{\binom{N}{2}} \right) f(n_i^* + 1, (N - n_i^*)) \tag{4.3}$$

$$P_{ij} = \left(\frac{\binom{N-n_i+n_{ij}}{2} + (n_i - n_{ij})}{\binom{N}{2}} \right) f(n_{ij}^\circ + N - n_i + 1, n_{ij}^* + (n_i - n_{ij})) \tag{4.4}$$

Under given specifications and assumptions, agent i compares these two measures before deciding to use interaction as a resource for mobilization. In the same line, the conflicting partner will also compute these two measures based on her personal network and resultant beliefs.

4.3.2 Analysis

First, I examine the conditions under which the structure encourage or discourage usage of interaction as a resource for mobilization against opposition.

One Category One Type Case

This part analysis the case when individuals differentiate only in a specific category. If there are k types within a specific category, conflicting possibility over each type is separately derived from

$$C_{ij}^{t} = \begin{bmatrix} \Gamma_{1t}\Gamma_{1t} & \Gamma_{1t}\Gamma_{2t} & \dots & \Gamma_{1t}\Gamma_{nt} \\ \Gamma_{2t}\Gamma_{1t} & \Gamma_{2t}\Gamma_{2t} & \dots & \Gamma_{2t}\Gamma_{nt} \\ \dots & \dots & \dots & \dots \\ \Gamma_{nt}\Gamma_{1t} & \Gamma_{nt}\Gamma_{2t} & \dots & \Gamma_{nt}\Gamma_{nt} \end{bmatrix}$$

Each entry of C_{ij}^{t} shows the conflicting possibility between two agents over the specific type.
We can rewrite the conflicting possibility for each person $C_{tj} = (c_{tj})_{k\times n}$ such that

$$C_{tj}^{i} = \begin{bmatrix} \Gamma_{i1}\Gamma_{11} & \Gamma_{i1}\Gamma_{21} & \dots & \Gamma_{i1}\Gamma_{n1} \\ \Gamma_{i2}\Gamma_{12} & \Gamma_{i2}\Gamma_{22} & \dots & \Gamma_{i2}\Gamma_{n2} \\ \dots & \dots & \dots & \dots \\ \Gamma_{ik}\Gamma_{1k} & \Gamma_{ik}\Gamma_{2k} & \dots & \Gamma_{ik}\Gamma_{nk} \end{bmatrix}$$

Each entry of C_{tj}^{i} shows the conflicting possibility of an individual i with each j over different types.

For simplicity, I start with a one type and two sides assumption.

Assumption 4.3.3. There is only one type and individuals identify themselves with same or opposite of that type.

Example 4.3.2. [$K = 1, t = 1$]:
Suppose $N = 10$, $K = 1$ and there is only one type such that $t = 1$. Under assumption 4.3.3, individuals either support the type or oppose it. There are 2^{10} possible states of the world. Suppose the identity matrix is given by

$$\mathbb{I}' = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \\ -1 \end{bmatrix}$$

The first four individuals have same type and the other six are opposites. The conflicting possibility is defined with outer product of $\mathbb{I}'$ such that $C = [\mathbb{I}'][\mathbb{I}']^T$.
C is a 10×10 matrix such that $C = (c_{ij})_{10\times 10}$ and;

$$C_{ij} = \begin{bmatrix} 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 & -1 & -1 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

Among these possibilities, existence of a conflict depends on the network structure. Suppose the network structure is $G'_{ij} = (g_{ij})_{10\times 10}$.

$$G'_{ij} = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

The $n \times n$ clash matrix will be defined as $\mathbb{C} = [c_{ij}g_{ij}]$ such that

$$\mathbb{C} = \begin{bmatrix} 1 & 0 & 1 & 1 & \mathbf{-1} & \mathbf{-1} & \mathbf{-1} & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & \mathbf{-1} & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & \mathbf{-1} & 0 & 0 & 0 \\ \mathbf{-1} & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\ \mathbf{-1} & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ \mathbf{-1} & \mathbf{-1} & 0 & \mathbf{-1} & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

The conflict appears between $\mathbb{C} = \{(1,5),(1,6),(1,7),(2,7),(4,7)\}$ as shown in Figure 4.4 with red lines. Nodes $3, 8, 9, 10$ have no conflicting link.

Based on the local information, we can define f_{ii} and f_{ij} for all conflicting

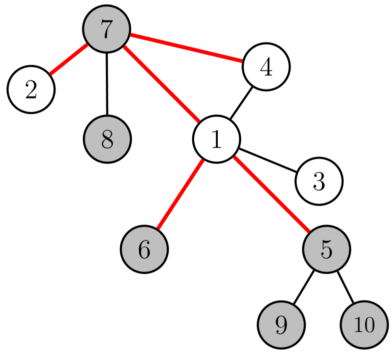

Figure 4.4: Representation of Conflicts

situations:

For $i = 1$: $f_{11} = f(3,7)$; $f_{15} = f(5,5)$; $f_{16} = f(5,5)$; $f_{17} = f(5,5)$.
For $i = 2$: $f_{22} = f(1,9)$; $f_{27} = f(9,1)$.
For $i = 4$: $f_{44} = f(2,8)$; $f_{47} = f(8,2)$.
For $i = 5$: $f_{55} = f(3,7)$; $f_{51} = f(7,3)$.
For $i = 6$: $f_{66} = f(1,9)$; $f_{61} = f(9,1)$.
For $i = 7$: $f_{77} = f(2,8)$; $f_{71} = f(7,3)$; $f_{72} = (6,4)$; $f_{74} = (7,3)$.
In terms of beliefs on participants, interaction is not a resource for any of the agents since in all cases $f_{ij} \geq f_{ii}$

[**Link Degree Centrality**]
As discussed above, these functions will be modified with link degree centrality measure. When there are 10 individuals, we can define 45 possible pair-wise links. Any agent knows own-links, whether a neighbor linked with other neighbour and given the size of population the links absent in her personal network. Table 4.2 represents the links degree centrality of the conflicting agents.

We can also calculate the link degree centrality of other agents. $\zeta_8 = \zeta_3 = \zeta_9 = \zeta_{10} = \frac{9}{45}$.

Now we can calculate the dominance measures used in decision making process.
For $i = 1$: $P_{11} = 0.42f(3,7), P_{15} = 0.42f(5,5), P_{16} = 0.42f(5,5), P_{17} =$

ζ	1	2	4	5	6	7
1	0.42	NL	ally	0.42	0.42	0.53
2	NL	0.2	NL	NL	NL	1
4	ally	NL	0.22	NL	NL	1
5	0.66	NL	NL	0.27	NL	NL
6	1	NL	NL	NL	0.2	NL
7	0.66	0.51	0.66	NL	NL	0.33

Table 4.2: Link Degree Centrality of Conflicting Agents

$0.53f(5,5)$
For $i = 2$: $P_{22} = 0.2f(1,9); P_{27} = f(9,1)$.
For $i = 4$: $P_{44} = 0.22f(2,8); P_{47} = f(8,2)$.
For $i = 5$: $P_{55} = 0.27f(3,7); P_{51} = 0.66f(7,3)$.
For $i = 6$: $P_{66} = 0.2f(1,9); P_{61} = f(9,1)$.
For $i = 7$: $P_{77} = 0.33f(2,8); P_{71} = 0.66f(7,3); P_{72} = 0.51f(6,4); P_{73} = 0.66f(7,3)$.
For any specification of f, for all agents $P_{ii} < P_{ij}$. This mechanism suggest that under g and $\mathbb{I}$ no one willing to use interaction as a resource.

Example 4.3.1 suggests that any link with the opposition increases the informational dominance but may decrease agent's beliefs on the informational dominance of opposing agents with whom she is not linked. On the other hand, link with an ally increases both informational and size dominance of any agent. At the same time, it may decrease the informational and size dominance of the opposing agents with whom she is not linked in reality.

Now, consider the case where there is still one category with more than one type.

Example 4.3.3. $[K = 1, t > 1]$
Suppose $N = 5$, $K = 1$ and $t = 3$ ans types are denoted by a_1, a_2, a_3. Moreover, suppose the extended form of matrix of identities is

$$\mathbb{I}_{53} = \begin{bmatrix} 1 & -1 & -1 \\ 0 & 1 & -1 \\ -1 & -1 & 1 \\ 0 & 0 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

and the undirected network is listed as $\{12, 14, 15, 23\}$. Each i calculates the dominance for each type separately. The network among individuals for each type is drawn in Figure 4.5.

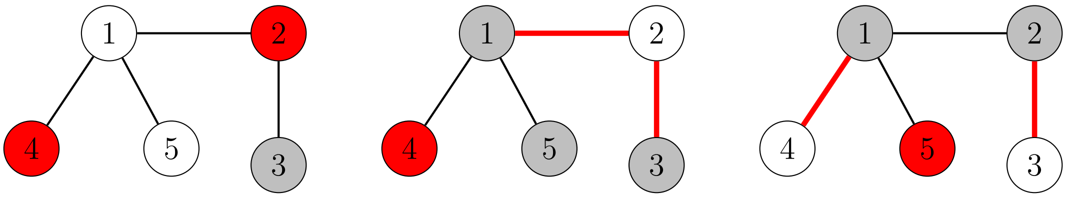

Figure 4.5: Conflicting Issues in 3-Type Category

For $t = 1$: $P_{11} = P_{1j} = 0$; $P_{22} = P_{2j} = 0$; $P_{33} = P_{3j} = 0$; $P_{44} = P_{4j} = 0$; $P_{55} = P_{5j} = 0$. Since conflicting agents don't interact under given structure; type 1 does not generate a conflict among the society.

For $t = 2$: $P_{11} = 0.7f(2, 2)$ $P_{12} = 0.5f(2, 3)$; $P_{22} = 0.5f(1, 4)$ $P_{21} = P_{23} = 0.7f(3, 2)$; $P_{33} = 0.4f(1, 4)$ $P_{32} = f(4, 1)$; . Person 1 is willing to use interaction as a resource for an action against type 2.

For $t = 3$: $P_{11} = 0.7f(2, 2)$ $P_{14} = 0.7f(2, 3)$; $P_{22} = 0.5f(2, 3)$ $P_{23} = 0.7f(3, 2)$; $P_{33} = 0.4f(1, 4)$ $P_{32} = f(1, 4)$; Person 1 is also willing to use interaction as a resource for movement against type 3.

In the example, only person 1 is willing to use interaction as a resource for an action opposing types 2 and 3. On the other hand, there is no conflicting issue on type 1.
The application of this example is as follows. Suppose the category reflects the identities on political views where type 1 is Nationalism, type 2 is Liberalism and type 3 is Socialism. Under this structure no one will use interactions as a resource for or anti-Nationalist action; but agent 1 is willing to use her interaction as a resource against Liberalism and Socialism.

Introduction of Multiplexity

The extension of the model so as to examine multiple issues communicated in multiple spheres sheds light on significant questions. For instance, why people mobilize around some issues but not others although the latter may be more populated or more relevant?

Example 4.3.4. $[K = 3, t = 1]$
Consider a society consisting 14 agents. The communication structure of the

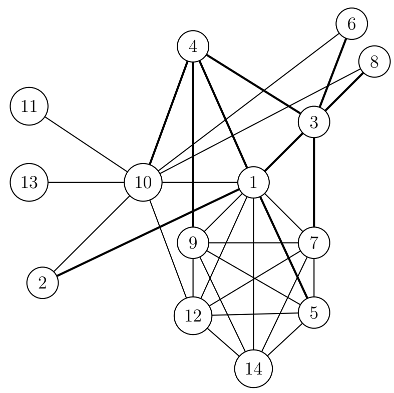

Figure 4.6: Network Structure of a Society- unified

society is shown in Figure 4.5.
In here the relations are taken as anonymous even if they reflect different categories. Suppose the context includes three different categories or equivalently interaction takes place in three different spheres. Presume the structure of interaction in each sphere is shown in Figure 4.7. In addition, suppose there

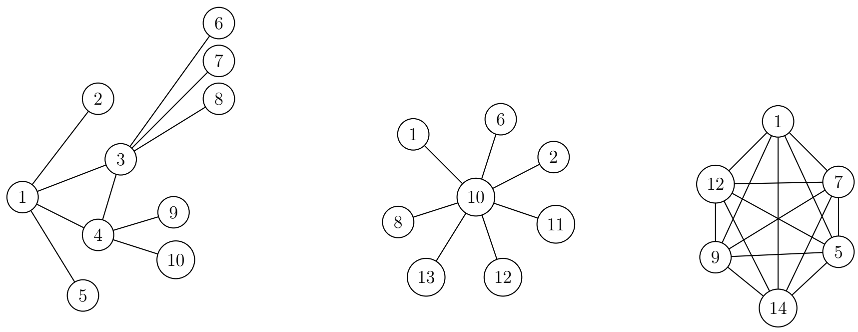

Figure 4.7: Network Structure of a Society- relations in 3-spheres

is only one type in each category and the identities are figured out in Figure 4.8. In the first case, although there is a size dominance of one type, information dominance of $3, 4$ discourage them from acting. Moreover, if for instance agent 3 linked with 9 and 10, under a certain f function agent 3 may be willing to use informational dominance as a source for an act against others. In the second case, again the informational dominance of 10 discourage populated group to act while encouraging her. Lastly, in the complete graph case, the size dominance encourage the crowded group to act. This mechanism can shed light on a controversial understanding. Consider we unify the relations and identities of whole society within one sphere as shown in Figure

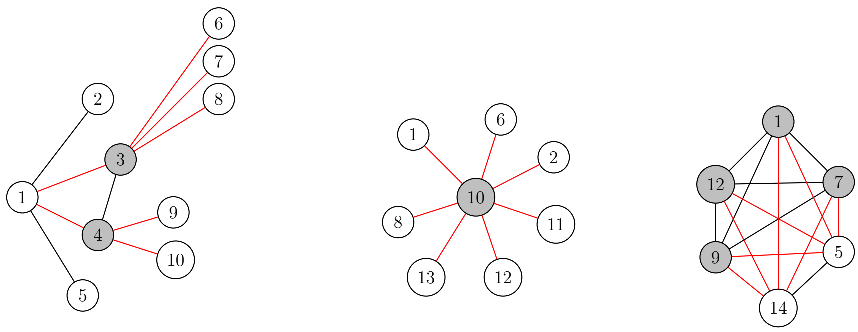

Figure 4.8: Representation of Clashes - different spheres

4.9.

Take the conflicting relation between 10 and 1 generated in sphere 2. Under

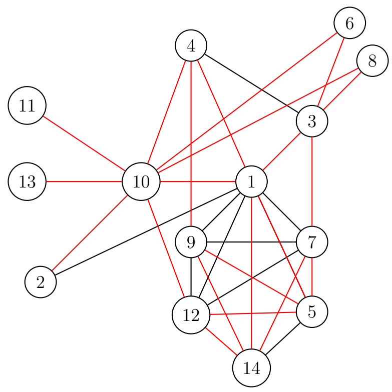

Figure 4.9: Representation of Clashes - unified

unification, 1 and 2 are seen to be allies due to relations in the first sphere although they do not interacted in category 2. Moreover, both 1 and 10 consider 4 as enemies again based on the relations in the first sphere. Under these conditions $P_{10,10} = 0.42f(1,8)$ while $P_{10,1} = 0.42f(8,6)$. Accordingly, we can conclude that 10 is not willing to use interaction as a resource against opposition. However, she is willing to use them in Sphere 2. Similar analysis can be made for the agents in Sphere 3. In other words, when we check the unified interaction we may fail to predict the willingness of the agents on mobilization. This generates a controversial situation and we can improve the understanding through spatial analysis.

We can conclude this part with summarizing the main findings of this very basic mechanism.

Proposition 6. Suppose there exist $i, j \in N$ such that $k_i = -k_j$ and $g_{ij} = 1$:
1. Complete network encourages the populated groups for action.
2. Independent of the size of allies or enemies, star structure encourages the central agent for action and discourages any other agents.
3. Within any partially connected structure, agents need some minimum amount of links to become willing for any action.

Proof. For the first case, it is obvious that everyone knows everyone has link centrality of 1. Since the size dominance is decisive, complete graph will encourage populated group to act.
Under star structure, the central agent i has link degree centrality of 1 and all others also believe this such that $\zeta'_{ji} = 1 \; \forall j$. Moreover $\zeta_{jj} = \frac{2}{N} = \zeta'_{ij}$. In terms of size dominance i believes that $f_{ij} = f(1, N-1) \; \forall j$. In the extreme case which produces lowest value for f_{ii}, it is equal to $f(1, N-1)$. As a result, in any case $P_{ii} > P_{ij}$. Furthermore star structure will also discourage opposition such that $f_{jj} = (1, N-1)$ and $f_{ji} = (N-1, 1)$ for any j.
The last case has already discussed in Example 4.3.1 and Example 4.3.3.
□

4.4 A Model for Mobilization

In this part, I take the mobilization as a demand for a transfer of value generated through the links between two conflicting partners.

The value is generated through costly direct links and indirect benefits. Assume that in the absence of any conflict, each agent gets the value it generates whereas conflicts create opportunity for value transfers.

In fact this is an extraction mechanism and the mechanism can be summarized as follows. A conflicting partner who believes she is dominant enough will use the propagation mechanism for a value transfer. If the partner also believes to the dominance of partner, she would not prefer others' to learn her identity. Otherwise they may also extract value from her. Roughly speaking, the dominant agent will say "I will not propagate other's against you, if you give me some part of the value". If the partner believes, she can, then she is willing to make the transfer. Even if partner doesn't demand, if one believes her dominance, she may willing for a transfer for not to face with an organized counter-movement.

I construct the utility function of each agent similar to the connection model discussed in Chapter 3.

$$u_i(g) = \sum_{j:j\in N} w\delta^{d_{ij}} - \sum_{j:ij\in g} c + \sum \tau_i \tag{4.5}$$

where $0 < \tau_i < 1$ shows the transfers defined below. Consider $i, j \in N$ such that $k_i = -k_j$

$$\tau_i(g) = \begin{cases} = 0 \text{ if } P_{ii} < P_{ij} \text{ and } P_{jj} < P_{ji} \\ = \alpha w \text{ if } P_{ii} > P_{ij} \text{ and } P_{jj} < P_{ji} \\ = -\alpha w \text{ if } P_{ii} < P_{ij} \text{ and } P_{jj} > P_{ji} \end{cases}$$

Efficiency

Definition 4.4.1. g is uniquely strong efficient network if $\sum_i u_i(g) \geq \sum_i u_i(g')$ for all $g' \in g^N$.

Proposition 7. If $c < w\delta - \delta^2$, the completely connected structure g^N is the uniquely efficient network.

Proof. By construction, any conflict is just generates opportunity for transfer of the value and does not change the total value generated. Contribution of a link to total value is at least $2(w\delta - c - \delta^2)$. If this is higher than zero, the complete structure is the uniquely efficient structure.

□

Stability

It is assumed that, transactions due to the beliefs of conflicts generate instability in the society even if they may be pairwise stable. Accordingly I define societally stability.

Definition 4.4.2. The network g is societally stable if no one motivated to demand any transfers due to the conflicts such that $P_{ii}(g, \mathbb{I}) < P_{ij}(g, \mathbb{I})$ $\forall i, j \in N$ st. $k_i = -k_j$ and $g_{ij} = 1$.

These definitions results in instability of efficient structures whenever conflicting groups are not equal in terms of size.

Proposition 8. Whenever $k_i = -k_j$ and $\#i \neq \#j$, the complete network is not societally stable.

Proof. Suppose $k_i = -k_j$. Consider the case $\#i = a; \#j = b$ and $a > b$. Under complete network, $\zeta_i(g^N) = 1$ and $\zeta'_{ij}(g^N) = 1$. Then for any i and j, $P_{ii} = f(a, b)$ and $P_{ij} = f(b, a)$ indicates that $P_{ii} > P_{ij}$ $\forall i, j$.

□

Proposition 9. Whenever there exists $i, j \in N$ such that $k_i = -k_j$, star network is never societally stable.

Proof. Star network always generates opportunity for the central agent to extract a value from opposition.
Consider the extreme case where the central agent is the only opposition. The beliefs of any periphery constructed such that whenever she is linked with any other periphery, she may also have a risk to pay the same amount of transfer to her. If the central agent determines α such that $w\alpha < w\delta - c - \delta^2$, any peripheral agent will not benefit from another link under her belief structure. As a result, central agent able to extract $(n-1)w\alpha$ amount of value. □

Definition 4.4.3. g is pairwise stable if
i. for all $ij \in g$, $u_i(g) \geq u_i(g - ij)$ and $u_j(g) \geq u_j(g - ij)$ and
ii. for all $ij \notin g$ if $u_i(g + ij) > u_i(g)$ then $u_j(g + ij) < u_j(g)$.

Analyzing the pairwise stability is complex under this structure but the example gives some insight.

Example 4.4.1. Suppose $N = 4$ where $\mathbb{I}^{-1} = \{1, 1, 1, -1\}$. Consider the complete structure. As discussed above, it is the uniquely efficient structure when $c < w\delta - \delta^2$. For all $i, j \in N$, such that $k_i = 1$, $k_j = -1$; $P_{ii} > P_{jj}$. Since empty network generates a value of zero, agent j is willing to pay some transfers which may discourage any mobilization to push her out of the g. However, if $\delta^2 > w\delta - c - w\alpha$, she will be better off with severing her two links with opposing partners. Under this conditions, complete structure is not pairwise stable. However, if $\delta^2 < w\delta - c - w\alpha$, complete structure will be both uniquely efficient and pairwise stable structure.

Figure 4.10 shows respectively, the efficient, pairwise stable and societally stable structures when $w(\delta - \alpha) - \delta^2 < c < w\delta - \delta^2$. The red lines show the conflicting situations, where the arrows shows the direction of the transfers.

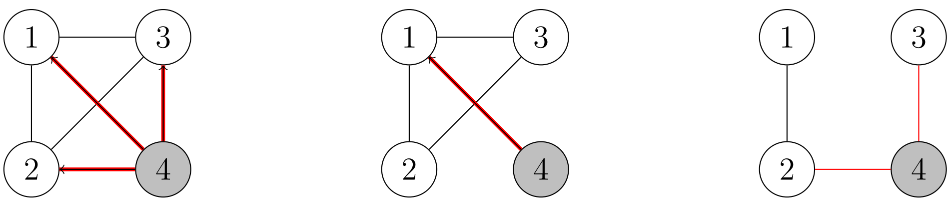

Figure 4.10: Efficiency, Pairwise Stability, Societally Stability

4.4.1 Introduction of Social Environment

Following the discussion of Broadbent (2003) on horizontal and vertical societies, this part focuses on the impact of social organization on relational effect. Three simple cases are discussed: hierarchy among identity groups, existence of social control and existence of organization behavior.

Definition 4.4.4. Horizontal groups are the groups where agents are anonymous in terms of relations whereas in vertical groups there are positional heterogeneity.

Hierarchy Among Identity Groups

Consider the hierarchy among groups is showed graphically by the size of the agents who belong to that identity.

Assumption 4.4.1. The hierarchy is common knowledge.

Suppose r_i denotes the size of the agent i which is a proxy for positional hierarchal role of the agent within a society. Then we can modify the f function representing the roles of the agents within a vertical society such that $f^V(\sum_{i:k_i=1} r_i, \sum_{j:k_j=-1} r_j)$.

Example 4.4.2. Consider the third case in Figure 4.6 and suppose low populated agents have hierarchical advantage such that $r_1 = r_{12} = r_7 = r_9 < r_{14} = r_5$. Figure 4.10 shows this modification.
If $i = 1, 12, 7, 9$ and $j = 5, 14$, dominance for any agent can be calculated by $P_{ii} = f(4r_i, 2r_j) = P_{ji}$ and $P_{jj} = f(2r_j, 4r_i) = P_{ij}$. If $r_i = 2r_j$, hierarchy have stabilizing affect. As the hierarchical gap increases, this may turn to be a counter-movement effect.
Note that, by definition the roles don't play a role in horizontal groups but

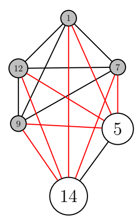

Figure 4.11: Representation of Clashes in the Existence of Hierarchy

the size dominance is decisive.

Proposition 10. Hierarchical heterogeneity among groups may have stabilizing or destabilizing effect.

Introduction of Social Control

Suppose there is a leader within a society who can control the allies among her neighbors. Example 4.4.3 is constructed to give an insight to analyze the role of the leader.

Example 4.4.3. Consider the Cases described in Figure 4.10 and suppose 4 is the leader. Leadership is not be effective for first two case when opposition knows 4 is alone. Consider the societally stable case. As long as $w\alpha < w\delta - c + \delta^2$, agent 2 willing to pay transfers to agent 4, believing that agent 4 has power to propagate agent 3 and this also holds for agent 3. The structure is pairwise stable as long as agent 4 determines the transfers such that $w\delta - c - \delta^2 < w\alpha < w\delta - c + \delta^2$.

We can extend the examples through defining various hierarchical roles within a society. However, these simplified cases give insight about a significant result .

Proposition 11. Whenever there is hierarchical heterogeneity among agents, as long as opposition is poorly connected, advantageous agents can define proper transfers which can be accepted by others.

Introduction of Organizational Behavior

Consider organized individuals are able to share their information about neighbors' identities.

Assumption 4.4.2. Linked agents can construct costly organizations and the transfers will be shared equally.

Whenever two allies could not able to use interaction as a resource, they can be better of through organizing. Note that if one is already willing but the other is not in organizing, equal share organizations will not be pairwise stable since the former will eventually transfer some value to latter.

Definition 4.4.5. Consider two agents i, z such that $k_i = k_z = -k_j$ and $P_{ii} < P_{ij}$, $P_{zz} < P_{zj}$. i and z will construct an *equal-share organization* if
1. If $P'_{ii} > P'_{ij}$ and $P'_{zz} > P'_{zj}$.
2. $c' < \tau$.

The conditions imply that two agents construct an equal-share organizations if it makes them to use interaction as a resource; makes them able to extract transfers and they can extract higher value than organizing cost.

Example 4.4.4. Consider the first Case discussed in Figure 4.7. Under assumption 4.4.2 there are three organization possibility: $12, 14, 34$. The first two will not make agents to get transfers by mobilizing since still $P_{ii} < P_{ij}$. Figure 4.12 shows the new network structure under organized 3 and 4. As long as there exists $w\alpha > \frac{c'}{3}$, 3 and 4 willing to construct an equal-sharing organization. Note that agents construct beliefs under risk-aversion, as a result they will prefer to connect with each other if $w\alpha < w\delta - c - \delta^2$. As a result as long as there exists transfers $w\alpha > max(\frac{c'}{3}, w\delta - c - \delta^2)$ equal-share organization is pairwise stable.

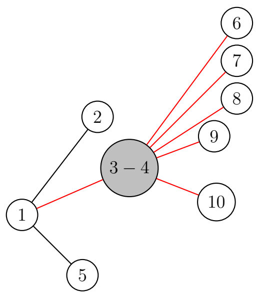

Figure 4.12: Representation of Clashes in the Existence of Organizing Possibility

This simple example shows that organization may have encouraging affect on mobilization.

Proposition 12. Organization of allies who have information dominance may give them opportunity of transfers even if they are dominated in terms of size.

4.5 Conclusion

In this Chapter, I attempt to draw a broader perspective on conflicting situations using the network mechanism described in Chapter 2. The society constructed by individuals with different identities. As all facts and situations, each identity has its opposition. As long as these don't interact, there is no problem at all. However, whenever they interact there is a possibility of conflict. This possibility turns to be reality based on the informational and size dominance of opposing groups. In case of incomplete information, individuals predict these measures based on their beliefs. In this point, individuals are assumed to be risk-averse. Whenever one faces with several situations she can not distinguish, she would prefer to behave as if the worst case occurs. Obviously, this assumption doesn't hold for everyone, but simplification lead us to examine basic cases. For horizontal societies, size dominance is seen to be more significant compared to vertical societies. Lack of communication discourage a possible movement and encourage opportunity for disadvantageous groups in terms of size dominance. For partially connected structures, there is a minimum amount of links that encourages advantageous groups to act.

In reality, these have significant policy implications. Although this is a very simple and incomplete mechanism, for now, further research can shed light on the sustainability of persistent inequality. In this point, obviously, the introduction of multiplexity will generate significant results. For instance, consider the case where the value is generated and distributed in one sphere and redistribution is possible in others. Another significant issue should be considered in following studies is organizing possibility. External shocks can be the subject of further studies.

Chapter 5

Conclusion

From a dialectic perspective, consensus and conflict are two sides of the same coin. Correspondingly, conflict is not an exception, but an ordinary state. What is more interesting is the *organized conflict* or the expansion of a specific conflict within the population. Moreover, social conflicts have the potential to turn into movements. Such social conflicts and movements are the main interests of this study.

For decades, there has been an increasing attempt to use network theory for explaining social phenomena. These attempts substantially motivated by global regularities like inequality, segregation, centralization etc. This is the main methodological motivation behind the use of network perspective.

In fact, the traditional literature on social movements is constructed upon a wrong paradigm. I couldn't find any consistent argument behind the limitation of movements to capitalist societies. Although it may generate simplicity for practical reasons and necessary for empirical studies, in most of the case leads to incoherent explanations. For instance, while the explanations of changing nature of the movements with post-modernism clarify the significance of identities but meanwhile these undermine the class-based characteristics of the identities. These fallacies can be overcome by extending the conceptual boundaries.

I describe social movements as outcomes of the interaction process between opposites. Conflicts are ordinary states, but the transformation to movements requires interaction. However, interaction does not always result in a movement. People should decide to use interaction as a resource of mobilization beforehand. At this point, I am closer to RMT. However, locality of communication needs a deeper analyze on the decision making process.

First, in the case of incomplete information, the communication structure determines the base of any possible movements. Second, communication has a spatial dimension which affects the possible forms of the movements. Third, communication has a political dimension which is able to encourage or discourage possible movements. At this point, I present a broader network perspective compared to RMT.

The first model I construct in the third chapter discusses the possible network structures in the existence of conflicting agents. I modify the standard connection model and replicate the main findings of this model. A remarkable finding of the model is that for a variety of variables, polarization is not efficient but it is frequently pairwise stable. A further study may interest in the transfer payments for the coincidence of stability and efficiency. This may shed light on inequality and the law of few. For instance, if coordination is limited the bridging agent may extract higher values in return to tie the two groups compared to the amount when people are organized. Furthermore, a more dynamic environment can be constructed to examine the social relations in a more realistic way. For instance, the possibility of a change of agent's identity codes may lead people to invest in communication in a different way. In short, although this model is highly stylized in construction, extensions are possible and promising to examine different aspects of communication between opposites.

The second model I discuss in the fourth chapter is a simple attempt for application of the tools developed in the second chapter. Under local knowledge, the beliefs of individuals become relevant. The beliefs are assumed to be constructed based on two factors: quantitative dominance as well as informational dominance. Apart from this, the spatial dimension of the interaction is represented by multilayer network structure. The necessity of multiplexity is shown by a simple example. Lastly, the social environment is discussed as a significant impact on the possibility of mobilizing. The outcomes of a structure may differentiate with the introduction of positional heterogeneity or organizational opportunity. In reality, horizontal relations are rarely experienced. Actually, this leads significant policy implications. In the case of vertical relations, it is more feasible and relevant to use several mechanisms to discourage or encourage mobilization. Obviously, a further research on policy implications will be relevant. Especially, an empirical study is necessary to test the arguments of this study and develop it further for a better understanding of social movements.

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