Multiplex Ties: The Antecedents and Consequences in Knowledge Sharing and Covering Depending on the Tie Formation Order

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ABSTRACT

Research on social networks has grown considerably in the last decades. Network scholarship addresses existing theoretical and empirical voids, such as the meaning of the ties that compose networks, micro processes derived from individuals as social actors, and network changes over time. This dissertation examines multiplex ties, which are defined as the tie connected by more than one type of social relationship. The development, distribution, and consequences of multiplex ties remain under-theorized and under-studied in network scholarship. To improve our understanding of multiplex ties, this study explores the processes by which multiplex ties form and the possible consequences of those different formation histories. I examine multiplex ties composed of both instrumental and expressive relationships, and differentiate between those multiplex ties based on the tie type that initially connected the dyad. The first type is a dyad originally tied via an instrumental relationship (e.g., colleagueship at workplaces) and later augmented with an expressive relationship (e.g., friendship), that is, an instrumental-first multiplex tie. The other is a dyad originally tied via an expressive relationship and later augmented with an instrumental relationship, that is, an expressive-first multiplex tie. Based on this dynamic view of multiplex ties, I examine the potentially distinctive antecedents of these ties and their consequences on organizational behaviors such as knowledge sharing. In short, this dissertation seeks to answer the following research questions: What factors are involved in the formation of multiplex ties? What are the different consequences of the instrumental-first and the expressive-first types of multiplex ties for knowledge sharing? I develop the theory based on the findings from the exploratory interviews from 24 Korean employees. I test for differences among the antecedents of multiples ties using longitudinal survey data from undergraduate students, and perform an experiment via an online survey to test for differences in the consequences of multiplex ties. The antecedent study using longitudinal survey provides that there are not causal relationships between individual and dyadic characteristics (e.g., personalities and demographic similarities) and the formation of multiplex ties. Also, online experiments offer the evidence that instrumental/ expressive uniplex tie similarly functions to multiplex ties in a certain context pursing an instrumental/expressive goal.

RÉSUMÉ

La quantité de recherches portant sur les réseaux sociaux a considérablement augmenté durant les dernières décennies. Les chercheurs dans le domaine ont remédié aux vides théoriques et empiriques existants tels que : la signification des liens qui forment les réseaux, les microprocessus dérivés des individus qui ont le rôle d'acteurs sociaux, ainsi que les changements sur les réseaux au fil du temps. Cette thèse étudie les liens multiplexes, c'est-à-dire les liens qui sont connectés par plus d'un type de relation sociale. Le développement, la distribution et les conséquences des liens multiplexes demeurent peu étudiés et la théorisation de ce sujet reste insuffisante. Pour améliorer notre compréhension des liens multiplexes, cet ouvrage explore les processus qui sont responsables de leur création et les conséquences possibles des différents historiques de formation. J'examine les liens multiplexes qui sont constitués à la fois de relations instrumentales et de relations expressives dans un environnement de travail. Ensuite, je différencie ces liens en me basant sur le type de lien qui relie initialement la dyade. Le premier type est une dyade qui a été liée à l'origine par une relation instrumentale (p. ex., la relation entre collègues dans le milieu de travail) sur laquelle s'ajoute par la suite une relation expressive (p. ex., l'amitié), ce qui représente un lien multiplexe premièrement instrumental. L'autre type est une dyade qui a été liée originellement par une relation expressive sur laquelle s'ajoute une relation instrumentale, ce qui représente un lien multiplexe premièrement expressif. En fonction de cette opinion dynamique sur les liens multiplexes, j'examine les antécédents potentiellement distincts de ces liens ainsi que leurs conséquences sur les comportements organisationnels telles que le partage de connaissances et l'action de couvrir pour un collègue. En résumé, cette thèse a pour objectif de répondre aux questions de recherche suivantes : Quels sont les facteurs impliqués dans la création des liens multiplexes ? Quelles sont les différentes conséquences des types de lien premièrement instrumental et premièrement expressif sur le partage de connaissances et sur l'action de couvrir pour un collègue ? J'ai développé cette théorie en me basant sur les résultats d'entrevues préliminaires de 24 employés coréens. Après, j'ai réalisé une analyse pour trouver les différences entre les antécédents des liens multiples en utilisant des données de sondage longitudinales qui proviennent d'étudiants du premier cycle. Également, j'ai effectué une expérience par l'entremise d'un sondage en ligne pour trouver les différences dans les conséquences des liens multiplexes. L'étude portant sur les antécédents démontre qu'il n'y a pas de lien causal entre les caractéristiques individuelles et dyadiques et la formation de liens multiplexes. De plus, l'étude sur les conséquences, basée sur les expériences en ligne, fournit la preuve que les liens instrumentaux ou expressifs simples fonctionnent de manière similaire aux liens multiplexes dans le contexte précis où ils poursuivent un but instrumental ou expressif.

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CHAPTER 1:

INTRODUCTION

Introduction

Imagine there are four people who work in the same organization: Alison, Brenda, Christine, and Diane. Alison and Brenda became friends at their workplace because Alison's office was next to Brenda's. Although Alison and Brenda did not work together at first, they had lunch together and shared their personal lives. Later, Alison and Brenda began working together when given their choice of partners on a new project; now they are friends as well as colleagues. On the other hand, Christine met Diane in her work group and began a relationship as colleagues. Through successfully accomplishing tasks in the group over time, Christine and Diane got to know each other not only professionally, but personally as well. Christine and Diane are still working together and now also consider themselves as friends.

These two pairs of relationships − Alison/Brenda and Christine/Diane − involve more than one type of relationship: friendship and collaboration, i.e., a *multiplex tie*. Without knowing the histories of each, the two relationships seemingly look the same; however, are these two multiplex ties really the same? Obviously, we may think that Alison and Brenda and Christine and Diane help each other by sharing information and knowledge about their task performances and personal careers in the workplace, but do Alison/Brenda and Christina/Diane use their relationships toward knowledge sharing and other organizational behaviors in the same way? If so, is this because their relationships are the same type? Or, despite these same components, are the relationships of Alison/Brenda and Christina/Diane distinct because they occurred in different ways? If so, what fundamental distinction exists between the two relationships?

The concept of multiplex ties, as a key network property, has been studied by social network researchers (e.g., Ibarra, 1992). Historically, multiplex ties have been considered "strong" and based on frequent and intense interactions with others who share overlapping relationships (Granovetter, 1973; Marsden & Campbell, 1984). As a result, multiplex ties allow actors to easily access resources and establish both high levels of trust and obligation between members (Nahapiet & Ghoshal, 1998), as well as constrain their behaviors (Brass, Butterfield, & Skaggs, 1998). Moreover, in terms of efficiency in mobilizing social relationships, two actors who are connected through multiple relationship avenues can exchange different types of resources without additional efforts to link with others.

While the concept of multiplex ties has been continuously studied, the characteristics of multiplex ties have not. According to Methot and her colleagues, two reasons lead to an incomplete understanding of the nature and functioning of multiplex ties: first, researchers may confuse a multiplex tie with a relationship that is largely one dimensional (i.e., instrumental work-focused exchange) and, as a result, their research yields mixed findings; and, second, predominant research on multiplex ties at the workplace focuses on their instrumental and relational benefit and support, without consideration of the potential costs for interpersonal relationships at work (Methot, Lepine, Podsakoff, & Christian, 2016).

I argue that these reasons − the confusion of multiplex ties with non-multiplex ties and research focusing on benefit excluding cost − result from the lack of fundamental knowledge about multiplex ties. We know relatively little about multiplex ties in terms of their origin, formation/decay processes (e.g., Jonczyk, Lee, Galunic & Bensaou, 2016; Kleinbaum, 2017), and consequences(e.g., Bush, Walker, & Perry, 2017; Methot, 2010; Lorenzen & Andersen, 2012), which can be both positive and negative (e.g., Hood, Cruz, & Bachrach, 2017; Methot et

al., 2016). For example, Jonczyk et al. (2016) examined tie loss and tie gain in changing in relations due to the promotions among service professionals found that more multiplex ties are less likely to be lost. Regarding consequences of multiplex ties, Bush et al., provide the result that people more rely on family-friends multiplex ties than on either family only or friend only tie when they share important information and discuss serious issues. Contrary to the positive outcome, Lorenzen and Andersen (2012) showed that multiplex ties produce negative outcome due to the resource iteration and lock-in effects among multiplexed connected filmmakers in Bollywood. Also, Methot (2010) and colleagues (2016) found the mixed results that multiplex workplace friendship improve job performance through trust but decrease job performance the maintenance difficulty. Similarly, Hood et al (2017) found that relational conflict between multiplex friendships in workplace is negatively related to team performance.

Like this, there are evidence that multiplex ties do not always lead to beneficial outcome but produce mixed results, and researchers suggest that several reasons (e.g., maintenance difficulty, redundant resource). However, these studies focus on the "current" multiplex ties and its consequences without knowing how multiplex ties were formed or developed. In this dissertation, not only to explain the reason for the mixed finding of multiplex ties, but also to explore the characteristic of multiplex ties that cause the difference from uniplex, I argue that there is a fundamental difference between uniplex and multiplex ties in terms of the formation process of multiplex ties.

In particular, as seen in the short story described earlier, multiplex ties may have distinct characteristics that cause different behavioral consequences depending on the history of tie formation. However, research on the formation of multiplex ties and their consequences, depending on the tie history, has been rarely studied (for exceptions see Snijders, Lomi, & Torló,

2012). The formation process of multiplex ties involves not only tie formation, but also tie persistence (Dahlander & McFarland, 2013) based on the relational history, compared to uniplex ties formation processes. That is, the nascent state of the formation and developmental process of a multiplex tie is different from that of a uniplex tie. In turn, the consequence of a multiplex tie can be studied further using diverse aspects beyond discussion on the advantageous and supportive consequences. In this dissertation, I argue that, depending on the forming order, multiplex ties have different characteristics and the consequences of multiplex ties might be different in organizational behaviors.

Consequences of Multiplex Ties

In this dissertation, I examine the consequences of multiplex ties prior to investigating the antecedents of the multiplex ties. I examine multiplex ties composed of both instrumental and expressive relationships, and differentiate between those multiplex ties based on the tie type that initially connected the dyad. The first type is a dyad originally tied via an *instrumental relationship* (e.g., colleagueship at the workplace) and later augmented with an *expressive relationship* (e.g., friendship), i.e., an *instrumental-first multiplex tie*. The other is a dyad originally tied via an expressive relationship and later augmented with an instrumental relationship − an *expressive-first multiplex tie*. I explore whether there are actual distinguishing consequences on organizational behaviors, such as knowledge sharing and covering, in assuming that trust is one of the distinctions between these two types of multiplex ties.

Trust

Trust is one of the critical properties of social relationships involved in exchange of resources (Chua, Ingram, & Morris, 2008; Coleman, 1990). Both instrumental and expressive

ties consisting of multiplex ties are differentiated by the resources exchanged via those ties, and they are associated with different types of trust. For example, instrumental ties are associated with *cognition-based trust* (e.g., competence trust) and expressive ties are associated with *affect-based trust* (e.g., goodwill trust) (Chua et al., 2008; Gibbons, 2004). I explain that trust is one of the factors that determine the types of multiplex ties in the forming process of multiplex ties.

Knowledge Sharing

Knowledge sharing (also known as "transfer") is essential activity in organizations (Powell & Snellman, 2004; Reagans & McEvily, 2003; Szulanski, 1996). Knowledge is exchanged through interpersonal networks within organizations, thus network characteristics, such as tie strength and structural holes that connect between two separate units, are associated with the knowledge sharing (Burt, 1992; Hansen, 1999; Uzzi, 1996, 1997). For example, the strong tie between two organizational members enables them to share complex and confidential knowledge, and weak tie facilitates sharing non-redundant knowledge (Granovetter, 1973). Consequently, social network and knowledge researchers have studied knowledge network through network structure, tie properties, and knowledge properties (Phelps, Heidl, & Wadhwa, 2012). However, except for a few studies (i.e., Beckman, Haunschild, & Phillips, 2004; Hansen, Mors, & Løvås, 2005), knowledge network research has generally considered only one type of tie by ignoring the association between multiplex ties and knowledge sharing (Phelps et al., 2012).

Covering

Covering for a coworker while the coworker is away from the office is a kind of organizational citizenship behavior (OCB) that "aims at helping for a coworker that are not formally a part of the helper's recognized duties" (Norman, Avey, Nimnicht, & Pigeon, 2010,

p.3). Research on covering has been relatively less studied in comparison with research on OCB and helping behavior. To date, previous research on multiplex ties has focused on its instrumental function at the workplace (i.e., Kuwabara, Luo, & Sheldon, 2010; Methot et al., 2016). Relatively speaking, the social and emotional functions of multiplex ties have been ignored and accessorily used in explaining a multiplex tie's superiority in its tie strength and the level of trust for its instrumental function. I investigate the consequence of multiplex ties with covering behavior as an emotion-based behavior which is corresponding to knowledge sharing behavior as an instrumental behavior.

Antecedents

Personality

Although social network researchers have paid less attention to agency and individuals' psychology (Kilduff & Brass, 2010), personality variables such as "Big five" traits and self-monitoring orientation have been studied as a factors that influence social network formation. For example, Klein et al. (2004) provide that personalities are related to the individuals' acquisition of the central position in their advice networks and friendship networks. Also, researchers show that people with different self-monitoring orientations occupy different positions within networks (Kilduff & Brass, 2010; Mehra, Kilduff, & Brass, 2001; Oh & Kilduff, 2008; Sasovova, Mehra, Borgatti, & Schippers, 2010). Fang et al. (2015) recently investigate the relationships between personality characteristics (i.e., self-monitoring, Big5 personality trains) and network positions (i.e., centrality & brokerage) and job performance and career success using a meta-analysis. Considering that antecedents have been studied in the formation process of uniplex ties, in this dissertation I focus on the personality as antecedents of multiplex ties.

Demographics

In social networks, *homophily perspective* explains how and why people begin to interact each other and form close relationships (e.g., McPherson, Smith-Lovin, & Cook, 2001). Demographic characteristics, such as gender, race, and age, are the representative personal attributes to measure similarity. Network researchers have examined the effect of demographic characteristics on networking style and network outcomes. For example, managers who are racial minorities have fewer intimate network relationships (Ibarra, 1995), and gender and ethnic minorities tend to interact with same gender and minority individuals (Mehra, Kilduff, & Brass, 1998). Moreover, women who are minorities in the male-dominant organizational context separate their instrumental networks from men and their expressive networks with women, and thus form relatively fewer multiplex ties (Ibarra, 1992). Given that demographic characteristics are the antecedents of social ties (uniplex ties), I examined how demographics affect the formation of multiplex ties.

Approach and Research Questions

The purpose of this study is to enhance the understanding of dynamic social networks by examining the formation process of multiplex ties and investigating the different behavioral consequences and their antecedents. In particular, the research questions are:

Are multiplex ties stronger predictors of knowledge sharing and covering behavior as compared to uniplex ties?

Does the order of tie formation in multiplex ties affect knowledge sharing and covering behavior?

From the pilot study, I found that organizational members differently perceive and use their multiplex ties depending on which type of relationship – i.e., task-related and non-

task related − came first in the development of their multiplex ties. I address the pilot study and the results in detail in Chapter 2. In order to answer the research question of whether there are different consequences of multiplex ties depending on the formation order of tie, I took a quantitative approach in concert with experiment studies. I conducted a vignette survey through Amazon's Mechanical Turk [M-Turk], a website that provides an integrated participants' compensation system and a large pool of employees. Data obtained from M-Turk are as reliable as those obtained from traditional methods in terms of internal consistency and test-retest reliability (Buhrmester, Kwang, & Gosling, 2011).

Then, for a hypotheses test for the antecedents of multiplex ties, I use longitudinal data which involved four rounds of data collection over a two-year period (2011-2012). This longitudinal data was collected by my supervisor, Brian Rubineau, and his colleagues under their permission, I analyzed this data for the purposes of this dissertation, using the stochastic actor-based models for network dynamics (Snijders, 1996, 2001) with the Simulation Investigation for Empirical Network Analyses (RSiena) and multiple regression quadratic assignment procedures (MRQAP).

Theoretical Contributions

This dissertation contributes to the organizational social network literature by highlighting the formation order of multiplex ties, which has been heretofore ignored. First, I intend to theorize the formation process and the distinctive consequences of multiplex ties. With the concept of multiplexity (i.e., multiplex ties) that has been considered as a core concept in social networks, network researchers in multidiscipline (especially in science field) increasingly pay attention to the multilayer networks as well. Multilayer networks consist of multiple interactions or networks between multiple layers that mean the different environments (Buono, Alvarez-

Zuzek, Macri, & Braunstein, 2014; Kivelä et al., 2014). To be specific, according to Kivelä et al. (2014), nodes of multilayer networks belong to any subset of layers (corresponding to a dimension and aspects in the social network literature) and a layer is combined with all dimension (i.e., type of interactions, time). Thus, depending on the type of the layer (e.g, family, co-wokers, friends), the location of edges between inter-and intra-layers (e.g., t1 or t2 layers), and the structure of connections among the edges (e.g., the connections among edges in each layers), multilayer networks can present various information of networks.

At first glance, multiplex networks seem like multilayer networks. However, multiplex networks are defined as "as edge-coloured multigraphs, which are networks with multiple types of edges" (colour is used for labelling the type of edges), while each edge colour corresponds to a layer in a multilayer network" (Kivelä et al., 2014, p218). For example, usually edge colour in multiplex network would present the type of relationships (e.g., friendship or advice) in the intra-layer, while edge colour in multilayer network presents each layers (e.g., academic conferences-EGOS, AOM and INSNA) and the nodes identify specifically. Considering this, although multiplex and multilayer networks seem to be similar, the concept of multiplex network could be under the multilayer network umbrella. In this study, I cope with the different types of relationships in an organizational context, not considering the multiple social systems and also I focus more on an individual tie (relationship) not the whole multiplex network. Thus, I study the concept of multiplex ties rather than the framework of multilayer network.

Unlike other concepts of social networks (e.g., *strong tie*, *weak tie*, *structural holes*) which have been more thoroughly studied in terms of origin, formation process, characteristics, and consequence (e.g., Burt, 1992; Granovetter, 1973; Krackhardt, 1992), we do not know a lot about

multiplex ties *per se*. By examining the developmental patterns of multiplex ties, this paper contributes to the literature on multiplex ties in social networks.

Moreover, this study contributes to the knowledge on multiplex ties. Conventional wisdom assumes that multiplex ties represent stronger and more consequential relationships as compared to uniplex ties based on their stronger tie strength than uniplex ties (Brass, 1992; Granovetter, 1983). However, this assumption in social networks is not clearly investigated. For example, Lorenzen and Andersen (2012) identify social ties as strong uniplex tie, weak uniplex tie, and (strong) multiplex ties and examine the relationship between filmmakers and their performance in Bollywood film production. Namely, although they do not directly compare the tie strength between uniplex and multiplex ties, this study implies the possibility that we can compare uniplex tie is as strong as multiplex tie, or whether uniplex tie is stronger than and multiplex tie. I compare the consequences of multiple and uniplex ties in knowledge sharing and covering behaviors, and then identify whether this assumption is true.

This dissertation examines the antecedents that influence the formation process of multiplex ties based on the history of the initial tie. I focus on individual attributes like personalities and demographic characteristics that have been considered as antecedents of social networks in previous network research (i.e., Klein, Lim, Saltz, & Mayer, 2004; McPherson et al., 2001; Mehra et al., 1998). I posit that an individual can choose his/her social tie via, for example, developing toward a multiplex tie or maintaining a current relationship with a contacts. This dissertation contributes to the research on psychological foundations in social networks with an agentic view of social actors who deliberately create ties.

Finally, this dissertation extends the previous research on social network and organizational behaviors, including both instrumental and expressive behavior (i.e., knowledge-sharing and

covering). In particular, in an organizational context − as compared to an instrumental behavior like knowledge sharing − the expressive behavior, such as covering, has been relatively ignored. I examine the consequences of multiplex ties in both instrumental and expressive behaviors and aim to contribute to an increased understanding of expressive behavior.

Structure of This Dissertation

This dissertation is structured as follows: Chapter 2 presents the motivating pilot study that led me to raise the question about how the order of tie formation influences the multiplex ties. Chapter 3 reviews the literature on multiplex ties, path-dependence of forming ties, and trust (one of the main characteristics of multiplex ties), based on the findings of my pilot study. I then propose a series of hypotheses about the consequence of multiplex ties in knowledge-sharing and covering, as well as the antecedents of multiplex ties including personal attributes, demographic characteristics, and other factors. In Chapter 4, I examine the consequences of multiplex ties as dependent on tie formation order using the experimental study and, in Chapter 5, I investigate the antecedents of multiplex ties with a hypotheses test using the longitudinal network data. In Chapter 6, I discuss the contributions and limitations of this study, and provide future research prompted by my findings.

CHAPTER 2:

PILOT STUDY

Research Background

My interest in the different characteristics of multiplex ties was borne of a previous research project on social networks and organizational identification. I interviewed six Korean employees regarding their social relationships at the workplace and their identification with their colleagues and organizations during the project. Of them, one of my participants, who was working in the HR team, told me that she distinctively identified her colleagues as "just co-workers" or "co-workers and friends" at work. In particular, she explained that she categorized her social relationships at work through initial and current relational histories with them and interacted with them in different ways. She mentioned that this was caused by her personality, that she kept her private and work life separate by not sharing private information with her colleagues. I found this interesting because her comments revealed formations and types of multiplex ties not yet studied. Furthermore, in addition to my own research, the idea of my dissertation also sprang from a research project on entrepreneurship in which I participated as research assistant. One of my roles was to find rough patterns within interviews before analyzing them in detail. One interviewee talked about he failed his first business venture with his friends but successfully stabilized his second start-up company with a business partner. I was interested in why he failed with his university friends, and how he came to choose to work with a non-friend instead.

The purpose of my pilot study was to examine how and why people develop their existing relationships into overlapping relationships that include diverse types of interactions. Based on the two research projects described above, I decided to focus on different types of

multiplex ties with different relationship histories. I further developed this idea to include why organizational members perceive their social relationships differently, and how they form multiplex ties from existing workplace relationships. In this chapter, I consider how tie strength and knowledge sharing are influenced by these relationship histories because most of the interviewees in my study mentioned either tie strength or knowledge sharing when they described evaluating and mobilizing multiplex ties as dependent on the developmental process of multiplex ties.

Research Design

Qualitative study typically focuses on in depth understanding using selected small samples, in contrary to the quantitative study which focuses on empirical generalizations from large random samples (Patton, 2005). I selected information-rich cases using the purposeful sampling method in order to learn the development of workplace relationships in depth. I interviewed 25 employees who were currently working in Korean companies. I recruited participants thorough personal contacts and using snowballing sampling (Patton, 2002). All participants had more than three years work experience and were regularly working with more than three coworkers; I chose these factors in order to examine the development of their relationships in organizations. The interview questions were broadly about: 1) the participants' history of social relationships (initial type of relationships and their changes) at the workplace, 2) an evaluation of these relationships (obligation/reciprocity), and 3) the trust created by these relationships. On average, the interviews lasted for 1 to 1.5 hours and were conducted in Korean. The data reported here is transcribed from Korean to English by the author.

The organizations in which the participants work were varied and included research institutes, IT companies, a stock company, construction, and tire manufacturing, among others. The number of employees from each industry is listed in Table 1.

Table 1: Research Participants by Type of Company Worked

Type of Industry	Female	Male	Total Number of Subjects	Role
Research Institute	3	6	9	7 researchers 2 professors
IT		3	3	1 IT manufacturer 2 software developers
Stock Company	1*	1	2*	
Construction & Tire		2		
Fashion & Beauty	3		3	1 administrative (Interior Design) 1 bookkeeper (Cosmetics) 1 displayer
Insurance Company		1	1	1 project organizer
Shipping Company		1	1	
Education	2		2	1 chief librarian, 1 textbook developer (Educational Media)
Film	1		1	1 distributor
Total	10*	14	24*	

* The audio file of one participant was damaged after the interview was conducted. This female interviewee worked at a stock company as a [role].

Analysis Process

I conducted these 25 interviews during June and July of 2013, recording and taking field notes about interesting quotes and relevant concepts of each. To analyze my interview data, I first listened to the recordings and made transcripts, repeatedly reading my field notes. During analysis of each case, I codified the data by identifying open codes using participants' own words, for instance: "ability," "task," "like," "trust," and "knowledge." Using Glaser and Strauss's (1967) and Boyatzis'(1998) strategies, I compared each new case to former cases

twice; I then re-analyzed and re-coded the cases in comparison for one month, and reduced the raw information to relevant themes about social relationships at work and helping behaviors using those relationships. Through the open coding process on each individual case, I mainly focused on what factors interviewees considered when they created, maintained, and terminated their social relationships, and began grouping similar open codes into categories.

Findings

The interview data provided that there are different types of multiplex ties depending on their workplace relationship histories and what factors influence the maintenance and development process of the existing social ties. According to participants, basically there were two factors that influenced their social interactions at work: 1) *organizational characteristics*, such as tasks and organizational cultures, and 2) *individual characteristics*, such as personality, personal value, and similarity with others. I provided the findings in detail by quoting the interviews of the 6 participants among 25 interviewees.

History of Relationship

The history of relationships has not been studied in the research of multiplex ties. According to my interviews, all participants remembered how and when they started relationships with their contacts. Interestingly, when participants had interacted with their coworkers or friends at the workplace, they considered how the relationships with those people were initiated. Sometimes, the future relationships were anchored in the history of the relationships.

Most of the relationships of the interviewees were formed within their organizational context. Participants distinguished their relationships between those which were initially work-

related and those which were non-work related, i.e., "expressive." Participants also mentioned relationships they formed outside of their organizations, such as colleagueships first formed at a previous company or a friendship at work first formed at school. My pilot study allowed me to distinguish between a multiplex tie initially formed from an instrumental tie and a tie originally formed from an expressive tie. Overall, I found that multiplex ties could be classified according to what the initial type of relationship was. One of the participants, who worked for the insurance company, illustrates this finding:

> *He is my best friend from middle school to high school. Before he joined my team, he was working in [a] different industry. He joined [this insurance company] one year ago. He is very honest and I can totally trust him in both work and personal aspects, compared to team members…. The department head, he was a friend of my former supervisor in the previous company and he scouted me to the current firm. He is a really successful man in this industry and he can change his personality depending on the situations. I can wholly rely on him in terms of work and career. He is my mentor and we sometimes play golf together but I do not personally trust him as much as I trust him as a supervisor.*

In addition to there being different types of multiplex ties depending on the history of their relationships, I also found that there were several factors that influenced the developmental process that transformed the initial uniplex tie into a multiplex tie such as task interdependence, organizational structure, actors' personality, and the similarity between actors.

Task Interdependence

Task interdependence refers to "the degree to which group members need to work closely with others, share material, information, and expertise in order to complete their tasks" (Cummings, 1978; Liden, Erdogan, Wayne, & Sparrowe, 2006). High task interdependence fosters group cooperation, and requires and causes personal interactions simultaneously. Several interviewees commented that task interdependence is an important factor when they decide whether to develop their existing relationships with coworkers into multiplex ties, or not.

Interviewees who had relatively independent work roles, such as an insurance salesman, said that this independence freed them from the forced relationships of the workplace. One research institute interviewee said:

> *Relational conflicts with my colleagues at work are not inevitable, but I can handle that conflict by managing my social relationships with them. Although I have to work with someone who I don't like (or don't want to work together [with]) now, I don't need to work with them again after the current projects end (e.g., three-month project). Also, sometimes, we can choose the members of the project team (i.e., research collaboration). We have our own specialized research areas and the tasks are relatively independent than the other types of employees. So if I do not want to deeply interact with someone, I can say hello only to them at work, even though he is in a higher position than me*.

Organizational Culture

Several interviewees mentioned how competitive or cooperative organizational culture influences their workplace social interactions. Employees of stock companies said that the competitive organizational culture hinders them from forming friend relationships at work. As one interviewee stated, "All members focus more on their own performance outcomes than the cooperation or social relationships with other colleagues." High competition within organizations may prevent employees personal interacting and developing multiplex relationships. Moreover, *organizational structure* is the one factor influencing the process of social relationships. According to some participants, how tightly connected each organizational work unit and how clearly organizational boundaries are defined affect when they decide whether just keep their existing tie as an uniplex tie itself or whether to develop it into a multiplex tie. A male branch manager of an insurance company said:

> *...our organizational structure is unique. The organization has two types of branches, independent and dependent branches. My branch is an independent branch which consists of one branch manager, sales managers (SM), and financial planners (FP). We call this "Incubate Branch." Usually, SMs with a*

> *required license are FPs without a license, hired by making a special contract, like entrepreneurs, with company. They look like a half-employee and half-entrepreneur. I regularly interact with my team members because I am a branch manager and my job is to manage my team members. However, my team members are absolutely independent of each other, although we call them one team.*

An *individual attribute* also affects the formation process of multiplex ties. People have different tendencies to maintain, develop, and terminate their social relationships. According to the interview analysis, individuals' different e*xpectations on relationships* (especially at the workplace) affected their views on the relational longevity of the relationships. If an individual thinks a workplace social relationship will last for the short-term, s/he may tend to form a multiplex tie in order to make it into a long-term relationship, or, alternatively, not try to develop the existing tie into a multiplex tie due to the required time and effort needed to form it. *Separation of relationships* between work life and personal life and *priority at workplaces* (social relationship vs. work ability) were also mentioned as factors affecting the tie formation process. I found that people separately managed their personal and work related relationships and didn't think they could be friends with a co-worker at workplace. In addition, *value* seems to play a role in encouraging social interactions with others; if an individual shared some values and principles (e.g., fairness, justice) with a co-worker, s/he might be generous toward accepting the coworker's differences and more easily accept them:

> *The most important thing at work is the organizational goal and people's ability in order to achieve it. If we share the similar value for living life, it would be great. However, it takes a long time to share value with others and I feel (psychological) distance with those [with whom] I do not share value… I think that social interaction is a kind of necessary evil and thus I try to keep the minimum social relationships at work.*

Along with the organizational and individual characteristics mentioned as factors affecting tie formation, *trust* is not only an important determinant of either terminating or

keeping a relationship, but also impacts the distinctive characteristics of the tie. Participants recognized that they had different levels of trust with each contact and thus behaved differently based on those trust levels. Interesting is that trust in a multiplex relationship involving both personal and work-related domains can sometimes turn out to be more distinctive in one domain. For example, trust on the contact's ability for task can stand out, especially if the relationship was generated in the work domain. On the other hand, once this trust is formed and a relationship is developed based on this trust, the trust spreads to other aspects of the multiplex tie, regardless of the domain in which it was derived.

Summary

At first, this pilot study was designed to explore the motive and process of the development of multiplex ties within organizations. Through the interviews with organizational members, I found that multiplex ties can be distinguished based on the tie type that initially connected the dyad. Also, there are several exogenous and endogenous factors that affect tie formation. Based on the results of my pilot study, I focus on the formation of multiplex ties and the different consequences of multiplex ties which can be derived from the distinctive characteristics of multiplex ties.

When people develop their social relationships, they are influenced by the organizational characteristics (structure, task interdependency, culture), individual characteristics (personal value, networking strategy), and trust in the relationships. I found that people discerned their social relationships at the workplace based on relational histories and levels of trust with the contacts, and also recognized the reciprocal benefits and costs of the relationships.

This pilot study has several limitations. First, the sample sizes of each industry are not equal. Thirty-seven percent (37%) of my interviewees worked for research institutes, as

compared to the other 63% working among eight (8) other fields, and thus characteristics specific to the research industry might be reflected in the findings. Second, data analysis for this pilot study was not systematic, though I analyzed data by repeatedly reading and taking notes to find patterns. Considering that the purpose of this pilot study is to understand the phenomenon which we have not known enough rather than to verify it, however, the findings of this pilot study were enough to inspire this dissertation.

In the next chapter, I review the literature on the multiplex ties, path dependence views that describe how multiplex ties are formed, instrumental-first and expressive-first ties, and trust as the characteristic that distinguishes between both types of ties.

CHAPTER 3:

LITERATURE REVIEW: MULTIPLEX TIES AND THEIR FORMATION

Multiplex Ties

According to many researchers, social relationships might be categorized as multiplex ties by *roles* (Barnes, 1972), *exchanges* (Kapferer, 1969), and/or *affiliations* (Wheeldon, 1969). Multiplexity of social ties basically means an overlapping of different types of relationships within a dyad (Hartman & Johnson, 1989; Lazega & Pattison, 1999; Verbrugge, 1979). Organizational researchers usually define "multiplexity" as the number of contents that are exchanged via relationships (e.g., Ibarra, 1992; Lincoln & Miller, 1979; Podolny & Baron, 1997). Borgatti and colleagues explain that ties can be *conduits* (i.e., roads or pipes) which convey information (Borgatti & Foster, 2003; Borgatti & Halgin, 2011); network ties are also defined as *recurring patterns* (e.g., Borgatti & Halgin, 2011; Dubini & Aldrich, 1991; Ebers, 1997). Thus, multiplex ties can be considered as ties which convey different types of resources, or which are involved in the different relational patterns (Heaney, 2014; White, 2008).

The mentor-mentee relationship in mentoring research, for example, has been studied as a multiplex tie which provides both career-related support and psychosocial support (Cotton, Shen, & Livne-Tarandach, 2011; Higgins & Kram, 2001; Molloy, 2005; Seibert, Kraimer, & Liden, 2001). Cotton and his colleagues (2011) found that the "extraordinary career achievers" among 62 Major League Baseball players developed multiplex relationships with their peers and supervisor/managers who provide both career and psychological support. Meanwhile, although the key characteristic of multiplex tie is the provision of different type of resources via a single tie, the different resources are not equally exchanged through multiplex ties between two actors. That is, one multiplex tie can be used for more instrumental purpose than expressive purpose, the

other can be more used for expressive purpose than instrumental one. Mentoring researchers, for example, found that the resources provided by mentors for their protégés are not the same. Podolny and Baron (1997) found that the mentors have different organizational goals and expectations for their mentoring behaviors and so that their mentoring behaviors (i.e., providing various types of support) different depending on the activities on which mentors focused (Podolny & Baron, 1997). Also, there are differences between *formal* and *informal* mentoring relationships in terms of the motive for the tie generation, its duration, and the goal of the mentoring relationship (Kram, 1985). For instance, a protégé and a mentor's primary approach to career development (e.g., an *instrumental orientation*) influences the formation of the mentoring tie and the development of relationships between the instrumental and the expressive role of the tie (Higgins & Kram, 2001). This shows that, although all multiplex ties may seem to be the same after having been developed, they can have different properties.

Recently, there are research on multiplex ties which more deeply examined multiplex relationship at workplace called as "business friend" (Ingram and Zou, 2008) or "multiplex workplace friend" (Methot, 2010, Methot et al. 2016). Ingram and Zou (2008) theoretically and comprehensively explains the concept of business friend starting with previous literatures dealing with the instrumental relationship combined with affective relationship. The authors defined business friendships as "friendships that coincide with a business relationship, which we recognize as either competitors, buyers or suppliers in a market, co-workers within an organization, or actors that occupy similar positions in different organizations or markets and may therefore provide each other with useful business information" (p170). Furthermore, Ingram and Zou suggest several distinctions of business friends from uniplex ties (pure instrumental or expressive ties). According to them, there are benefits of multiplex ties through enhanced trust,

empathy, sympathy, while there are difficulties of management due to the conflicts, such as self-concepts, incommensurability of exchange resource, and norms of reciprocity, caused from the different characteristics of both affective and instrumental ties.

To the extent Ingram and Zou's research, Methot (2010) and her colleagues (2016) empirically examined the relation between multiplex ties and job performance with multiplex ties defined as "multiplex workplace friendship". Similar to the definition of business friend, multiplex workplace friendship is defined as "multiplex workplace friendships are those in which two people look to each other for friendship as well as for help meeting job demands (Methot et al.2015). In particular, Methot et al. (2016) empirically research found that large size of multiplex ties increase work performance through increasing trust and emotional support, but simultaneously, large number of multiplex ties decrease work performance because of maintenance difficulty (e.g., managing conflict and self-concept for maintaining multiplex network) and felt obligation (psychological indebtedeness toward coworker).

Also, Shah, Parker and Waldsrøm (2017) investigated how multiplex relationship is associated with performance differently from both uniplex relationships from the. Interestingly, they found that that multiplex ties have an inverted U shaped association with work performance, comparing to the significant linear association between both exclusively instrumental and expressive ties and work performance. This result is consistent with previous research that argued multiplex ties' constraints, such as higher costs of work time than uniplex ties (Adler & Kwon, 2002), incommensurability of exchange resource within multiplex ties, conflicting reciprocity (Ingram & Zou, 2008) emotional exhaustion and maintenance difficulty (Methot et al.,2016). That is, too small number of multiplex cannot give enough resources comparing to uniplex ties and too many number of multiplex ties restrain its utility.

Meanwhile, instead of terminologies of "multiplexity", "instrumental", and "expressive" (or "social"), Soda and Zaheer (2012) proposed the concept of "network consistency" which they defined as "the overlap between the informal network of advice and information with formal structures and processes, expressed as networks" (p751). Soda and Zaheer argued that consistency is related to, but conceptually different from, multiplexity. According to them, multiplex ties between same nodes convey different contents, while network consistency is the equivalence of same actors across multiple networks. Thus, high level of consistency of ego networks means that there are large numbers of a focal node's ties are being multiplex. Using four types networks of employees with a single company, such as authority network, reciprocal workflow network, sequential workflow network and informal advice network, they show that consistency between formal and informal networks can help or hurt performance. For example, consistency between the authority network (formal network) and informal network help individual work performance. However, there is an inverted U-shaped relation between inconsistency in the reciprocal workflow network and informal network in the performance due to two opposite effects of reducing coordination and enhancing the possibility to access valuable and diverse information. From the untraditional approach on the overlapping networks, this study shows the new approach to the (multiplex) network research in splitting apart tie content from network structure. As the similarly but different new approach, Casciaro, Gino and Kouchaki (2014) splits apart tie content (e.g., professional tie-work related dimension & personal tie-individual's personal life dimension) and motivation of creating tie. (instrumental tie which is initiated for the specific goal & spontaneous tie which emerge naturally). They also suggest that we will be able to learn about the inevitable effect of the personal content (e.g., content of social

ties) in organizational context in detail, by comparing research avenue professional-instrumental networking and personal-instrumental networking.

Ferriani, Fonti and Corrado (2012) investigated how two distinct tie contents (i.e., social and economic exchange) lead to emergence of multiplex ties among entrepreneurs using longitudinal data. The findings present that both ties (i.e., economic tie –instrumental tie & social tie- expressive tie) contribute the formation of multiplex ties, and also that social ties more strongly impact on formation process. Even though it is not pure interpersonal network research, it gives us insight on multiplex ties' formation at the individual level.

Social network researchers usually distinguish social ties at workplaces between instrumental and expressive ties in an organizational context (e.g., Ibarra, 1995; Lincoln & Miller, 1979; Podolny & Baron, 1997; Roberson & Williamson, 2012). Instrumental ties, such as work-related ties, are used for gaining information and resources in order to fulfill assigned tasks. Meanwhile, expressive ties, such as friendships, convey positive or negative psychological and emotional components, including a sense of identity, personal belonging, and normative expectations (Umphress, Labianca, Brass, Kass, & Scholten, 2003). Although they often overlap in organizations (Brass, 1984; Burt, 1992; Ibarra, 1992), there are distinctions between instrumental and expressive ties (Gibbons, 2004). For example, instrumental ties are related to the newcomers' learning of organizational knowledge, task mastery, and role clarity, while expressive ties are related to the organizational commitment and social integration during socialization (Morrison, 2002). Also, compared with expressive ties, which enable one to discuss sensitive issues like career-related decision-making (Kilduff, 1990; Krackhardt, 1992), instrumental ties are generally functional in nature in order to accomplish group or organizational goals and/or to fulfill a job, and are related to job performance (Sparrowe, Liden,

Wayne, & Kraimer, 2001) and organizational power (Brass, 1992; Ibarra & Andrews, 1993). Moreover, instrumental ties assigned by organizations are difficult for an actor to completely disconnect from and avoid, even if s/he emotionally dislikes and prefers not to work with another, compared to expressive ties and those instrumental ties formed through the actor's active and purposive actions.

Therefore, instrumental and expressive ties are differently associated with organizational behaviors and the forming mechanisms of instrumental and expressive ties are different. In particular, instrumental ties usually form from the work collaboration central to an organization's functioning once individuals join organizations, while the formation of expressive ties frequently occurs beyond the organization's setting (Dahlander & McFarland, 2013; Lazarsfeld & Merton, 1954). Compared to instrumental ties initiated by the purpose of fulfilling a job, expressive relationships (e.g., friendships) often begin with attraction derived from similarity to others who share the same race, gender, educational background, values, and/or attitudes (Carley, 1991; Gibbons, 2004; McPherson et al., 2001; Verbrugge, 1997) and strengthen over time through frequent interactions and shared experiences (Krackhardt, 1992).

Multiplex ties have these characteristics of both instrumental and expressive ties, and the forming process of multiplex ties is involved with the formation mechanisms of both instrumental and expressive ties. Therefore, it is important to examine the formation processes of multiplex ties in order to understand the differences among them as shown in the literature and phenomena (e.g., mentoring studies) but overlooked in the network scholarship. My pilot study provides insights into the developmental process of multiplex ties and how the tie formation order influences different usage of the ties. The findings provided that people perceived their multiplex ties differently, even though some of the people did not recognize how they started

their relationships at first. For instance, one of the people who is a manager of a film distributor said that she distinguishes and differently uses her multiplex ties at her workplace. In particular, she has two people who are linked with multiple relationships with her. One is the single female co-worker who had worked with her in the previous company and met again in the current firm. They are members of the same social club that consists of people from their previous company. Despite overlapping multiple facets of her life with this colleague, she usually interacts with this person for discussing task related matters, due to the differences in marital status and personality. The other person is the married male co-worker who was her previous client. At first she just thought him as a co-worker but now they talk about both their work and family, not only because he has more experience than her in the field and also the current company, but also because his life pattern is similar to her as a married person. Like this, an individual might prefer a specific multiplex tie over other multiplex ties in use, or distinguish between multiplex ties, or exclusively use each tie for either instrumental or expressive functions.

Also, the findings show that employees had different types and levels of *trust* in their multiplex ties. For instance, a participant who had three multiplex ties evaluated the trust of each multiplex tie differently depending on whether the tie was initiated from an instrumental tie or an expressive tie. Moreover, I found that participants did not use only one multiplex tie when asking for help from others. Instead, they used several multiplex ties differently, depending on what type of help they needed (i.e., help-giving versus help-receiving), what types of trust they had with their contacts, or how much they trusted these contacts.

Path Dependence in Network Evolution

To date, few studies have focused on the *order* in which an individual forms social ties and the subsequent impact this order has on behavioral consequences in social networks. Path dependence is an important concept referring to "developmental sequences and social dynamics" (Davis, 2007, p1) based on the history matter. Previous research has shown that path dependent nature of relationship development and the role of previous networks in creating the following networks. For example, researchers found that individuals are likely to focus on their existing networks (Granovetter, 1973; Portes & Sensenbrenner, 1993) and can be relationally locked in their existing network (e.g., Gargiulo & Benassi, 2000).

For example, Snijders, Lomi, and Torló (2012) found that existing friendship and advice ties mutually influence the formation of one another among a group of MBA students. These friendship and advice ties also influence the employment preferences in job searching processes and *vice versa:* the employment preferences encourage friendship and advice ties (e.g., Kilduff, 1990; Snijders et al., 2012). However, these foregoing studies did not examine the effect of the order the formation of ties had on outcomes.

Like this, network literature suggests that the effect of path dependence exists on tie formation, although that path dependence may occur for different reasons at the individual (and also organizational) level. In this dissertation, I investigate the effect of multiplex ties in behavioral consequences at the workplace depending on the multiplex tie formation from the path dependence perspective.

Type of Multiplex Ties: Instrumental-first and Expressive-first Ties

Given that organizational researchers tend to distinguish social ties between instrumental and expressive ties within the work context (e.g., Ibarra, 1992), and that multiplex ties are composed of both instrumental and expressive relationships, my pilot study found that people differentiated their multiplex ties according to which type of tie - instrumental or expressive - came first. Based on these findings, I categorized multiplex ties as one of two types:

1. An **instrumental-first** multiplex tie ("I-first" tie), being a dyad originally tied via an instrumental relationship (e.g., colleagueship at workplaces) and later expanded with an expressive relationship (e.g., friendship); or

2. An **expressive-first** multiplex tie ("E-first" tie), being a dyad originally tied via an expressive relationship and later augmented with an instrumental relationship.

Formation of Uniplex and Multiplex Ties

Social network researchers have studied tie formation mechanisms and found that individual attributes (e.g., personality, instrumental skills), structure characteristics (previous ties), and environmental factors (e.g., national culture, environmental change) are the antecedents of interpersonal networks (e.g., Brass, Galaskiewicz, Greve, & Tsai, 2004; Hinds, Carley, Krackhardt, & Wholey, 2000). Specifically, Rivera, Soderstrom, and Uzzi (2010) found that three mechanisms of assortative mechanism, relational mechanism and proximity mechanism for examining the process of formation, persistence, and dissolution of dyadic ties through reviewing sociological research. According to their findings, assortative mechanism emphasizes compatibilities and complementarities between actors' attributes, while relational mechanism stresses actors' positions in existing social network. Proximity mechanism focuses on actors' social and cultural environment such as geographical and physical propinquity. For example, from the assortative perspective, self-monitoring personality influences an individual's network

maintenance and change (e.g., Mehra et al., 2001; Sasovova et al., 2010) and from the relational perspective, change of existing network ties/position via promotion is the important factor which affect tie loss and gain (Jonczyk et al., 2016). From the proximity perspective, Sailer and McCulloh (2012) shows the empirical results that spatial configuration of office is associated with tie formation by facilitating interpersonal interactions.

More recently, in a research collaboration setting, Dahlander and McFarland (2013) examined six factors that influence tie formation and persistence, focusing on the intra-organizational context: 1) shared organizational foci, 2) homophily in attributes and interest, 3) tie advantage from the popularity, 4) tie reinforcement from triadic closure, 5) tie strength, and 6) multiplexity based on tie inertia and the instrumental returns of products. The authors found that these six factors differently influence tie formation and persistence processes, and highlighted that multiplex ties are positively associated with tie persistence. While Dahlander and McFarland's research shows the relation between multiplex ties and tie formation/persistence, it reveals that the issue is not about the formation of multiplex ties, but rather the probability that the tie persists after multiplex ties have formed. However, the formation of multiplex ties differs not only from the persistence of multiplex ties, but from the formation of uniplex ties.

From research on new ventures' tie evolution, we can examine the evolution of the entrepreneurs' personal networks including the set of interpersonal relationship between entrepreneurs (ego) and their partners (alter) (Aldrich & Zimmer 1986). For instance, Vissa examined the entrepreneurs' intention to add new ties to their personal network (2011) and also investigated the entrepreneurs' interpersonal networking styles on the initiations of economic exchanging ties. In his study on the entrepreneurs' intention of forming new tie, Vissa (2011) found that language similarity, social status similarity (caste), and task complementarity had a

strong effect on entrepreneurs' intentions of forming an interpersonal tie. By showing the importance of task considerations for entrepreneurs' tie formation intention, this finding is contrary to the findings of Casciaro and Lobo's research (2008) which shows the importance of social aspects rather than the work partners' task competence: Casciaro and Lobo (2008) found that employees prefer to form a tie to a person they like, regardless of task competence, rather than to a task expert whom they dislike. Moreover, Vissa (2012) presents that there are two types of entrepreneurs' networking actions, network-broadening actions (adding new contacts) and networking- deepening actions (managing existing contacts) depending on the cost-benefit calculus of using referrals when searching for new contact. He found that, depending on whether their reliance on referral-based search increases or decreases, entrepreneurs differently use network-deepening actions (increased reliance) and network-broadening actions (decreased reliance). Considering that network-broadening actions is the forming action of multiplex ties and network-deepening action is the maintaining action of uniplex ties, the cost which occurs in the tie formation process is the one of the key factors whether to decide between forming new (multiplex) ties or maintaining uniplex ties.

Beyond the tie persistence processes associated with multiplex ties, I further argue that the forming process of multiplex ties - as well as the persistence process - is different from that of uniplex ties. It is because that the formation of multiplex ties simultaneously requires the persistence of existing ties and the formation of new uniplex ties of a type different from the existing tie. In other words, I argue that the effects of one type of tie on the formation of another play an important role in the formation of the multiplex tie and its consequences. For example, Snijders et al. (2012) examined that how friendship and advice relationship in a group of MBA

cohorts influence the employment preferences and showed that friendship relationship influences the tendencies to reciprocity of advice relationships.

Different Types of Multiplex Ties and its Formation Process

The reason that instrumental-first and expressive-first multiplex ties have different characteristics is that the characteristics of an initial tie remain and still function within the newly-formed multiplex tie. In other words, the effect of the characteristics of the initial tie may be stronger than the effect of the added tie later. In understanding this tie inertia effect in the developmental process of multiplex ties, it would be helpful to understand the process of tie formation and tie persistence from the network evolution theory (Stokman & Doreian, 1997), as well know the similarities and differences between those processes and the developmental processes of multiplex ties. This is because the tie inertia of an initial tie is related to tie formation and persistence - especially when these processes of tie formation and persistence occur at the same time but into different types of ties.

According to the network evolution theory, there are two steps in network generation: *selection* and *retention*. At the dyadic level, Stokman and Doreian (1997) describe that network relations are created through two steps: access requests and acceptance. *Access request*, similar to selection, is an "actor's proposal to establish relations with others" and *acceptance* is "an actor's accepting the most profitable relations" (p247). Recently, Farh and colleagues theorized a five-stage model of tie formation between expatriates and contacts in their host country, showing the process between the access request of the actors and acceptance by their contacts (Farh, Lee, & Farh, 2010) . Also, Dahlander and McFarland (2013) examined both the process of tie formation and the process of tie persistence in the research collaboration networks by showing

that these two processes occur in different contexts. To be specific, tie formation occurs in people who did not share a previous relationship, while the tie persistence occurs between two people who are familiar with each other in order to repeat and extend their relationships.

There are two views on tie formation and tie persistence, depending on whether inertia is considered. The first view is that the tie persistence process is similar to tie formation process and thus the factors guiding tie formation also drive tie persistence. For example, both tie formation and tie persistence (or dissolution) are driven by homophily, including status homophily (e.g., gender, age, education, and occupation) and value homophily (e.g., attitude, belief) (McPherson et al., 2001). The second view is that the processes of tie formation and tie persistence are different because of path dependence and inertia (Cohen, March, & Olsen, 1972; March & Simon, 1958), which asserts that once relationships are formed, people tend to maintain these relationships despite of having better alternatives. Dahlander and McFarland's (2013) six influences on tie formation and persistence processes. They showed that organizational foci (e.g., shared positions and activities), connection with popular ties, and triadic closure positively influence tie formation but not tie persistence, while status homophily positively influences both the tie formation and persistence processes, and tie inertia influences only the persistence process based on the shared experience and investment in relationship.

However, it is important to distinguish between the process of tie formation, tie persistence, and the development of multiplex ties. In particular, while the tie formation process is influenced by opportunity and preference, such as future network benefit and the homogeneity between actors, the tie persistence process is influenced by obligation and complementary experience with familiar and somewhat proximate actors (Dahlander & McFarland, 2013). The developmental process of multiplex ties partially involves both processes of tie formation and tie

persistence. More specifically, on the one hand, the developmental process of multiplex ties is a kind of the process of tie formation considering that a new type of relationship is formed. When people develop their existing ties in to an instrumental-first tie, homophily may play an important role in the process, while when developing their existing ties into an expressive-first tie, resources and benefits from the new instrumental relationship lead individuals to develop their existing tie into a multiplex one. On the other hand, the process also involves that of tie persistence, which considers that the decision in developing from uniplex to multiplex ties is made to the complementary experiences through the existing relationship. That is, people efficiently seek resources and support within their existing ties based on their knowledge of resource possessors and with limited networking effort. Also, multiplex ties require maintaining previous ties; newly-developed relationship without the presence of the existing relationship are not multiplex ties (Kuwabara et al., 2010). Hence, the developmental process of multiplex ties involves both the processes of tie formation and tie persistence. Given that the process of tie persistence occurs in a more certain context (based on the existing relationship) than the tie formation (Dahlander & McFarland, 2013), multiplex ties also form in a more certain and familiar context than in the tie formation process. That is, the certain type of pre-existing relationships influences an actor's motive in creating multiplex ties (Ferriani, Fonti, & Corrado, 2012), although s/he has not experienced other types of relationships with the same person.

Based on the influence of tie inertia and the dynamics of the processes of tie formation and persistence, when examining the characteristics between an instrumental-first tie and an expressive-first tie, I look at the concept of trust in each type.

Trust: Different Types of Trust Associated with Different Types of Relationships

Trust has been studied as an antecedent and favorable consequence of social relationships in organizations. Social network researchers have examined the emergence, function, and influence of trust. In particular, trust emerges in a relationship from previous interactions between two actors through the exchange of knowledge and information which derives from initial expectations and judgments of others' trustworthiness (Kramer, 1999). Trust in a new relationship can also be developed and diffused by a third party even if s/he did not have access to the previous knowledge or interaction history of the primary actors (e.g., Uzzi, 1997). Trust reduces transaction costs (Arthur & Rousseau, 1996; Nebus, 2006; Uzzi, 1997), enables actors to facilitate information sharing (Chan, 2000; Tsai & Ghoshal, 1998), and increases cohesiveness and cooperation within organizations (Ashford & Taylor, 1990).

There are two forms of trust: *cognition-based* trust and *affect-based* trust (Chua, Ingram, & Morris, 2008; McAllister, 1995). Cognition-based trust results from the calculative and instrumental judgment of another's competence and reliability, while affect-based trust results from emotional bonds and positive perceptions about another's motive for the relationship (Chua et al., 2008; McAllister, 1995). Moreover, cognition-based trust enables actors to expect another's behavior under certain circumstances, while affect-based trust applies across situations. Also, because cognition-based trust is "more superficial and less special" (Johnson-George & Swap, 1982, p1316), affect-based trust is relatively more enduring than cognition-based trust.

Given the characteristics of the two forms of trust, researchers have noted that instrumental ties are associated with cognition-based trust, and expressive ties are associated with affect-based trust (Chua et al., 2008; Gibbons, 2004). More importantly, in cognition-based trust, actors consider the perceived expertise of others when they pursue task-related support

(Andrews & Delahaye, 2000; Fisher, Ilgen, & Hoyer, 1979; Nebus, 2006; O'Reilly & Roberts, 1976). By contrast, the actors generate expressive ties based on the affect-based trust arising from the interpersonal attraction (Carley, 1991; Verbrugge, 1979) and develop them through increased interaction and shared experience (Krackhardt, 1992).

Recently, Chua and his colleagues (2008) examined how multiplex ties (i.e., career guidance) are related to both cognition-based and affect-based trust in managers' professional networks within an organization. The results consistently show the positive associations between instrumental (i.e., task advice) and expressive (i.e., friendship) ties and cognition- and affect-based trust respectively. Moreover, Saint-Charles and Mongeau (2009) show that individuals differently activate and use their networks in organizations according to the organizational situations that require different type of trust: organizational members depend on cognition-based trust networks in uncertain situations with lack of information, while they rely on affect-based trust networks in ambiguous situations with many interpretations but with no lack of information. Interestingly, even though this study considers that organizational relationships are potentially overlapped (i.e., are multiplex ties), the authors did not investigate each dyadic relationship between the respondent and the contact.

Initial ties, compared to augmented ties that occur later, are the long-lasting ties that exist throughout the history of a relationship, and these ties are less likely to be changed due to relational inertia (Kim, Oh, & Swaminathan, 2006). Moreover, considering that the developmental process from a uniplex tie to a multiplex tie is not a tie change from one type to another type but, rather, a tie extension, the characteristic of the initial tie will persist due to tie inertia, although the effect of the initial tie itself might be reduced (Kim et al., 2006). On the other hand, if an individual no longer works with the co-worker who became a friend during a

past project, this tie between them is not extended as a multiplex tie but is instead transferred from an instrumental tie to an expressive tie. In addition, because the adjusted norms of interactions to the transferred tie are not the same as the simultaneously-managed norms of multiplex ties (Kuwabara et al., 2010), the effect of the initial tie may be reduced as compared to the effect of a uniplex tie, but more strongly exist in comparison to the added tie within a multiplex tie due to tie inertia. Given that multiplex ties are associated with both types of trust, it is not clear which type of trust of either initial or augmented tie is dominant within a multiplex tie dependent on path dependence. However, multiplex ties can be distinguished according to the dominant trust of the multiplex tie as an instrumental-first and an expressive-first multiplex tie.

In this dissertation, I argue that there are two types of multiplex ties depending on the order of tie formation in the developmental process. In the following section regarding consequence in multiplex ties, I examine knowledge sharing and covering in an organizational context.

CHAPTER 4:

THE CONSEQUENCES OF MULTIPLEX TIES ON KNOLWEDGE SHARING AND COVERING

Research Motivation

Interpersonal relationships that have been developed through a history of interactions can be considered *resources* (i.e., relational social capital) (Granovetter, 1982; Lin, 1999; Tsai & Ghoshal, 1998). For example, instrumental and expressive relationships among organizational members influence their behaviors, those such as organizational citizenship behavior (Bolino, Turnley, & Bloodgood, 2002), knowledge sharing (Reagans & McEvily, 2003; Reinholt, Pedersen, & Foss, 2011), and unethical behavior (Brass et al., 1998). That is, instrumental ties are associated with behaviors in gathering information, advice, and resources in order to accomplish a task, while expressive ties are associated with behaviors based on interpersonal attractions like emotional expression, encouragement, mentoring and career support to increase psychological well-being (Umphress et al., 2003).

Given the literature asserting that instrumental and expressive ties provide distinct resources but multiplex ties provide several resources simultaneously, I examine the consequences of multiplex ties in organizational behaviors depending on the tie formation order of multiplex ties. I take special aim on the behavioral consequences of multiplex ties, focusing on knowledge sharing and covering behaviors because: 1) knowledge sharing is an important organizational behavior insofar as it is an instrumental purposive behavior that influences organizational performance (Maurer, Bartsch, & Ebers, 2011) covering is an emotion-based behavior without recognition of organizational duty (Norman et al., 2010).

This chapter is different from my initial proposal in which I only focused on knowledge sharing as a consequence of multiplex ties as a behavioral outcome. However, I realized that knowledge sharing is strongly associated with instrumental ties, so I decided to add another study strongly associated with expressive ties using the covering behavior as the consequence of those multiplex ties associated with expressive ties. With that addition, given the nature of vignette study that could not measure trust, I took removed the issue of trust from this chapter even though I argue that trust is an important factor that makes distinctions between instrumental- first and expressive-first multiplex ties. However, I contend that trust is one of the key mechanisms to determining the characteristics of multiplex ties in my pilot study and literature review chapters.

In Chapter 4, I compare the consequences of uniplex and multiplex ties and examine the effect of formation order of multiplex ties in knowledge sharing and covering through vignettes experiments.

Theoretical Background and Hypotheses

The Consequences of Multiplex Ties in Knowledge Sharing and Covering

Knowledge Sharing and Covering

Knowledge sharing is defined as "the provision or receipt of task information, know-how, and feedback regarding a product or procedure" (Cummings, 2004, p352; Hansen, 1999). By definition, knowledge sharing is necessarily involved in the instrumental purpose to improve performance in an organizational context. In knowledge-intensive tasks, individuals can save time and increase the quality of work output through knowledge sharing (Haas & Hansen, 2007).

Knowledge sharing also influences the consequences of organizational process and performance, such as through organizational learning (Reagans, Argote, & Brooks, 2005),

innovation (e.g., Obstfeld, 2005), and performance of subunits (e.g., Hansen, 1999). As a critical organizational resource, knowledge and knowledge sharing have been consistently studied in organizational research. A large body of research shows that social relationships and networks are closely related to the process of knowledge creation, diffusion, adaptation, and knowledge outcomes at various levels (see a review by Phelps et al., 2012). For example, tie characteristics such as tie strength, multiplexity, and informality increase the exchange of tacit and complex knowledge within organizations (Schulz, 2003). Especially strong ties which are multiple and socially embedded improve fine-grained information transfer between actors (Uzzi, 1996), and improve exchange of tacit knowledge among organizational subunits (Hansen, 1999).

Granovetter introduced the concept of strength of an interpersonal tie which is formed by a combination of duration, frequency, and emotional closeness of tie (1973). Hence, depending on the dimension of the strong tie researchers focus on, the association between strong tie and knowledge sharing could be different. For example, in terms of the diversity of shared knowledge, empirical evidence shows that strong ties between two actors connected through long-lasting relationships involving frequent interactions are positively associated with the redundant knowledge sharing (Reagans,2005). Whereas, strong ties based on emotional closeness between actors increase their willingness to work closely with others by fostering actors' intrinsic motivation (Marsden & Campbell, 1984). Furthermore, research on knowledge creation required knowledge sharing process suggests that strong tie based on positive work-related emotional intensity can helpful in generating knowledge (Sosa, 2011). Considering multiplex ties as a strong tie and enable simultaneous access to both affect and instrumental contents, individuals will mostly use multiplex ties over uniplex ties (e.g., instrumental only ties) in knowledge sharing

Hypothesis 1: An individual is more likely to use a multiplex tie than an uniplex tie in knowledge sharing.

Covering for a coworker while s/he is away from the office is a type of organizational citizenship behavior (OCB) which "aims at helping for a coworker that are not formally a part of the helper's recognized duties" (Norman et al., 2010, p3). Regarding voluntary altruistic behavior as an emotion-centered behavior, there are two research streams: one is that voluntary altruistic behavior helping to potentially enhance organization as OCB (Organ, 1988), and another that it is potentially destructive, i.e. a behavior intended to hurt a colleague such as avoiding work and sabotage, which is considered as counterproductive work behavior (CWB) (Spector & Fox, 2002). When individuals cover by defending someone, it requires emotional bond to be willing to take negative consequences in future such as having a negative relationship with the person who attacked your friend and being branded as a same token with your friend. For example, when you defend your colleague at workplace, it is common that you can have interpersonal conflict with a people who mistreat your colleague (Keenan & Newton, 1984). Thus, when people have more positive and stronger relationships with their colleagues, they are more likely to cover their colleagues within the organization. Due to the risk of covering someone at workplace, without emotional bond, minorities who identify with each other with a distinctiveness may not tend to cover each other. For example, women who are a numerical minority in an organization may be less likely to support each other in order to avoid situations which would categorize them as women or the minority and thusly be distinct from their work group (e.g., Duguid, 2011; Mehra et al., 1998). Taken together, I argue that an individual would prefer a multiplex tie over a uniplex tie for covering behavior because multiplex ties are based on the strength from overlapping relations than on an uniplex tie based only on an expressive tie.

Hypothesis 2: An individual is more likely to use a multiplex tie than an uniplex tie in covering.

Type of Multiplex Ties and Knowledge Sharing and Covering

Multiplex ties, including both uniplex ties of instrumental and expressive ties, can be used for both type of purposes. The ordering of multiplex ties might lead to different consequences per two explanations. First, instrumental-first and expressive-first multiplex ties will lead to different behavioral consequences because the type of trust which dominates in those multiplex ties is different depending on the order of multiplex ties. Alternatively, the duration of each tie within a multiplex tie is associated with each type of behavior. Individuals have different histories of their relationships and they have had different experiences with instrumental-first and expressive-first ties. In other words, instrumental tie within instrumental-first tie has been used longer for task performance than the expressive-first tie which is extended later and vice versa. Thus, even though multiplex ties include each uniplex tie, individuals will use the multiplex tie for the event which has been more accustomed with longer experience. If order effect presents, I can expect that more instrumental behavior with instrumental-first multiplex ties and more expressive behavior with expressive-first multiplex ties. Therefore, this paper offers the following additional hypotheses:

Hypothesis 3: An individual is more likely to use the instrumental-first tie than the expressive-first tie in knowledge sharing.

Hypothesis 4: An individual is more likely to use the expressive- first tie than the instrumental-first tie in covering.

On the one hand, in this dissertation, I consider two different knowledge sharing behaviors of knowledge seeking and giving. Previous network research on knowledge sharing has been merely focusing on knowledge seeking behavior, but there are not only similarities but

also differences between knowledge seeking and giving (Reinholt, Pedersen & Foss, 2013). Specifically, Reinholt et al.'s (2013) study on the association between network position (centrality), motivation and ability, they found that employees' knowledge sharing ability is important for knowledge seeking but it is less important for knowledge giving. Also, knowledge giving occurs when actors are in central position, but knowledge seeking appears when actors' central position combined with their autonomous motivation and knowledge sharing ability.

Given the differences between knowledge seeking and giving behaviors in terms of motivation and egos' and alters' ability to share knowledge, I think that the association between type of ties and specific purposes of whether to seek or give knowledge could be different. Thus, I consider both behaviors of knowledge seeking and giving, even though I do not hypothesize them separately in this dissertation.

On the other hand, I categorize covering behaviors as defending and baling-out. Comparing to knowledge seeking and knowledge giving that a focal person's role changes as either a provider or receive, it seems to be there is no clear reason to categorize covering behavior into defending and bailing out, because the role of a focal person as a help provider does not change in defending and bailing-out context. However, I categorize covering behavior into two pattern between defending and bailing-out depending on entailing cost for those behaviors. Going back to knowledge sharing, although there is not exact research to compare psychological and social cost between knowledge seeking and knowledge giving, I infer that knowledge seeking require more cost than knowledge giving. That is because knowledge seeking involves psychological cost such as highly threatening an individual's desired self-image (Bamberger, 2009) and also knowledge seeking is associated with trust which is not associated with knowledge giving (Reinholt et al.,2013). Based on this inference, I have two covering

behaviors between defending which would require less cost and bailing-out which need more cost. As same as in knowledge sharing, there are not separate hypothesis on defending and bailing-out.

Methods and Results

In this chapter, I propose four hypotheses (H1-H4). To test the hypotheses, I conducted two web-based vignette study experiments. I conducted two studies for each consequence of multiplex ties in knowledge sharing (H1, H3) and covering (H2, H4). I use the same vignette to explain each type of relationship for the two studies of knowledge sharing and covering. I collected the data for each study using Amazon's Mechanical Turk (M-Turk).

Study 1: Consequence of Multiplex Ties in Knowledge Sharing

A. Design: Vignette Study

To investigate the different effects between uniplex and multiplex ties and the order effect on multiplex ties, the data should represent a specific type of relationship. I used vignettes describing an imaginary co-worker's relationships which she had developed over time (see Appendix). Each vignette described a specific type of relationship, such as an instrumental tie, an expressive tie, an instrumental-first multiplex tie, and an expressive-first multiplex tie. The label "Advisor Only" represented an instrumental-only tie, and the label "Friend Only" represented an expressive-only tie. "Advisor then Friend" was the label used to describe a multiplex tie originally formed from an instrumental tie (i.e., instrumental- first), while "Friend then Advisor" described the multiplex tie originally formed from an expressive-first tie.

In the vignettes, instrumental relationship is represented as an advice exchanging relationship and expressive relationship is represented as a friendship. Advice and friendship relationships have typically studied as an instrumental and expressive relationship. Employees

exchange work-related information such as job and organizational-related information through advice ties (Gibbons, 2004; Ibarra, 1993). Friends share similar beliefs regarding other co-workers (Krackhardt & Kilduff, 1990) and the idea of stressful work environment (Beehr, Bowling, & Bennett, 2010), thus when employees face with sensitive issues, they discuss them with their friends for support (Kilduff, 1990; Sias & Cahill, 1998). Thus, in vignettes, the advice relationship was explained as the relationship with "seeking work-related information and advice to enhance your effectiveness on the job" and the friendship relationship was explained as the relationship with "feeling comfortable discussing personal matter".

B. Procedures: Mechanical Turk

A total of 453 individuals were initially recruited using Amazon's M-Turk program. I solicited participants who were currently employed, over 18 years old, to investigate the relationship between the type of relationships and knowledge /covering behaviors in the organizational setting. Also, in order to hire reliable participants with the experience of M-turk survey in the past, I selected participants who had an average positive rating by previous M-Turk employers of over 97%, and had completed at least 1000 M-Turk tasks in the past. I removed 33 participants who did not, in fact, meet these conditions, and the remaining 420 participants who completed the short online survey received 50 cents.

Participants completed a survey about knowledge sharing intentions with "Casey," a hypothetical co-worker, after reading a vignette. This study included two sets of manipulations. First, participants were randomly assigned to one of four vignettes, each explaining a certain type of relationships with Casey; thus, each participant saw only one of the four vignettes. Then participants were randomly assigned to a dependent variable type. There were three conditions: 1) a question of knowledge seeking only, 2) a question of knowledge giving only, and 3) a

question of both types. The second manipulation was intended to test whether participants' intention of knowledge seeking or giving could be changed when they were asked to answer about knowledge seeking only, or *vice versa*, compared to when they were asked to answer both questions. Thus, there were 12 groups of participants: 4 (type of tie) × 3 (frequency and likelihood of knowledge sharing) in total.

Inclusion criteria. To verify that the participants recognized the nature of the relationship present in their vignettes, I asked them to answer two manipulation check questions about the original and the current relationship with Casey: 1) "Which option of relationship best describes your original relationship with Casey?" and, 2) "Which option best describes your current relationship with Casey?" Only correct responses to both questions were included in the analysis. Among 420 participants, 257 (over 61%) respondents were satisfied the inclusion criteria. This is the sample size I used to acquire the results in this dissertation.

C. Measures

Independent Variables. I measured four different types of ties which were manipulated through the four vignettes: *instrumental only, expressive only, instrumental-first, and expressive-first*.

Dependent Variables: Knowledge Seeking and Giving. I measured *knowledge sharing* through *knowledge seeking* and *knowledge giving* as two dependent variables. Participants were asked to answer the likelihood of acquiring/providing work-related knowledge from/to Casey on a 5-point scale of 1=never to 5=very frequently. Sample questions were: "When you need information or knowledge on work-related topics, how likely is it that you will seek relevant information and knowledge from Casey?" and, "When Casey asks you for information or

knowledge on work-related topics, how likely is it that you will provide the relevant information and knowledge to Casey?"

Table 2 illustrates the vignettes for the manipulation of the types of ties, the questions about knowledge seeking and giving, and the manipulation check questions.

Table 2: Subjects: Cross-Table of Tie Type and Knowledge Sharing Behaviors

		Knowledge Behaviors			Total
		Seeking	Giving	Both	
Tie Type	Advisor Only	29	23	20	72
	Advisor then Friend	23	20	22	65
	Friend Only	14	17	22	53
	Friend then Advisor	24	21	22	67
Total		90	81	86	257

D. Result

I used analysis of variance (ANOVA) to investigate statistically significant differences among the condition assignments. First, I examined whether there are differences in the dependent variable conditions when participants were asked to answer only the seeking/giving questions and when they were asked to answer both questions together. If there were differences in knowledge sharing depending on the manipulation conditions, the 12 groups of participants were analyzed separately, otherwise, the responses to the knowledge seeking/giving question in the isolation and simultaneous condition could be combined. The variance in the knowledge seeking responses when asked alone did not differ significantly from when asked the knowledge seeking and giving questions together. Similarly, the variance in the knowledge giving responses when asked alone did not differ significantly when the question was asked in the presence of the knowledge seeking question. Also, to check for the unequal distribution of gender across

conditions in knowledge sharing, I performed chi-square tests. The result showed that the gender distribution did not significantly differ across the types of tie in knowledge sharing ($\chi 2(3)=7.487$, $p=.058$). There was only one person who answered his or her gender as "others" in the knowledge sharing study and I excluded that person from the chi-square analysis.

Knowledge Seeking. The mean knowledge seeking for each condition, along with a 95% confidence intervals, was similar between subjects responding to knowledge seeking via a single question and both questions on knowledge giving (Table 3). Thus, I combined those subjects and the means for knowledge seeking are given in Figure 1.

Table 3. Means and SDs by cell Ns of Knowledge Seeking

Tie Type	Isolation			Simultaneous			Combined		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
1: Advisor Only	37	3.7	0.82	24	3.5	0.88	61	3.6	0.84
2: Advisor then Friend	34	3.9	0.69	35	4.0	0.80	69	3.9	0.75
3: Friend Only	28	2.6	1.1	44	2.1	1.0	72	2.3	1.1
4: Friend then Advisor	41	3.6	0.74	37	3.8	0.82	78	3.7	0.78

Knowledge seeking outcomes did differ significantly by relationship condition ($F(3, 170)= 49.223$, $p=.000$) after controlling gender. The result of pairwise comparisons by condition, shown in Table 4, provides that the "Friend only" condition, which is different from all others, makes this difference. In other words, for knowledge seeking, multiplex ties are not distinctive in comparison to uniplex ties (instrumental only ties). Moreover, there is no significant difference between instrumental-first and expressive-first multiplex ties.

Figure 1. Tie Type and Knowledge Seeking Behavior

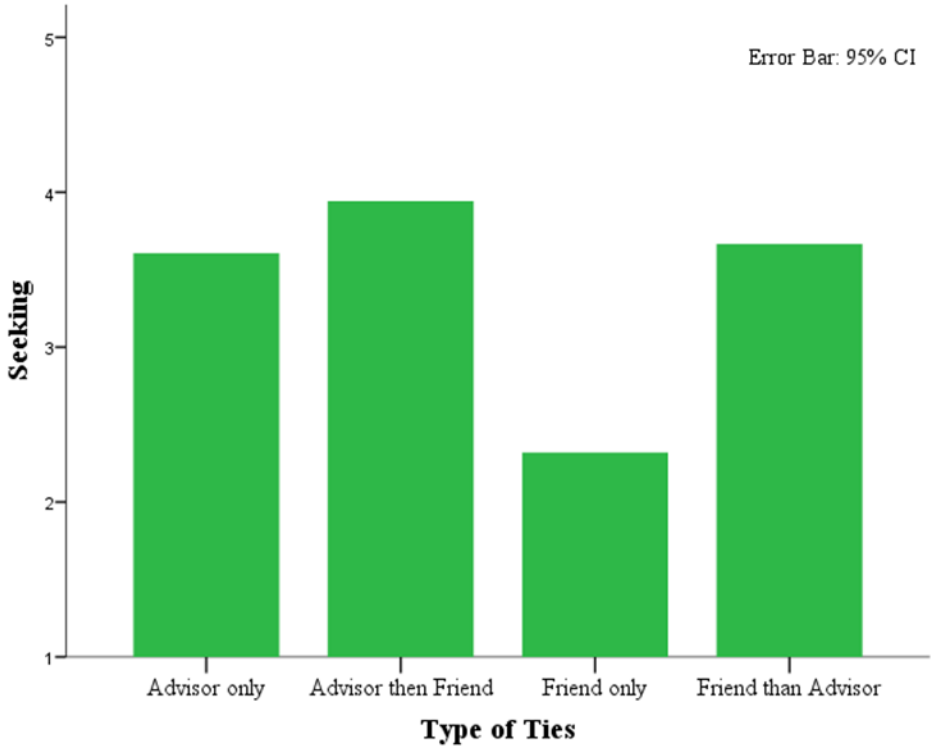

Table 4: Pairwise Comparison among Tie Type for Knowledge Seeking Behavior

(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.
Advisor only	Advisor then Friend	-.24	.166	.951
	Friend only	1.70*	.176	.000
	Friend then Advisor	-.07	.164	1
Advisor then Friend	Friend only	1.94*	.180	.000
	Friend then Advisor	.17	.169	1
Friend only	Friend then Advisor	-1.77*	.178	.000

Based on observed means.
The error term is Mean Square(Error) = .641.
*. The mean difference is significant at the 0.05 level.

Knowledge Giving. The mean knowledge giving between subjects responding to the single knowledge giving or both questions with knowledge seeking is more similar than knowledge seeking along with their 95% confident intervals (Table 5). The combined means are given in Figure 2.

Table 5. Means and SDs by cell Ns of Knowledge Giving

Tie Type	Isolation			Simultaneous			Combined		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
1: Advisor Only	40	3.8	1.0	24	3.8	0.92	64	3.8	0.97
2: Advisor then Friend	36	4.4	0.65	35	4.1	0.95	71	4.3	0.81
3: Friend Only	31	3.3	1.3	44	3.3	1.2	75	3.3	1.2
4: Friend then Advisor	33	4.5	0.71	37	4.2	0.67	70	4.3	0.70

Knowledge giving outcomes also differ significantly by relationship condition ($F(3, 162)= 16.100$, p=.000) with gender control. According to the result of pairwise comparisons by condition shown in Table 6, the "Friend Only" condition had the lowest level of knowledge giving relative to all others, and both type of multiplex ties were significantly more associated with knowledge giving than were uniplex ties. The uniplex instrumental tie was associated with middle-level of knowledge giving compared to all other ties, including both multiplex ties and uniplex expressive ties. For knowledge giving, both multiplex ties represented significantly stronger consequential relationships as compared to uniplex ties, but both multiplex ties were not significantly different. However, the results show that the uniplex expressive ties and multiplex ties were distinctive in knowledge giving.

H1 predicts the stronger consequences of multiplex ties compared to uniplex ties in knowledge sharing. However, the analysis shows that there are no differences between instrumental-first and expressive-first multiplex ties in knowledge seeking and giving. Thus, H1

is not supported. Also, H3 states that an instrumental-first multiplex tie is more mobilized than an expressive-first multiplex tie in knowledge sharing; H3 is not supported.

Figure 2: Tie Type and Knowledge Giving Behavior

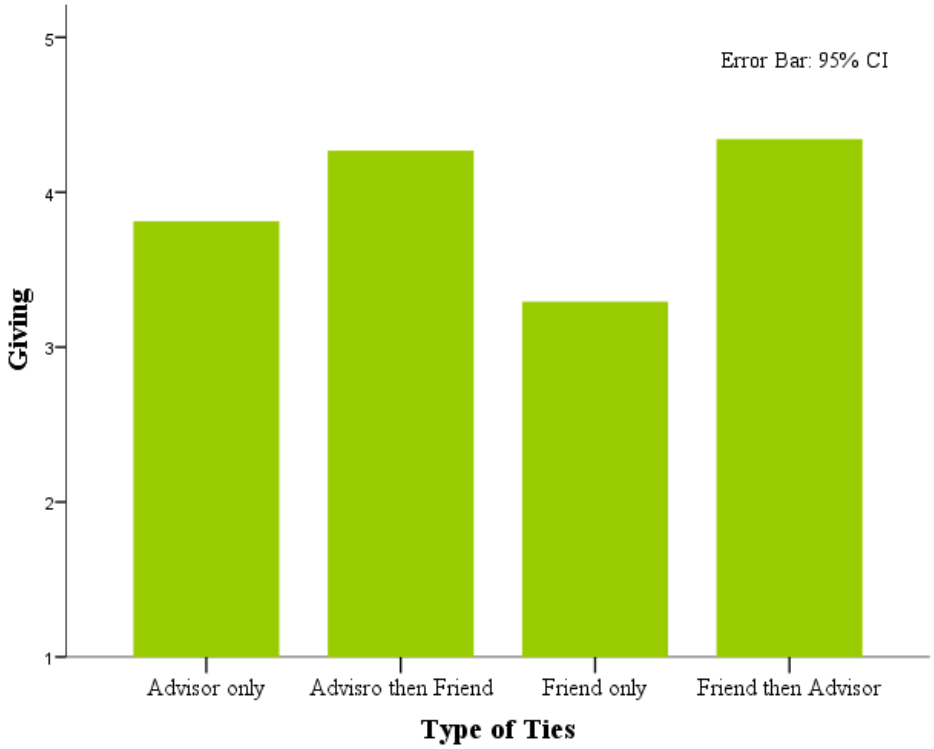

Table 6: Pairwise Comparison among Tie Type for Knowledge Giving Behavior

(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.
Advisor only	Advisor then Friend	-.24	.189	1.000
	Friend only	.90*	.193	.000
	Friend then Advisor	-.28	.188	.838
Advisor then Friend	Friend only	1.15*	.194	.000
	Friend then Advisor	-.04	.189	1.000
Friend only	Friend then Advisor	-1.18*	.193	.000

Based on observed means.
The error term is Mean Square(Error) = .760.
* The mean difference is significant at the 0.10† and 0.05 * levels.

E. Findings and Discussion

The purpose of my study was to explore the consequences of multiplex ties in knowledge sharing. Specifically, I investigated whether there are differences not only between uniplex and multiplex ties, but between instrumental-first and expressive-first multiplex ties in knowledge sharing, which is instrumentally-oriented behavior, as well. Unfortunately, I could not find statistically significant differences between instrumental-first and expressive-first multiplex ties in both knowledge seeking and giving. That is, against my expectations of the different effect of multiplex ties depending on the tie formation order, I could not find significant differences between the instrumental-first and the expressive-first multiplex ties in both knowledge seeking and knowledge giving.

However, I found some interesting results contrary to the general view on multiplex ties. The results provide that there is no statistical differences between uniplex ties (instrumental only ties) and multiplex ties in knowledge seeking, thus diverging from the general belief that multiplex ties are better than uniplex ties in seeking knowledge (Brass, 1992; Granovetter, 1982). Considering that it requires substantial time and effort to form and maintain a multiplex tie over a uniplex tie, this result suggests that individuals can have the same or similar benefits of multiplex ties by forming/maintaining instrumental only ties in knowledge seeking at work.

Study 2: Consequence of Multiplex Ties in Covering

A. Design and Procedures

In addition to the instrumental behavior, I conducted the same experiment about emotion-based behavior in my second study. A total of 392 subjects, again recruited from Amazon's M-Turk, participated in the experiment and 233 who matched with the inclusion criteria were used in the analysis. As with Study 1, participants were asked to read the same vignettes describing

Casey's four relationship types (i.e., instrumental only tie, expressive only tie, I–first tie, and E-first tie), but were then asked to answer questions about the covering.

Table 7: Subjects: Cross-Table of Tie Type and Covering Behavior

		Covering			Total
		Defending	**Bailing-out**	**Both**	
Tie Type	Advisor only	25	20	30	75
	Advisor then Friend	19	16	20	55
	Friend only	16	24	15	55
	Friend then Advisor	16	15	17	48
Total		76	75	82	233

B. Measure

Independent variables. Four different types of ties were independent variables (as they were for Study 1): "Advisor Only" tie as an instrumental tie, "Friend Only" tie as an expressive tie, "Advisor then Friend" as an instrumental-first multiplex tie, and "Friend then Advisor" as an expressive-first multiplex tie.

Dependent variables. I asked two questions about "defending" and "bailing-out" as covering behaviors. I measured defending as a relatively weak covering, and bailing-out as a relatively strong action to cover for co-workers. The questions were: "If Casey made a decision or took some action that needed defense or justification, how likely is it that you would defend or justify Casey's decision to others in your organization even if Casey were not present at the time?"(defending) and "How likely is it that you would be willing to go out of your way to "bail out" Casey, if Casey needed it, within your organization?" (bailing-out).

C. Results

Using the same method as I used for my knowledge sharing analysis, I used one-way ANOVA with gender control and pairwise comparisons to investigate statistically significant differences in covering on the order of formation of multiplex ties and the strength of the multiplex ties. First, I analyzed each group who read the defending script only, the bailing-out script only, and then both scripts, using the total 392 participants. Then, I excluded the participants who were not satisfied the inclusion criteria (size=233). I combined the group who read the script of defending/bailing-out only and those who read the both scripts. Each group had 157 (defending) and 156 (bail-out) participants. As same as in knowledge sharing study, I performed chi-square tests to check for the unequal distribution of gender across conditions in covering. The result showed that the gender distribution did not significantly differ across the types of tie in covering ($\chi^2(3) = 1.475$, $p = .688$) as well. There was no one who answered as "others" gender category in the covering study.

Tables 8 and 9 show the results regarding the differences among the types of ties (i.e., Advisor Only, Friend Only, Advisor then Friend, and Friend then Advisor) in the two covering behaviors. The results indicate that instrumental ties are negatively different with both instrumental-first and expressive-first ties in justification and bail-out, while there is no difference between instrumental-first and expressive-first ties. Also, there is a significant difference between instrumental-first ties and expressive ties in defending ($p < .10$) and bailing-out ($p < .05$). Instrumental and expressive ties are slightly different ($p < .10$) only in defending, and expressive ties are negatively significant with expressive-first ties only in bailing-out.

Figure 3. Tie Type and Defending behavior

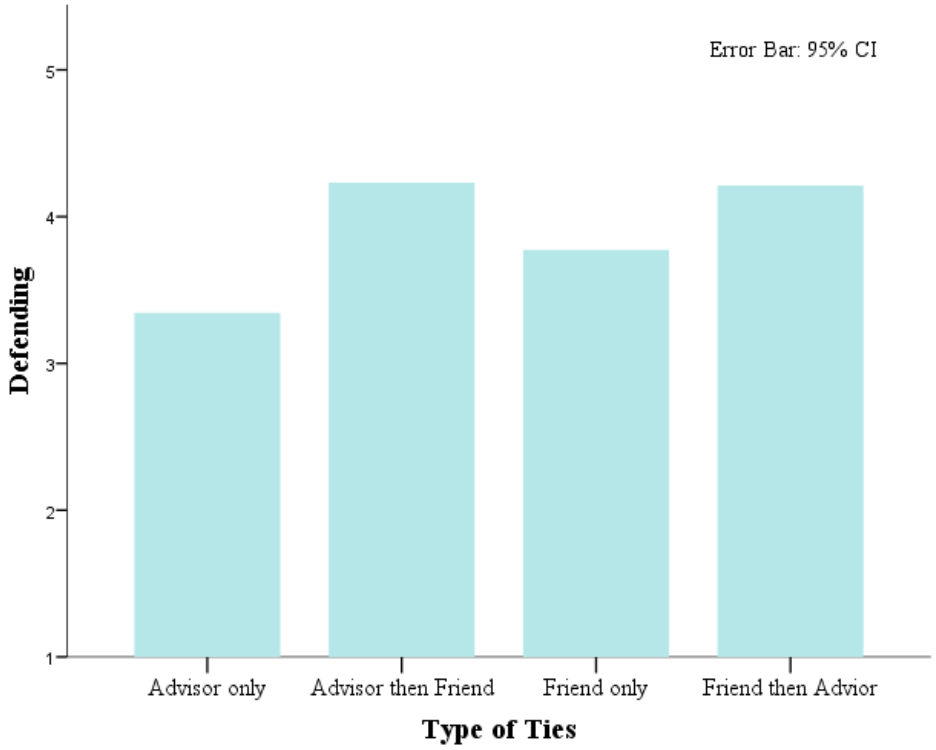

Table 8: Pairwise Comparison among Tie Type for Defending

(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.
Advisor only	Advisor then Friend	-.885*	.162	0
	Friend only	-.429†	.174	.089
	Friend then Advisor	-.867*	.17	0
Advisor then Friend	Friend only	.457†	.187	.094
	Friend then Advisor	.019	.184	1
Friend only	Friend then Advisor	-.438	.194	.153

Based on observed means.
The error term is Mean Square(Error) = .603.
* The mean difference is significant at the 0.10† and 0.05 * levels.

Figure 4. Tie Type and Bailing-out Behavior

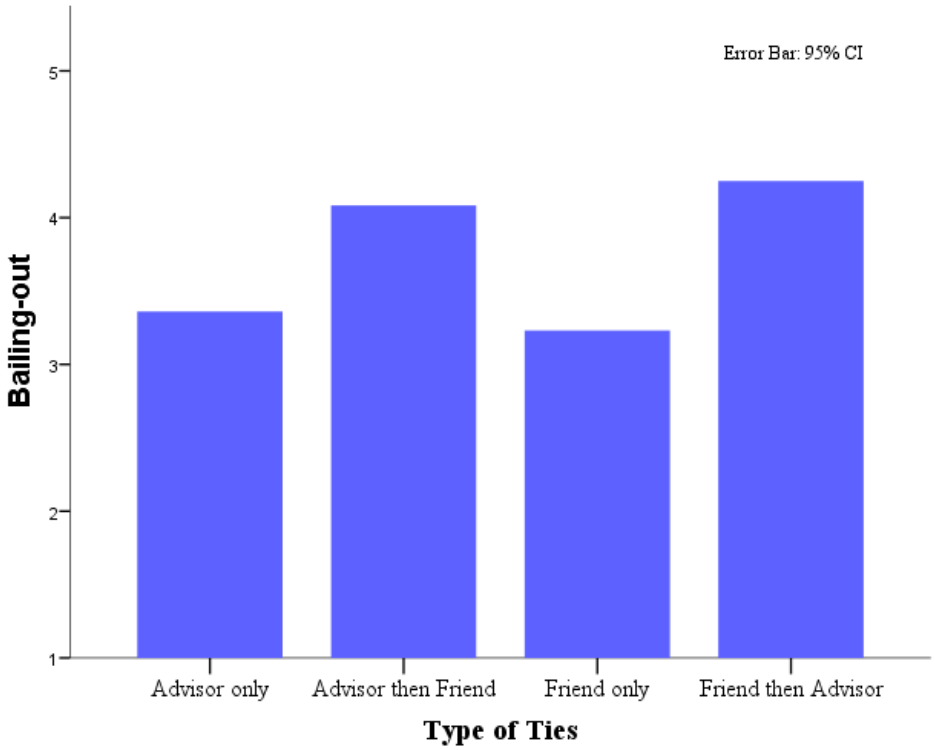

Table 9: Pairwise Comparison among Tie Type for Bailing-Out

(I) Type	(J) Type	Mean Difference (I-J)	Std. Error	Sig.
Advisor only	Advisor then Friend	-.723*	.212	.005
	Friend only	.129	0.207	1
	Friend then Advisor	-.890*	.220	0
Advisor then Friend	Friend only	.853*	.224	.001
	Friend then Advisor	-.167	.235	1
Friend only	Friend then Advisor	-1.019*	.231	0

Based on observed means.
The error term is Mean Square(Error) = .941.
* The mean difference is significant at the 0.10† and 0.05 * levels

D. Finding

The findings of my second experiment also showed that there is no significant effect of multiplex ties depending on the tie formation order on covering. Like the results of the experiment on knowledge sharing, I found that people do not discern their co-workers who are connected with multiplex relationships depending on the order of tie formation. Instead, uniplex ties and multiplex ties are either not different or different depending on context which one between instrumental and expressive purpose an individual pursues . For example, when engaging in emotion-based behavior, such as defending a co-worker, there is no difference between expressive only ties and multiplex ties, while expressive only ties are different than multiplex ties in bailing-out. Considering that covering can be categorized according to the level of trust required for the action, uniplex ties can be substituted for multiplex ties in behavior with a relatively lower level of trust, while multiplex ties are more consequential relationships when trust is more needed.

Interestingly, however, multiplex ties were still more strongly used in bailing-out than were uniplex ties, as was the with knowledge giving. That is, although uniplex ties can replace multiplex ties depending on the context where the social ties were mobilized, the differences of behavioral natures for the instrumental and expressive purposes may influence an individual's choice of tie between uniplex and multiplex ties.

Summary and Discussion

Social network scholarship has studied multiplex ties as one distinctive form of social ties and their consequences in organizational phenomena. Currently, workplace friendships have been examined as multiplex relationships at workplaces in terms of the characteristics of

business friendships (Ingram & Zou, 2008), advantages and disadvantages on outcomes (Morrison, 2009), and task performance (Methot et al., 2016). However, we do not know about the distinctions of multiplex ties themselves, empirically and theoretically.

In this chapter, I investigated the effect of formation order of multiplex ties in knowledge sharing as an instrumental behavior and covering as an expressive behavior. Contrary to my expectation, there were no statistically significant differences between the instrumental-first and the expressive-first multiplex tie in knowledge sharing and covering. Meanwhile, I found that the effects of uniplex ties are as the same as the effects of multiplex ties depending on the situation. In particular, the effect of an instrumental-only tie is the same as the effect of multiplex ties when pursuing instrumental behavior, and the effect of an expressive-only tie is the same as the effect of multiplex ties when pursuing emotion-based behaviors. However, when high levels of trust are required for each action, multiplex ties prove better than uniplex ties. This is an interesting finding given the common belief that multiplex ties are distinguishable from uniplex ties in terms of tie strength and versatility in use for various purposes. For instance, considering that there are still differences between an instrumental-only tie with a multiplex tie in knowledge giving, and an E-only tie and multiplex ties in bailing-out, multiplex ties could be distinctively perceived in comparison with the uniplex ties depending on the nature of instrumental and expressive behaviors. Even though knowledge seeking and giving are under the umbrella of instrumental purpose in knowledge sharing, the mechanisms of seeking and giving could be different (i.e., required reciprocity and trust). Thus, network researchers can investigate the similarities and differences between uniplex and multiplex ties depending on the behaviors and context in future.

The limitation in these two studies is that the relationships measured through them are not actual relationships. My M-Turk experiments were designed with vignettes that explain imaginary relationships, so participants answered their behavioral intention in knowledge sharing and covering with a degree of subjectivity. In the future, I will conduct a recall study to examine participants' actual relationships.

Also, the results could be different using data collected from the real companies for which respondents work, not from M-Turk experiments and knowledge intensive context (i.e., IT and R&D companies). In these M-Turk experiments, knowledge sharing was not essential for the participants' tasks. There might be some differences among participants in understanding of benefit, cost, and reciprocity of knowledge sharing. Thus, this research needs to be examined using the data collected from real situations in which knowledge sharing occurs and employees have experienced knowledge seeking and giving.

CHAPTER 5:

ANTECEDENTS OF THE FORMATION OF MULTIPLEX TIES

Introduction

Although types of multiplex ties depending on their formation order (i.e., instrumental-first and expressive-first types) have not specifically been explained before, their assumptive existence can be found in previous organizational literature. For example, Gouldner (1954) examined how previously personalized informal relationships among gypsum company employees (expressive-first ties such as family and community relations) have been added to with formal relationships defined by organizational hierarchies (instrumental-first ties such as with supervisor and subordinates) by a new manager with authority.

Ferriani and his colleagues (2012) examined two distinct logics of *social interaction* and *economic exchange*, leading to the emergence of multiplex ties at the inter-organizational level. The logic of social interaction explains that a personal social relationship can evolve into a potential business relationship (expressive-first tie) based on information acquisition and the trust developed from the existing ties (e.g., Coleman & Li, 1996). On the other hand, according to economic exchange logic, business transaction ties between firms can be developed into multiplex ties (instrumental-first ties) because existing economic transaction relationships become interdependent through repeated interactions over time (Uzzi, 1996) and with increased relational stability (Lomi & Pattison, 2006). Additionally, Ferriani et al. (2012) found that social ties are more likely to evolve into multiplex ties than are transaction ties because social ties are expressive ties based on affect-based trust (goodwill trust) and it takes time to build that trust, in contrast to instrumental ties which are based on cognition-based trust.

However, the relationship forming process at the organizational level, is different at the interpersonal levels, especially in the developmental process of multiplex ties. For example, inter-organizational relationships are largely influenced by characteristics of the institutional environment (e.g., Zelizer, 2005), differentiation and specialization in societies (e.g., Smith-Lovin, 2007), and cultural differences (Chua, Morris, & Ingram, 2009), while interpersonal relationships are more immediately influenced by individual differences such as the orientation of self-monitoring (Flynn, Chatman, & Spataro, 2001; Gangestad & Snyder, 2000; Mehra et al., 2001; Sasovova et al., 2010), positive and negative effects (e.g., Casciaro & Lobo, 2008; Labianca, Brass, & Gray, 1998; Sparrowe et al., 2001), and cognition on network opportunity, such as knowing a powerful person or having a high-status friend (e.g., Kilduff & Krackhardt, 1994; Krackhardt, 1990).

Of course, it is impossible to exclude contextual effects on forming individual relationships because actors are embedded in social and organizational contexts. For example, individuals' initial instrumental ties could be formed by organizational decisions such as team assignments or job rotations. However, interpersonal interactions may also be more immediately influenced by individual attributes than by contextual factors. Behavioral science researchers have examined that individual attributes predict motivation and behaviors at the workplace (Barrick & Mount, 1991; Barrick, Mount, & Li, 2013). For instance, *personality* is defined as "an individual's characteristic patterns of thought, emotion, and behavior, together with the psychological mechanisms − hidden or not − behind those patterns" (Funder, 2001, p2), and these traits influence individuals' behaviors through their choices, preferences, and desires. Thus, individual personality influences choice in social relationships regarding whether an individual maintains, develops, and terminates his/her social relationship with others. Further, network

studies have paid attention to individual attributes that play a role in explaining network outcomes, such as how and why some people occupy certain network positions (see Kilduff & Brass, 2010).

Rivera et al.(2010) suggested that there are three mechanisms - assortative, relational, and proximity mechanisms - in explaining tie formation, persistence, and dissolution of dyadic ties through reviewing sociological research. In particular, comparing to the other two mechanisms based on structural perspectives, the assortative mechanism examines that the formation persistence, and dissolution of social relations are outcomes of actor's attributes, such as gender, age, religion, value, education etc., based on homophily. In this dissertation, I focus on interpersonal relationships in organizations and consider individual attributes in forming multiplex ties given the effect of environmental factors. As antecedents to the formation of multiplex ties, individual attributes which have been representatively studied and personal network characteristics are my focus. In developing my hypotheses, *ego*, *alter*, and *similarity* effects are considered: how ego's characteristics influence the formation of multiplex ties, how alters are attracted to the ego's characteristics, and how similarity in dyads are associated with the formation of multiplex ties. In addition, the formation of the distinctive type of instrumental-first and expressive-first multiplex ties are separately developed as necessary.

Personality

Individuals' personality has been studied as the antecedents of network structure (Anderson, 2008; Emirbayer & Goodwin, 1994; Kilduff & Krackhardt, 2008; Mehra et al., 2001; Sasovova et al., 2010). For example, researchers show that personalities are significantly related to an individual's acquisition of the central position in his/her advice networks and friendship

networks (Klein et al., 2004), and that individual personal traits contribute to his/her accuracy in social network perceptions (Casciaro, 1998). Mentoring research shows that the relationships between mentors and protégés are more likely to be initiated by protégés with internal loci of control, high self-monitoring, and high emotional stability and that these protégés tend to receive more mentoring (Turban & Dougherty, 1994). In addition, an individual's motivation and ability for knowledge sharing is directly and indirectly associated with the position within his/her knowledge sharing network (Anderson, 2008; Moran & Ghoshal, 1996; Reinholt et al., 2011). For instance, Anderson (2008) provides empirical evidence that managers with a high need for cognition of information searching and benefits take greater advantage of social network opportunities than do those who have a low need for cognition.

Furthermore, *self- monitoring personality* has been investigated in many social network studies to help explain why some people tend to occupy different network positions (Kilduff & Brass, 2010). Self-monitoring personality is concerned with the "processes by which individuals actively plan, enact, and guide their behavioral choices in social situations" (Snyder, 1974; Snyder & Cantor, 1980, p222). Many researchers showed that people with different self-monitoring orientations occupy different positions within networks (Kilduff, 1992; Mehra et al., 2001; Oh & Kilduff, 2008; Sasovova et al., 2010) based on their different tendencies in interpreting and responding to situations. In the micro-dynamics of network change, high and low self-monitors have different approaches to forming and developing (and terminating) their interpersonal relationships (e.g., Gangestad & Snyder, 2000; Snyder, Gangestad, & Simpson, 1983; Snyder & Simpson, 1984; Turnley & Bolino, 2001). In particular, high self-monitors are more likely than low self-monitors to attract new friends who are not only outside their own functional groups, but who are relative strangers, unconnected to their existing friends.

Although the personalities involved in individuals' network positions, tie formations, and tie activations have been studied, strong theoretical evidences about how personality is associated with the formation of multiplex ties has not. In my study, I examine how individual personalities influence the formation of multiplex ties; specifically, I look for the "Big-5" personalities which have been accepted as a general taxonomy of personality traits (Judge, Bono, Ilies, & Gerhardt, 2002).

Big 5 Personalities

The so-called "Big 5" personality traits are *extraversion*, *neuroticism*, *agreeableness*, *conscientiousness*, and *openness to experience* (Barrick & Mount, 1991). These five personalities are considered as ''endogenous basic tendencies'' unaffected by the environment (McCrae & Costa, 1996). *Extraversion* refers to the tendency to be outgoing, gregarious, energetic, assertive, active, and cheerful. People who are extroverted are usually sociable and good at social interactions. *Neuroticism* is the tendency to be moody, anxious, depressed, insecure, and hostile. People who score high for neuroticism are emotionally unstable and tend to have negative attitude toward others. *Agreeableness* describes the tendency to be cooperative, compliant, sincere, gentle, and trusting, and has been labeled as "friendliness." People who are in high agreeableness vectors tend to more readily engage in teamwork and interact more with others, while those who are in low agreeableness areas tend to care less for others. *Conscientiousness* refers the tendency to be dutiful, persistent, responsible, careful, prepared, organized, and detail-oriented. Conscientious people are generally hard-working and achievement-oriented. *Openness to experience* is the tendency to be imaginative, cultured, curious, intelligent, and artistically-sensitive. People who score high for this trait tend to have positive attitudes toward learning experiences and are more open to peers in their network (Barrick & Mount, 1991).

In the research about personality and relationships, Asendorpf and Wilpers (1998) investigated the change of social relationships and personality traits among students after their entry to university and found that personality influences social relationships but not *vice versa*. In particular, the study showed that extroverted people are likely to expand their peer network over time and receive support from an opposite sex peer later. The study also found that people who scored higher in agreeableness levels tend to have less conflict with opposite sex peers, and conscientious people tend to interact more with their families than do less conscientious people. However, they found that there are no effects of neuroticism an openness on relationship.

Also, Dinh and Lord (2012) explained the mediation effect of individual differences on leadership outcome. Compared to the dispositional approach that assumes the direct effect of trait on leadership outcome, the authors suggest that the process approach of individuals' characteristics, which includes not only personality but also various "person-variables" (e.g., skills, work experiences, identity, value, and goal structures), influences their leadership behavior and, in turn, leads to subsequent leadership outcomes.

Furthermore, LePine and Dyne (2001) showed that relation between individual differences using the Big 5 personalities, as well as the three types of performances (e.g., task performance, cooperative behavior and voice behavior as a form of contextual performance) directly and indirectly contribute to organizational success (e.g., voice and cooperative behavior). The authors' results show that conscientiousness, extraversion, and agreeableness are positively related to cooperative behaviors, while neuroticism is negatively related. Further, conscientiousness and extraversion are positively related to voice behaviors (defined as "constructive change-oriented communication intended to improve the situation" (Motowildo,

Borman, & Schmit, 1997)), while neuroticism and agreeableness are negatively related (LePine & Van Dyne, 2001, p326).

Recently, one study examined the effects of self-monitoring and Big5 personality traits on workplace network positions (i.e., in-degree centrality and brokerage in instrumental and expressive networks) and investigated the relationships between those network positions and job performance and career success (Fang et al., 2015). The results of the meta-analyses on the bivariate correlations between personality (self-monitoring and the Big Five) and network positions (in-degree centrality and brokerage), extraversion was not related to in-degree centrality in either expressive nor instrumental networks and conscientiousness was positively related to in-degree centrality in instrumental networks only. Also there was negative relationship between neuroticism and in-degree centrality in both instrumental and expressive networks. There was negative relationship between openness to experience and in-degree centrality in instrumental networks. Additionally, in their Meta Analytic Path Model including personality, network position, and work outcomes, each extraversion and neuroticism has positive and negative relationship with in-degree centrality in both instrumental and expressive networks. Also, conscientiousness has positive relationship with in-degree centrality in instrumental networks only, while agreeableness has negative relationship with the centrality in expressive networks only. Considering that the in-degree centrality is measured as the number of incoming ties received from others (Freeman, 1979), the relationship between personality traits and in-degree centrality helps us think about the individuals' intention to form new relationship with others.

In this study, I develop the hypotheses of personality on the formation of multiplex ties based on the definition and characteristics of each personal trait. I exclude openness to

experience because it is commonly associated with dimensions of intellect (Borgatta, 1964; Hogan, 1983), such as being imaginative and intelligent, rather than social dimensions. Although Fang et al. found the negative relationship between openness and friendship networks, previous research found that there is not significant link between openness and social relationship (e.g., Asendorpf and Wilpers, 1998; LePine and Dyne, 2001) as well.

Extraversion

Extroverts enjoy social interactions with and like to receive attention from others, therefore they tend not to have difficulty in making new relationships. People with high extraversion levels will have more social relationships than will people with low extraversion (i.e., introversion) rates (Roberts, Wilson, Fedurek, & Dunbar, 2008). Consequently, extroverts can access diverse resources from their broad networks. In this sense, compared with developing existing ties into multiplex ties, extroverts may not feel they have any advantage in keeping and deepening their existing ties. For example, extraverts tend to hold brokerage position to bridge disconnected friends (Fang et al., 2015; Klein et al., 2004) by bring different social contact to their networks (Kalish & Robins, 2006). Hence, extroverts may not be intrigued enough to develop multiplex ties but prefer to extend their network with new contacts.

The network patterns of extroverts may be similar to those of high self-monitors considering the positive correlation between extraversion and self-monitoring (Luu, Collins, & Tucker, 2000). High self-monitors tend to belong to various social groups and choose friends based on others' skills for each activity they themselves are engaged in (Snyder, 1987). In line with the correlation between extraversion and self-monitors, people with high extraversion are likely to maintain their distinct social networks. That is, extroverts will be more interested in

expanding their networks across boundaries than in solidifying and deepening them; therefore, extroverts are less likely to develop multiplex ties.

Hypotheses 5: An individual's extraversion is inversely associated with the likelihood of forming multiplex ties.

Conscientiousness

Conscientious people are dependable, careful, responsible, thorough, and organized (Barrick & Mount, 1991). Because highly-conscientious people tend to be hard-working, achievement-oriented, and perseverant, they tend to be cooperative with others (LePine & Van Dyne, 2001). Accordingly, highly-conscientious people are considered as good work partners and are attractive as such (Hinds et al, 2000). Reversely, if conscientious people work with those who are not as responsible and reliable as they are, they likely incur not only task-related conflicts, but relational conflicts as well. Extending this argument to the forming process of multiplex ties based on the existing relationships, highly-conscientious people are likely to be preferred as work partner and they will also want to work with others who are similar to them. Thus, rather than ego's conscientiousness, alter's conscientiousness and the similarity between ego and alter in conscientiousness will more importantly play a role in forming multiplex ties. When people already have friendships ties with others, they will be willing to expand their existing expressive ties into instrumental ties as well. However, if people are already connected via instrumental ties, it is not attractive to develop those instrumental ties into expressive ties (i.e., instrumental-first ties), because conscientiousness is not related to the popularity in friendship networks (Klein et al., 2004).

Hypothesis 6a: Individuals' likelihood of forming expressive-first multiplex ties is directly associated with alters' conscientiousness.

Hypothesis 6b: Similarity in the dyad on conscientiousness is directly associated with likelihood of forming an expressive-first multiplex tie.

Agreeableness

Agreeable people are friendly, flexible, trusting, forgiving, soft-hearted, and tolerant (Barrick & Mount, 1991). People who are of high agreeableness can be good friends as well as good colleagues in the workplace. In particular, agreeable individuals are more attractive (i.e., more popular) who are more likely to be chosen as friends over time (Selfhout et al., 2010), as well as more cooperative, with tendencies toward preventing conflict with others (Asendorpf & Wilpers, 1998). Thus, those with high agreeableness are more likely to be friends with colleagues and good work partners with friends. Moreover, agreeable people are preferred as friends and work partners because they have a high desire to maintain positive relationships with others. Therefore, existing relationships with agreeable people tend to develop into multiplex ties. Similarities of agreeableness between people are associated with the development of multiplex ties because both actors in dyad are altruistic.

Hypothesis 7: Individuals' likelihood of forming instrumental-first multiplex ties is directly associated with alters' agreeableness.

Neuroticism

Neurotic characteristics, such as worry, nervousness, embarrassment, and self-pity, are negatively associated with job performance (Barrick & Mount, 1991); neurotic individuals are not cooperative and have lower quality interactions with others at work (LePine & Van Dyne, 2001). Their unfavorable and negative attitudes toward others are not welcomed by others, thus people prefer not to interact with those with high neuroticism either as work partners or friends (Fang et al., 2015). Consequently, multiplex ties with these people will be formed less often. On

the other hand, people in high neuroticism may tend to not build new relationships with others, because it requires time and effort to make new people learn about them. People in high neuroticism tend to have smaller social networks and usually do not keep their social contacts too close (Kalish & Robins, 2006). Thus, those who are in high neuroticism will tend to form multiplex ties with the long-lasting relationships they already have. However, two people in high neuroticism, who are insecure and emotionally unstable, will not develop their relationships into multiplex relationship because it is especially hard for these actors to exchange expressive support.

Hypothesis 8a: ***An individual's neuroticism is directly associated with the likelihood of forming multiplex ties.***

Hypothesis 8b: ***Individuals' likelihood of forming multiplex ties is inversely associated with alters' neuroticism.***

Demographic Characteristics

Demographic characteristics, such as gender, race, age, and education, have been studied in social relationships (see review in McPherson et al., 2001). With respect to studies on homophily, initial social network research has focused on how demographic characteristics function in forming network ties within small groups. For example, some studies have shown that school children tend to form friendships and play groups with others who are similar in demographic characteristics (e.g., Wellman, 1992). Researchers have extended their interest into the effect of demographic characteristics on social relationships in the organizational context. *Demographic similarity* was used to explain the formation of expressive ties based on interpersonal attraction (Lazarsfeld & Merton, 1954; Marsden, 1988; McPherson & Smith-Lovin, 1987). In particular, Marsden (1988) shows that discussion relations are associated with

race/ethnicity, gender, and education of the dyad, and that confiding relations are patterned by religious preferences and age.

Network research also finds that age and tenure similarities lead to frequencies of communication (Zenger & Lawrence, 1989), while dyadic differences, such as gender, education, and race, decrease supervisors' liking for their subordinates (Tsui, Egan, & O'Reilly III, 1992; Tsui & O'Reilly, 1989). In addition to the effect of demographic characteristics on cohesive relationships and the formation of relationships, researchers have investigated how demographic characteristics conversely restrict social interactions among actors. For instance, Mehra and colleagues (1998) found that racial minorities were excluded from their friendship networks because of negative stereotypes of tokens, and racial minority managers and female employees incurred structural constraints on career success (Ibarra, 1992; Ibarra, 1995). In line with previous studies which showed that demographic similarity in dyads influences individuals' social interactions, demographic characteristics also influence the formation of multiplex ties.

Gender

In terms of gender difference in social networks, many studies have documented different relational patterns and allocations of network rewards based on gender, finding that females commonly have limited access to resources and to the people who possess these resources and power, especially in male-dominant organizational contexts (Brass, 1985; Burt, 1998; Ibarra, 1992, 1993). For example, Ibarra (1992, 1993) showed that the structural characteristic such as a predominance of men in an organization and the systemic discrimination caused by majority of men who take high status within organization. Specifically, she found that men were more likely to form strong homophilous ties that enabled them to obtain both expressive and instrumental resources, whereas women pursued differentiated network patterns by asking for expressive

assistance from other women (i.e., social support and friendship) and instrumental resources from men (i.e., task advice). As a result, men tended to have more multiplex ties than did women because women did not select other women for instrumental relationships at work. More specifically, at the ego aspect, men tend to instrumentally and expressively interact with men. At the alter aspect, given that women have separate networks with men and women for instrument support and expressive support respectively (Ibarra, 1992, 1993), both men and women are more likely to form multiplex ties with men, not only because men are not likely to form instrumental and expressive ties with women, but because women are not likely to form instrumental ties with women, even if expressive ties with women exist. Based on this information, I develop the following hypotheses:

Hypothesis 9a: ***Women are less likely to form multiplex ties at work than are men.***

Hypothesis 9b: ***Individuals are more likely to form multiplex ties at work with men than with women.***

Hypothesis 9c: ***Gender similarity is directly associated with the likelihood of forming multiplex ties at work.***

Race

The importance of racial homophily for the formation of social relationships has been well known in much research on social networks (McPherson et al., 2001; Wimmer & Lewis, 2010). The effect of racial homophily on school networks is greater than other characteristics (McPherson et al. 2001) and those effects are amplified via reciprocity and transitivity in friendships (Goodreau, Kitts, & Morris, 2009; Mouw & Entwisle, 2006). Moreover, racial minorities and individuals who have salient racial identities are more likely to interact with others of the same race or ethnicity (e.g., Ibarra, 1995; Mehra et al., 1998; Mollica, Gray, &

Trevino, 2003). That is, not only do individuals tend to interact with others of their same racial group, but the more salient individuals' racial groups are, the more strongly these individuals interact with their same racial groups. For example, Wimmer and Lewis (2010) showed that, within a cohort of college students, two individuals of the same racial background tend to become friends using the data set in Facebook pages. In addition, Mollica et al.(2003), found that, inside and outside unities, racial minorities are more likely to form more homophious friendship ties than are Whites. In this regard, compared to the majority (i.e., Whites), racial minorities' existing ties are homophilous ties within the same race and thus they form multiplex ties with others of the same race.

Hypothesis 10: Similarity in the dyad on race is directly associated with the likelihood of forming a multiplex tie.

Religion

Religion is socially created and reified in social networks (Duriekheim, 1965) and a source of friendship selection inducing network homophily (Lazarsfeld & Merton, 1954; McPherson et al., 2001). Compared to gender and race which can be visually salient in social contexts and thus considered as "not preferable contact", the effects of religion in forming relationships -for example whether it is the contact is preferable or not - may be less so, becauseindividual's religion is not easy to be visually detected by others (for an initial relationship). In forming relationship, rather than ego and alter effecting of religion, the similarity effect of religion may be significant. For example, Cheadle and Schwadel (2012) found that there was similarity effect of religion in adolescents' friendship network: adolescents who have same (or similar) religion tend to be friends over time (similarity effect). Thus, I drew

a hypothesis only on similarity effect of religion in forming multiplex tie here, excluding ego and alter effects.

Hypothesis 11: Similarity in the dyad on religion is directly associated with the likelihood of forming a multiplex tie.

Political View

Value homophily, of which political view is an example, is based on similarities of values, attitudes, and beliefs, leads to attraction and interaction (e.g., Huston & Levinger, 1978; Meglino, Ravlin, & Adkins, 1989), and influences the process of forming, maintaining, and disrupting friendships (Lazarsfeld & Merton, 1954). In a longitudinal study of friendship (Hill & Stull, 1987) researchers found that female students tended to choose each other as roommates when they had value similarity. Particularly, in the developmental process of social relationships, value similarity as a deeper-level similarity is more influential later on in a relationship, as compared to gender and race similarities which influence the initial relationship as superficial similarities (e.g., Harrison, Price, & Bell, 1998; Neimeyer & Mitchell, 1988; Turban, Dougherty, & Lee, 2002). Lazer and his colleagues(2010) found that there was no significant association between political view and social tie formation among university students during their first school year, while in subsequent years there were distinctions in forming ties and expanding networks depending on their political views (e.g., liberals and conservatives). Drawing from previous studies showing that deep level similarity - including political view - influences an individual's network development (i.e., later tie formation), I examine how political view similarity between ego and alter influences the formation of multiplex tie, especially instrumental-first ties:

Hypothesis 12: Similarity in a dyad's political view is directly associated with the likelihood of forming instrumental-first multiplex tie.

Existing Personal Network Size

As network size increases, individuals tend to have more opportunities to interact with and access resources from their direct and indirect connections. For example, Higgins (2000) showed that lawyers with large networks obtain more career (e.g., helping for challenging work assignments) and psychosocial (e.g., listening, encouraging one's thinking, and mutual sharing) support in their early careers. Moreover, network size provides the basis on which people decide whether to form further social relationships. In terms of the formation of instrumental ties, Casciaro and Lobo (2008) found that seeking out valuable and complementary task-related skills from others is a key fact of organizational life. Therefore, organizational members who are looking for those who have work-related skills and knowledge may perceive that individuals with large instrumental networks can easily fulfill their tasks using many social contacts. On the other hand, individuals with large instrumental networks do not feel a need to expand their networks and consequently will not invest significant time to maintain a number of relationships, not only because they have sufficient social capital, but because, as an individual's network size increases, the time-per-contact decreases (Mayhew & Levinger, 1976). That is, people want to maintain the quality of relationships in order to mobilize them when they need help rather than maintain the large network size itself.

Similarly, in the process of forming multiplex ties, individuals who already have large instrumental networks do not feel the strong need to form new instrumental relationships with existing expressive relationships. Namely, given that different type of ties provide different kinds of resources (Wellman & Wortley, 1990), it is not efficient to form new instrumental

relationships with those who are connected as expressive relationships, although one may already have many work-related contacts. This is because "when you launch into a task with those you already know, you don't want waste a lot of time figuring out what to expect from them or explaining what you mean every time you say something" (Casciaro & Lobo, 2005). In addition, rather than taking the risk of damaging existing expressive relationships (e.g., friendships) by working with others, it is easier, safer, and surer to work with one's existing contacts to whom one has been instrumentally tied.

Hypothesis 13: Individuals' existing instrumental network sizes are inversely associated with the likelihood of forming expressive-first multiplex ties.

Methods and Results

I first attempted to test thee hypotheses using RSiena as a longitudinal method in order to examine how factors are associated with network change. Next, I used the MRQAP (Multiple Regression Quadratic Assignment Procedures) focusing on the node characteristics, in order to investigate what individual attributes influence the formation of multiplex ties.

Analysis 1: RSiena

Setting and Sample

I used the existing data set collected by my supervisor, Professor Brian Rubineau, and his colleagues under their permission. Originally, the data were collected from 1600 participants (including a total of 770 newly-entering students) across 14 distinct, large universities (predominantly from the Midwestern U.S.) from 2011 to 2012. The empirical context is the scholarship dormitories of STEM (Science, Technology, Engineering, and Mathematics)-major undergraduate students in which only those who earned scholarships were eligible for residency.

The five types of networks (1- I spend a lot of time around this scholar, 2- I hold this scholar in especially high esteem, 3- Sometimes I do not find it easy to get along with this scholar, 4- This scholar is a close friend, 5- I frequently discuss politics, social issues, or current events with this scholar) and the study partner networks (6- This scholar has assisted me with my academics (e.g. in study groups, advice)) of all students in the dormitories were collected using a roster method (Marsden, 1990) at two points during the fall semesters of each of the two academic years. The first data collection was conducted among all students at the very beginning of the academic year during the first three days after students arrived on campus. The second data collection was conducted among all students approximately ten weeks after the first survey. The first survey included questions asking about students' political identification and social activities. The second survey repeated the same questions and also included those asking about students' social relationships.

I used the study partner networks and the close friendship networks as instrumental network and expressive networks respectively at T1 (2011) and T2 (2012). Also, because the membership of dormitories changed over time depending on the scholarship acquisition, the enrollment, and the graduation of students, I focused on the students who stayed in schools from 2011- 2012 consecutively, and analyzed them by the three cohorts: 1st and 2nd year students; 2nd and 3rd year students; and, 3rd and 4th year students.

Measures

Dependent Variables. Dependent variables were the network changes in longitudinal networks from T1 to T2. To create dependent variables, I used the study partner network as instrumental ties and the close friendship network as expressive ties. Participants received the roster of their dormitories and were asked to indicate their social relationships per the following

questions: “This Scholar has assisted me with my academics (e.g. in study groups, advice)” (for the study partner network); and, “This Scholar is a close friend” for the close friendship network. Using two sets of longitudinal networks, I had three dependent variables of network change:

1) the instrumental network at T1 and the multiplex network at T2 (***instrumental-first tie*** [$=I_{T1}$-M_{T2}]);
2) the expressive network at T1 and the multiplex network at T2 (***expressive-first tie*** [$=E_{T1}$-M_{t2}]); and,
3) multiplex networks at T1 and T2 ($\mathbf{MT}_{T1\text{-}T2}$).

I defined the *instrumental-first multiplex tie* as a tie that was an instrumental tie at T1 and then developed into an expressive tie at T2. That is, the instrumental-first multiplex tie described a relationship with someone whom the student considered solely a study partner tie at T1 and then included both study partner ties and close friendship ties at T2. Contrary to the instrumental-first multiplex tie, I defined the *expressive-first multiplex tie* as one that was an expressive tie at T1 and then developed into an instrumental tie at T-2. Thus, the expressive-first multiplex tie was one which was solely a close friendship tie at T1 and evolved into a study partner tie at T2. If a student was already involved in the both types of relationship at T1 and maintained them at T2, I considered it a *multiplex tie* (i.e., both instrumental-first and expressive-first ties).

Independent Variables. Independent variables were characterized as *personal characteristics* (e.g., gender, religion, race, and Big 5 traits), *value* (i.e., political view), and *personal instrumental network size*. Specifically, taking advantage of a complete roster network survey, the independent variables at the individual and dyadic levels were used to examine the ego, alter, and relational effects on the formation of multiplex ties.

Personality. I utilized four of the Big 5 personality traits to measure personality: extraversion, neuroticism, agreeableness, and conscientiousness. Respondents were asked to rate

the extent to which these traits applied to them, how much they agreed with each item on a 5-point scale (1=strongly agree to 5=strongly disagree). These four personality traits were measured three times in August 2011, once in August 2012, and once in November 2012. Each trait was assigned a pair of questions, including a reverse question, and I averaged the four scores for each personality trait in order to arrive at one value.

Religion. Participants were asked identify their religious affiliation among fourteen (14) given categories. Seven (7) of these categories − Baptist, Protestant, Catholic, and Mormon − were grouped into one category labeled "Christian." *Christian* was coded as 1 and all other religions were coded as 0. *Christian alter* was created by transposing the original matrix values.

Race. The race variable was operationalized as *White* and *Non-White*. There were eight (8) racial categories: White, Black, Hispanic, Asian, Native American, Middle Eastern, Mixed, and Other. First, White was coded 1 and the other racial categories were coded as 0. Then again, racial similarity was calculated as 1 if two actors are in the same race, otherwise as 0.

Gender. In indicating their gender; I coded participants as 1 for female and 0 as male.

Conservativeness/Political View. Because adults are more likely to associate with those who share political orientations (Huckfeldt & Sprague, 1995; Knoke, 1990; Verbrugge, 1997), affectively-connected relationships are specifically influenced by political attitudes of actors (Lazer et al., 2010). Participants were asked to answer the question: "In general, do you think of yourself as..." and responses were rated on a scale of 1 to 7 (1= extremely liberal, 2=liberal, 3= slightly liberal, 4= moderate, middle of the road, 6= slightly conservative, 6= conservative, 7= extremely conservative). The question of political identification was asked twice per year (August and November) in both 2011 and 2012. *Conservativeness* was operationalized as the average scores of four answers.

Personal Network Size. Personal network size was measured by the number of direct connections each individual had with other actors in the network using the measure known as *degree centrality* (Kilduff & Tsai, 2003). In this study, I measured the network size using the *out-degree effect* parameter in RSiena, means the sum of the ties from actor *i to j*.

Control Variables. I controlled the network variables, such as reciprocity, transitivity, and closure, in all models by default following the recommendation of Snijders et al (2010) in RSiena model. I also used *structural zeros* to deal with "actors leaving and joining at specified moments between observations" (Ripley et al., 2016, p. 30), for example, a senior in 2011 who is not present in 2012 or a freshman in 2012 who was not present in 2011. Ties between students who had no chance to interact in different schools, as well as those who did not attend the university in either 2011 or 2012 (e.g., students who joined or graduated in 2012), were fixed to 10 and not allowed to change in the simulations.

Analysis

I analyzed the data using the stochastic actor-based models for network dynamics (Snijders, 1996, 2001) with RSiena software in order to test my hypotheses on network dynamics (tie change) depending on actors' characteristics. The stochastic actor-based model is the appropriate way to assess the influence of a variety of exogenous (e.g., individuals' attributes) and endogenous (e.g., reciprocity, transitivity) tendencies on the emergence of networks over time (Snijders et al., 2010). Also, because RSiena does not rest on the assumption of independence in observations (i.e., basic assumption of typical regression procedures), it is particularly well suited to this longitudinal network data, not only because the current social relationships are influenced by the previous networks, but also because students are nested within their cohort and dormitories.

Results

The estimated parameters were the expected values of the statistics which were equal to the observed values. Expected values were approximated as averages over simulated networks and observed values were calculated from the data set. These parameters values were calculated by an iterative stochastic simulation algorithm through three phases. In Phase 1, the parameters were roughly determined, and in Phase 2 provisional parameter values were updated iteratively. Finally, in Phase 3, I checked that the average statistics of many simulated networks were indeed close to the observed value from the overall maximum convergence ratio and the t-statistics for deviations from observations. If some of these were too high, the estimation was repeated; for example, if the overall maximum convergence ratio was greater than 0.25, or if the absolute value of the t-statistics for deviations from observations was greater than 0.1, I reran the estimation (RSiena Manual, 2016).

To test Hypotheses 4 through12, I used three models of each multiplex ties: the instrumental-first ties, the expressive-first ties, and multiplex ties at t2. All three models had a convergence ratio of less than 0.25. However, despite repeating the equation ten times, the convergence ratio of the expressive-first tie was too high (over 7.10) and it was not possible to interpret the results of RSiena for the hypotheses test. The result of the models of the multiplex ties at T2, and the study partner and multiplex (instrumental-first ties at T2), are shown on Table 10 even though the results of RSiena are not meaningful for the hypotheses test.

Models #1 and #2 in Table 10 show the effects of the structural characteristics and individual attributes on the formation of instrumental-first multiplex ties and multiplex ties at T2. In particular, the effect of outdegree negatively influences the formation of instrumental-first multiplex ties and multiplex ties at T2, while effects of reciprocity and GWESP (Geometrically

Weighted Edgewise Shared Partners, i.e., transitivity) positively influence the formation of both multiplex ties. The effect of three-cycles positively influences forming only instrumental-first multiplex ties.[1]

In terms of the effect of individual attributes, when ego's religion is Christian, there is significant effect of religion on formation of multiplex ties and instrumental-first multiplex ties. Also, there are female's ego effect, conservativeness similarity effect, and conscientiousness similarity effect among Big 5 personality on the formation of instrumental-first multiplex ties only (Model #1).

In RSiena analysis, the convergence to know whether the average statistics are close to the observed values must be sought out. According to the *RSiena Manual* (2016), the overall maximum convergence ratio, which is less than 0.25, is ideal. If the ratio is not ideal, the Manual suggests making another estimation run using the last obtained result. The overall maximum convergence ratio of Model #2 was greater than 0.25, so I ran the estimation ten times per the Manual's directive. However, the overall maximum convergence ratio was still greater than 0.25 in spite of the repeated estimation runs and, as a result, the model of expressive-first multiplex ties was not valid. Hence, the RSiena analysis was neither appropriate nor an appropriate tool to test the hypothesis.

[1] Three-cycles: the tendency for i → j → k to lead to triadic closure in a cyclical direction, k → I (Snijders et al., 2012).

Table 10. Determinants of Multiplex Ties

Effects	Model 1		Model 2	
	Study partner		Multiplex at t2	
	Estim.	S.E	Estim.	S.E
Rate period	10.8331	0.3573	9.4133	0.782
Outdegree (density)	-2.0739	0.28	-2.2044*	0.162
Reciprocity	1.2701*	0.1382	1.3543*	0.1411
Transitive triplets	0.0749	0.0974	-0.6011	0.2409
3-cycles	0.226*	0.0994	0.0759	0.109
GWESP I -> K -> J (69)	1.1508*	0.4056	4.3106*	1.0346
Indegree - popularity	-0.1348	0.0515	-0.1768	0.0491
Outdegree - popularity	-0.08	0.0181	-0.0371	0.0176
Female alter	0.1416	0.221	-0.0969	0.1691
Female ego	0.7443*	0.2204	0.0576	0.2025
Same Female	0.0211	0.1723	-0.033	0.1336
White alter	-0.3892	0.1698	-0.1492	0.1284
White ego	-0.3599	0.1418	0.204	0.1407
Same Race	0.355*	0.163	-0.0239	0.1514
Christian alter	0.1608	0.139	0.0319	0.0899
Christian ego	0.5922*	0.1218	0.3163*	0.1
Same Religion	-0.1205	0.1338	0.0542	0.0948
Conservativeness alter	0.0427	0.0356	-0.0068	0.0326
Conservativeness ego	-0.1646	0.0334	-0.0255	0.0405
Conservativeness similarity	0.4926*	0.211	0.302	0.1948
Extroversion alter	-0.0015	0.0482	-0.0092	0.0411
Extroversion ego	-0.2368	0.0741	0.0334	0.0467
Extroversion similarity	-0.0336	0.2363	-0.0915	0.2081
Agreeableness alter	-0.1273	0.0696	-0.0461	0.0488
Agreeableness ego	0.1401	0.0804	0.0139	0.0681
Agreeableness similarity	-0.722	0.3311	-0.2115	0.2375
Conscientiousness alter	0.1886	0.0911	0.0638	0.0493
Conscientiousness ego	0.0523	0.0633	0.1191	0.0667
Conscientiousness similarity	0.0342*	0.269	0.0628	0.1872
Neuroticism alter	0.0302	0.0756	0.0372	0.051
Neuroticism ego	0.0382	0.0676	-0.0259	0.0621
Neuroticism similarity	-0.8349	0.2848	-0.3437	0.2255

RSiena analysis deals with the multiple observations of the network with small changes (Snijders et al., 2010). In particular, RSiena is more appropriate for small changes of the network

with short intervals than with large changes of the network from one observation. However, the data I analyzed for was only two time periods, the minimum requirement for the analysis. Thus, there could have been a big change a year later compared to small changes within short intervals. Also, I was focusing on the changes from either instrumental ties or expressive ties at T1 to multiplex ties at T2; these could have been big differences in a network in terms of density and tie strength in comparison to the changes within a same type of network (e.g., change of friendship network). Hence, the data structure I used in this study was not ideally suited to the RSiena analysis and might have led to results unsuitable for interpreting. Alternatively, I tested my hypotheses using MRQAP in analysis 2.

Analysis 2: MRQAP

MRQAP tests are permutation tests for multiple linear regression model coefficients between different dyad-level variables such as social network data (Dekker, Krackhardt, & Snijders, 2007; Krackhardt & Hanson, 1993). MRQAP allows the estimation of node level effects on network outcomes with the possibility of having networks as dependent variables. My dependent variables were three multiplex ties at T2: multiplex ties, instrumental-first multiplex ties, and expressive-first multiplex ties. The three types of multiplex ties were created the same way as with the RSiena analysis. As the independent variables, I consider the node characteristics using four of Big 5 personality traits, gender, religion, race, political view. MRQAP exclusively focuses on node characteristics, while network structures such as transitivity, reciprocity, and network size are controlled; thus, MRQAP is appropriate for the analysis of the antecedents of multiplex ties. However, due to the focus on the node level

characteristics of MRQAP, it is not possible to test the hypotheses which are related with network size in MRQAP models and so I removed Hypothesis 13 from my analysis.

Another method often used in longitudinal networks is called the Separable Temportal ERG Model (STERGM); however, STERGM does not control for network structure, without including appropriate structural controls, the estimates for node level characteristics can be biased when using this tool. For example, Goodreau et al. (2009) shows that when closure terms in friendship formation are omitted, the estimates of homophily is biased. Because I do not have a strong theory about the distinctive formation of multiplex ties in this study, I do not deal with structural antecedents of multiplex ties here, therefore, MRQAP is more suitable for my model so as to ignore those controlled structural effects that STERM requires be manually controlled.

Measures

The independent variables used in my RSiena analysis were used in MRQAP as well. The personality variables of extraversion, agreeableness, conscientiousness, and neuroticism, along with conservativeness, were operationalized at the ego, alter, and dyad (similarity) levels. Similarly, gender, race, and religion were operationalized at the ego, alter, and dyad (sameness) levels.

I created one matrix for each variable by combining the four matrixes of all surveys to handle the missing values. The variables that were coded either 0 or 1 (i.e., gender, race, religion) were coded as maximum. At the dyad level, similarity was measured as the absolute value between ego and alter, and the sameness was measured as 1 when ego and alter had same value; otherwise, they were valued at 0.

Personality. The four Big 5 personality traits included the values of the reversed questions. I measured the average of the personality values, including the reversed values, which

was subtracted from 5. The variables at the ego and alter levels were calculated as the average of four scores of each survey and similarity was calculated as the absolute value between ego and alter.

Gender. Female was coded as 1 and male as 0. Also, if ego and alter were the same gender, the dyad was coded 1; otherwise the dyad was coded at 0.

Race and Religion. Race and religion had several categories. I categorized them as "majority" (i.e., White and Christian) and "minor." There were 14 religious categories and I combined 7 religions as Christian including Baptist, Protestant, and Pentecostal and the minor religion include Muslim, Hindu, and Buddhist and so on. Of 8 racial categories, I categorized 7 racial groups such as black, Hispanic, Asian, and Mix and so on as minority. The nodes in the major category were coded as 1 and those in the minor category as 0. When ego and alter were in the same category, the dyad coded as 1, otherwise as 0.

Conservativeness. The variables at the ego and alter levels were measured from 1= extremely liberal to 7= extremely conservative, and the similarity was calculated as the absolute value between ego and alter.

The dependent variables were three types of multiplex networks at T2: Instrumental- first multiplex network, expressive-first multiplex network, and Multiplex network at T2. First, I created the multiplex network at T2 by multiplying both friendship and study partner networks at T2. Then I created an instrumental-first multiplex network and an expressive-first multiplex network at T2 by matching the instrumental only and expressive only networks at T1 with the multiplex networks at t2.

Analysis

MRQAP is designed for dyad-level variables so that it does not recognize other numbers except for 0 or 1. That is, MRQAP in R does not accommodate structural zeros using 0 to control the different sites. I separately ran the 14 sub-models of each site for three multiplex networks and combined the results using meta-analysis later. However, by using MRQAP in R, I could become free from the MRQAP's network autocorrelation and multicollinearity because R has the default setting of a Double Semi-Partialing (DSP) method which is developed to adjust for these issues (Dekker et al., 2007).

In interpreting results, MRQAP requires unique interpretation. Contrary to normal statistical regression results that are interpreted whether the observed effects are significantly different from 0, MRQAP results are interpreted whether they are significantly different from a simulated distribution resulting from the random permutations in the network data. Thus, the MRQAP result is more significant when it is similar to 0.

Results

Table 11 shows the results of the MRQAP Meta test of including the effects of the individual attributes on the formation of multiplex ties. Models #1, #2, and #3 show the effects of individual attributes on the formation of multiplex ties, expressive-first multiplex ties, and instrument-first multiplex ties respectively.

In the results for Model #1, there is a negative and a significant effect of ego's extraversion on the formation of multiplex ties, therefore Hypothesis 5 is supported. In Model #2, the effect of alter's conscientiousness on the expressive-first multiplex ties was not significant (Hypothesis 6a), while the similarity effect of conscientiousness on the formation of the expressive-first multiplex ties was positively significant (Hypothesis 6b). Thus, Hypothesis

6b is supported and Hypothesis 6a is not supported. Model #3 shows that alter's agreeableness was not significantly associated with the formation of instrumental-first multiplex ties, ego Hypothesis 7 is not supported.

In terms of neuroticism, I predicted egos with high neuroticism would tend to form more multiplex ties (Hypothesis 8a), while alters with high neuroticism would tend to form fewer multiplex ties (Hypothesis 8b). However, the results showed the opposite: ego's neuroticism is inversely associated with the formation of multiplex ties, while alter's neuroticism is directly associated, though these results are not significant; thus, Hypotheses 8a and 8b were not supported.

Hypotheses 9a, 9b, and 9c concern the relationships between gender and the formation of multiplex ties. I predicted the negative effects of female on the formation of multiplex ties. Even though the show a negative direction on the effects, the results illustrate that there were not significant associations between both female ego and alter with the formation of multiplex ties; therefore, Hypotheses 9a and 9b were not supported. Also, Hypothesis 9c, which predicted the positive same gender effect on the formation of multiplex ties was supported. In addition, there were significant results that female ego and alter are less likely to form expressive-first multiplex ties and instrumental-first multiplex ties respectively. The effect of same gender was also significant on the formation of the expressive-first multiplex ties.

Hypotheses 10 and 11 concerned the similarity of race and religion in forming multiplex ties, and Hypothesis 12 referred to conservativeness similarity in forming instrumental-first multiplex ties. I found that there was no significant association between race similarity and the formation of multiplex ties, but that religion similarity positively influenced the formation of multiplex ties. I did not find a significant relation between the similarity of political

conservativeness among actors and the formation of instrumental-first ties. In brief, Hypothesis 11 is supported, but Hypotheses 10 and 12 are not. Table 12 shows the summary of the results of hypothesis test.

Table 11. Individual attributes effects on the formation of Multiplex Ties

	Model 1	Model 2	Model 3
	Multiplex	Expressive-First	Instrumental-first
(intercept)	-6.615*	-5.437*	-6.820*
Extroversion Ego	-2.350*	-3.401*	1.344
Extroversion Alter	0.408	-0.545	-1.121
Extroversion Similarity	-4.660*	-1.566	-0.097
Agreeableness Ego	-4.018*	-1.440	1.046
Agreeableness Alter	0.189	0.926	-0.198
Agreeableness Similarity	0.568	-2.014*	-1.882
Conscientiousness Ego	0.850	0.765	-0.822
Conscientiousness Alter	-2.033*	-1.844	-0.173
Conscientiousness Similarity	-2.165*	-2.325*	-1.564
Neuroticism Ego	-1.637	-1.677	0.076
Neuroticism Alter	0.733	0.039	-0.714
Neuroticism Similarity	-0.953	-2.005*	-0.112
Female Ego	-0.625	-2.292*	-0.938
Female Alter	-0.533	-1.070	-2.654*
Same Gender	7.633*	3.449*	0.745
White Ego	6.055*	4.269*	0.914
White Alter	2.438*	1.300	0.934
Same Race	0.281	-0.242	1.807
Christian Ego	3.853*	1.445	0.890
Christian Alter	-0.094	1.836	-0.539
Same Religion	2.999*	2.477*	0.543
Conservativeness Ego	-0.388	-1.208	1.627
Conservativeness Alter	-0.566	-0.670	0.275
Conservativeness Similarity	-1.782	-1.565	1.910

$p < 0.05$*

Table 12. Results of the Hypotheses Test

	Supported	Not supported	Opposite Effect
H5. Extraversion Ego – (-) Multiplex ties	Supported		
H6a. Conscientiousness Alter - Expressive-first ties		Not	Opposite
H6b. Conscientiousness Sim - Expressive-first ties		Not	Opposite
H7. Agreeableness Alter – Instrumental-first ties		Not	Opposite
H8a Neuroticism Ego – Multiplex ties		Not	Opposite
H8b. Neuroticism Alter – (-) Multiplex		Not	Opposite
H9a. Female Ego – (-) Multiplex ties		Not	
H9b. Female Alter – (-) Multiplex ties		Not	
H9c. Gender Sim – Multiplex ties	Supported		
H10. Race Sim- Multiplex ties		Not	
H11. Religion Sim – Multiples ties	Supported		
H12. Conservativeness Sim – Instrumental-first ties		Not	

Findings

Contrary to my predictions, I found a few significant results from my analysis about the antecedents of multiplex ties. Among the Big 5 personality traits, I found that only extraversion negatively influences the formation of instrumental-first and expressive-first multiplex ties. In particular, individuals with high extraversion did not develop either their existing expressive relationship or their instrumental relationships into multiplex ties. Also, regardless of the hypothesis test, results show that the relationship between both agreeable and conscientious people who are expressively connected to each other is also less likely to develop into multiplex ties. Additionally, it looks obvious that two people with high neuroticism who are friends do not

form multiplex ties; this might indicate that people with high neuroticism can understand each other and become friends, but cannot work together.

According to the results of this study, women do not expand their expressive ties into instrumental ties with women, and people do not develop instrumental ties into friendship ties. This is consistent with previous research on women's segregated networking style (Ibarra, 1992). Regarding religion, people in the same religious groups develop their expressive relationship into multiplex ties because individuals in same religious group have more opportunities to interact.

In this study, I aggregated the Big5 traits and the political view which collected at the two points in two years (four time points based on the traditional perspective that personality and personal value are stable as "endogenous basic tendencies" (McCrae & Costa, 1996). However, most of the hypotheses on personalities and political views view are not supported. Thus, I additionally analyzed using a repeated measures ANOVA to test whether the Big5 traits and the political view change within a person over time.

The result of the repeated measures ANOVA with a Greenhouse-Geisser correction (Table13 in APPENDIX) presents that there were not significant effects within-subject of the time on Agreeableness ($F(1.847, 576.292) = .436$, $p=.631$) and Neuroticism ($F(1.850, 575.293) = 1.227$, $p=.292$), while there were significant effects within-subjects of time on Extraversion ($F(1.461, 460.205) = 83.462$, $p<.001$), Conscientiousness ($F(1.786, 557.257) = 595.116$, $p<.001$), and Openness ($F(1.775, 553.857) = 379.528$, $p<.001$). This result means that there is difference between at least two time points in Extraversion, Conscientiousness, and Openness within-person, although Agreeableness and Neuroticism are consistent. This result provides the evidence that, in the same vein, Big5 traits can be changed over time (e.g., Mund and Neyer 2014). Thus, researchers who want to use these variables should conduct a pre-test when

researchers aggregate the longitudinal data of Big5 traits. Regarding the political view, I found that there was not a significant effect within-subjects of time on political view ($F(3, 325) = .167$, $p=.919$). With the result of inconsistent Big5 traits from longitudinal data and for completeness of the analysis model, although there are no hypotheses about openness trait, I performed the extra MRQAP test including openness trait and added the results (Table 14, 15) are added an Appendix.

Discussion

From the results, I could not find strong evidence that individual attributes are the antecedents of multiplex ties. However, I do not infer from this finding that the effects of individual attributes on the formation of multiplex ties do not exist. These results may be caused several limitations.

First, I used data which were collected based on a one-year interval survey. How long the effects of individual attributes on tie formation lasts is unknown. Even though effects of personalities, gender, race, and personal political view (value) on forming multiplex ties could exist, those effects could have disappeared before the second survey was administered. Studying these effects within a shorter period survey could yield a clear understanding of how individual attributes affect the formation of multiplex ties.

Second, the factors of gender and race considered in this analysis are surface-level attributes (Harrison et al., 1998). Also, the hypotheses on gender (H9a, 9b, & 9c) have been drawn from Ibarra's findings (1992, 1993) which showed the working environment (structural characteristics) influences the unequal network effect to women and men respectively. However, the analysis in this study did not test the unequal gender environmental variable, given the

general common consensus that the STEM domain is well known context where men are dominant rather than women. This would be one limitation of this analysis.

Student data could be the one of the reasons leading to these results. In particular, the data were collected by students who lived in universities' dormitories. Students might interact with one another more frequently and intensively than do organizational members in workplaces. While the student data allows me to measure the longitudinal models of both expressive and instrumental ties, the strength or necessity of motivation to form expressive and instrumental ties could be different between students and organizational members depending on social context. Conducting the survey of organizational members may yield different results, more accurately showing how individual attributes affect the formation of each type of multiplex tie.

Though I could not find significant antecedents of multiplex ties in this dissertation, my work provides an initial step into examining the antecedents of multiplex ties.

CHAPTER 6:

SUMMARY, DISCUSSION, AND CONCLUSION

Summary

Social network scholarship has studied multiplex ties as one of the distinctive forms of social ties and their consequences in organizational phenomena. Some studies show the similar effects of multiplex ties with strong ties (e.g., Oh, Chung, & Labianca, 2004), while other studies show the different effects based on the distinctive structural composition of multiplex ties (e.g., overlapping relationships). However, the characteristics of multiplex ties themselves, especially focusing on its order of formation are rarely studied, either empirically and theoretically. Thus, in this study, I examined the antecedents of the formation of multiplex ties and the consequences of multiplex ties in organizational behaviors depending on the order of tie formation. I first categorized multiplex ties as Instrumental-first multiplex ties and expressive-first multiplex ties which are defined by the initial type of tie within a multiplex ties, drawing from a pilot study and the literature on multiplex ties in social networks. I also examined how antecedents (e.g., personality, demographics, political value, individual's network size) influence the formation of multiplex ties based on the effect of the initial ties (i.e., tie inertia) and whether the consequences of multiplex ties are different in organizational behaviors such as knowledge sharing and covering.

With respect to the antecedents of multiplex ties, unfortunately I did not come to any significant results regarding my hypothesis test in examining the effects of individual characteristics, such as personality, demographics, and political view, on both instrumental-first and expressive-first multiplex ties. Moreover, the results of my study of the consequence of multiplex ties showed that there is no effect of the order of tie formation in knowledge sharing

and covering behaviors, which is different than I expected. Instead, under certain circumstances, I found the interesting result that uniplex tie consequences are no different than those of multiplex ties, while multiplex tie consequences are better than uniplex tie consequences. In particular, in knowledge seeking of instrumental behavior and defending a coworker of expressive behavior, not only there is no difference between instrumental-first and expressive-first ties, none exist between instrumental/expressive only uniplex and instrumental-first /expressive-first multiplex ties as well. This is a new finding that differs from traditional wisdom which assumed that multiplex ties are strong ties and more consequential ties than are uniplex ties. Meanwhile, multiplex ties still represent more consequences in knowledge giving and bailing out situations. Also, I could not find significant associations between individual attributes and the formation of multiplex ties.

Discussion

Theoretical Contributions

This study has several theoretical contributions for network research. First, this dissertation offers a deeper understanding of the concept of multiplex ties which remains under-theorized and under-studied in network scholarship. First, I explored the developmental process of multiplex ties and suggested two different types of multiplex ties at the workplace depending on the tie formation order. Although recently researchers have paid attention to workplace friendship multiplex ties (Ingram & Zou, 2008; Methot, 2010; Methot et al., 2016; Morrison, 2009), they mainly focus on the characteristics of multiplex ties, including both instrumental and expressive components and their link with the performance. This dissertation raises more fundamental questions with path dependence perspective in terms of why and how multiplex ties

are formed based on existing ties and what determines the distinct characteristics of multiplex ties that have not been studied before. This approach contributes to the changing view on multiplex ties that has focused on consequential benefits, and expands the research interests in social networks. For example, when considering a multiplex tie's history of interactions, new issues in social networks, such as the tie strength of multiplex ties that consist of positive instrumental ties and negative expressive ties (i.e., an excellent relationship as business partners between two people who do not like each other) and the undeveloped tie which has been intentionally maintained as uniplex ties over time, arise. Thus, this dissertation contributes to dyad relational dynamics and social networks.

With respect to the consequences of multiplex ties, my results show that the effects between instrumental-first and expressive-first multiplex ties, as well as between uniplex and multiplex ties, are not different in knowledge sharing and covering behaviors depending on the type of resources exchanged via the ties. In particular, I could not find differences between instrumental-first multiplex ties and expressive-first multiplex ties in both knowledge sharing and covering behaviors, but find similar functions of uniplex ties and multiplex ties depending on whether instrumental or expressive resource is pursued by the ties. To explain these unexpected results, we need to think about the two things: 1) the duration of the effect of initial ties after forming multiplex ties, and 2) individuals managing and mobilizing social ties. When multiplex ties are formed, coexistence of instrumental and expressive components within multiplex ties occurs for a while. However, it is not clear whether the properties (i.e., effect) of one type of tie disappear or whether both ties are integrated. I argued that the characteristics of multiplex ties are dominated by initial ties, but this is not proved in this dissertation. Even though

the results are not significant, this dissertation gives us intuitive ideas that have not yet been studied.

Moreover, the results show that whether the consequences of multiplex ties and uniplex ties are different or similar is determined by situations. For example, there are no significant differences between instrumental-first ties and instrumental only ties in knowledge seeking, as well as between the expressive-first ties and the expressive only ties in defending. Meanwhile, multiplex ties yielded more consequential relationships than did uniplex ties in knowledge giving and bailing-out behaviors and this is consistent with the network research that multiplex ties are stronger than uniplex ties (e.g.,Brass, 1992; Granovetter, 1982; Methot, 2010). For instance, Methot (2010) and her colleagues (2016) argued that multiplex ties are stronger than exclusively instrumental and expressive ties and produce a pool of resources that are richer and greater utility based on its intimate and secure characteristics of the relationship. Recent study of Bush et al. (2017) examined the kinship/ friendship multiplex tie and its functionality. Specifically, they categorized the ties as ties who are neither family nor friend, ties who are solely friend, ties identified as exclusively family, and ties identified as both family and friend. The findings present that multiplex tie is the strongest relationship among four types of ties because people who are associated with multiplex relationships have very frequent contact, close relationship, and intimate discussion, comparing to a just family or friend, members.

However, even if multiplex ties would be stronger than uniplex ties such as instrumental only or expressive only ties, the consequences which are created through multiplex ties are not always better than the outcomes of uniplex ties. For example, Lazer et al. (2010) showed, in their study that how social ties influence an individual's attitude change (e.g., political attitude), social ties more strongly influence an individual's political attitude than multiplex ties of task and

social ties. Especially, because political attitude change occurs through persuasion which is a function of affect via social ties rather than through information exchange via task ties, the attitude change as outcome was associated with social tie, not with task tie in their attitude change study. Similarly, Shah et al. (2017) found that, in their cross-sectional study of professional bank employees, both uniplex ties (i.e., instrumental only ties and expressive only ties) have positive and significant linear association with work performance, while multiplex ties have an inverted U shaped association with work performance. This is because a few multiplex ties cannot give enough resources to a focal person, whereas too many multiplex ties require maintain cost and obligation.

In consistent with the mixed results of outcomes of multiplex ties, this study provides the possibility that individuals may develop, manage, and mobilize their social ties in a various way. For example, if a multiplex tie is not a stronger tie than a uniplex tie, and the consequences of the multiplex tie are not superior to those of the uniplex tie, individuals may not invest a lot of time and effort into developing multiplex ties because uniplex ties could replace the multiplex ties' functions. Thus, research on individuals' networking strategies and mobilizing social ties may be examined in many different aspects depending on the organizational context.

On the other hand, drawing on the literature from the psychological foundations in social networks with an agentic view, I examined whether and how individuals decide to develop an existing tie toward a multiplex tie, or to maintain an existing uniplex tie. Individual attributes were examined as the antecedents which influence an individual's decision to form and maintain the social network; yet, unfortunately I could not find significant results. Thus, I would suggest that other individual attributes and structural variables, such as task-interdependency,

organizational structure, and culture, found from the pilot study will be examined as antecedents of multiplex ties rather than personality and demographic variables in this study.

Lastly, this dissertation extends previous research on trust, knowledge sharing, and covering behaviors in social networks. This study focuses on the relationship between knowledge sharing and trust, which is the base of knowledge sharing, though I did not actually examine trust. Also, unlikely knowledge sharing and trust, covering, and emotion-based behaviors have not been studied specifically. This attention to the linkage between multiplex ties and knowledge sharing, emotion-based behavior such as covering, and trust will foster researchers' further interest. In particular, this study might evoke new interest in the link between expressive-first ties and expressive ties in emotion-based behaviors which has been relatively ignored compared to the instrumental behaviors in organizational context.

Limitations and Future Research

Nevertheless, this research has several limitations that may cause different or non-significant results. First, knowledge seeking and giving are accompanied costs that could be differently understood by employees depending on the field. For example, if knowledge sharing is intensively and essentially required in their work, people who are working for a knowledge-intensive company may feel cost less than would those working for a knowledge-seeking organization. Future research might investigate the effect of the formation order of multiplex ties on knowledge seeking and giving behavior in either real organizations or knowledge intensive work such as IT and R&D companies.

Similarly, the findings from my antecedent study using student data could benefit from replacing it with workplace data. The context in which students live, i.e., dormitories, might not be enough to capture the effects of individual attributes on the formation of multiplex ties.

Moreover, students living together could be more generous toward the dissimilarity and conflicts between others' religions, political views, and different personalities. Due to the relatively more frequent interactions based on spatial limitation, individual attribute effects may be worn down. Also, this data set had more friendship relationships than it did study-partner relationships. This imbalanced ratio between different type of ties (i.e., friendship ties and study partner ties) could be relieved by using workplace data.

Moreover, longitudinal data was collected yearly. Considering that RSiena analysis deals with the multiple observations of the network in small changes (Snijders et al., 2010), one year is too long a gap to properly gauge tie formation effects. Also, in the M-Turk experiment, designed with vignettes that explain imaginary relationships, participants did not answer their behavioral intention in knowledge sharing and covering with an actual person. Next time, I would conduct a recall study in order to examine participants' actual relationships. Also, I used Big5 personality from longitudinal data as antecedents of multiplex ties. However, there are only a few supported results regarding Big5 personality and I found that Big5 personality could not be stable over time through post-analysis of the repeated measures ANOVA. Thus, I will use Big5 personality in my future research after pre-test to check its consistency over time from the longitudinal data or carefully conduct depending on research setting in future.

Lastly, this paper examines the possible different consequences of multiplex ties based on the different types of dominant trust. Types of trust in multiplex ties could be examined as different characteristics of multiplex ties, led by developmental patterns. However, here I did not measure trust to test whether the dominant trust of instrumental-first and expressive-first multiplex ties are actually different because vignette survey about the imaginary relationship was not available. Thus, research on trust in multiplex ties could be examined in future. Likewise,

focusing on cognition-and affect-based trust, which are respectively associated with instrumental and expressive ties, would allow researchers to further examine how the initial type of trust influences dominant trust in a multiplex tie through the effect of tie inertia. How dominant trust in multiplex ties affects an individual's choosing the tie for either knowledge seeking and giving and defending and bailing-out behaviors, could also be examined.

Taking these limitations and extending my M-Turk study, I would design the M-turk experiment using participants' actual relationships to compare uniplex and multiplex ties in knowledge sharing and covering behaviors. Specifically, it will be ideal to select the participants who are working in organizations in which require intense knowledge sharing among organizational members. Because knowledge intensive working environment helps decrease the different perception of the definition of knowledge and knowledge sharing behaviors among people. Also, actual relationship enables to examine trust on other people and thus I will be able to measure the trust of instrumental only tie, expressive only tie, instrumental-first ties and expressive-first ties respectively and also examine the similar and different characteristics between uniplex and multiplex or instrumental-first and expressive-first multiplex ties. Given this setting, I would propose several hypotheses as following

H: Cognition-based trust will be dominant in instrumental-first ties, while affect-based trust will be dominant in expressive-first ties.

H: The ties with the dominant cognition-based trust such as instrumental tie and instrumental first tie will be more used in knowledge sharing than the ties with the dominant affect-based trust.

H: The ties with the dominant affect-based trust such as expressive tie and expressive-first tie will be more used in covering than the ties with the dominant cognition-based trust.

Conclusion

This study is the first to examine the antecedents of multiplex ties and the order effect of tie formation of multiplex ties by differentiating the multiplex ties as instrumental-first and expressive-first multiplex ties. I examined the difference consequences of multiplex ties in knowledge sharing and covering as instrumental based and expressive based behaviors. Although I did not find evidence of path-dependence effects of multiplex ties, instead I found the interesting results that sometimes the effect of uniplex ties is the same as that of multiplex ties. This result suggests that we need more research about the prevalent belief that multiplex ties are stronger than uniplex ties in social networks. Also, in terms of the antecedents of multiplex ties, I found no evidence that individual attributes influence the formation of multiplex ties. This null finding on the antecedents of multiplex provides other directions for research on the antecedents of multiplex ties.

REFERENCES

Aldrich, H., & Zimmer, C. 1986. Entrepreneurship through social networks. In D. Sexton & R. Smilor (Eds.), ***The art and science of entrepreneurship:*** 3–23. New York: Ballinger.

Anderson, M. H. 2008. Social networks and the cognitive motivation to realize network opportunities: a study of manager's information gathering behaviors. ***Journal of Organizational Behavior***, 29: 51-78.

Andrews, K., & Delahaye, B. 2000. Influences on knowledge processes in organizational learning: The psychosocial filter. ***Journal of Management Studies***, 37: 797-810.

Arthur, M. B., & Rousseau, D. M. 1996. The boundaryless career: a new employment principle for a new organizational era. Oxford: Oxford University Press.

Asendorpf, J. B., & Wilpers, S. 1998. Personality effects on social relationships. ***Journal of personality and social psychology***, 74(6): 1531-1544.

Ashford, S. J., & Taylor, M. S. 1990. ***Adaptation to work transitions: An integrative approach***. Greenwich, CT: JAI Press.

Barnes, J. A. 1972. ***Social networks.***: Addison-Wesley.

Barrick, M. R., & Mount, M. K. 1991. The big-five personality dimensions and job performance: A meta-analysis. ***Personnel Psychology***, 44: 1-26.

Barrick, M. R., Mount, M. K., & Li, N. 2013. The theory of purposeful work behavior: The role of personality, higher-order goals, and job characteristics. ***Academy of Management Review***, 38(1): 132-153.

Beckman, C. M., Haunschild, P. R., & Phillips, D. J. 2004. Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection. ***Organization science***, 15(3): 259-275.

Beehr, T. A., Bowling, N. A., & Bennett, M. M. 2010. Occupational stress and failures of social support: When helping hurts. ***Journal of Occupational Health Psychology****, 15*(1), 45-59.

Bolino, M. C., Turnley, W. H., & Bloodgood, J. M. 2002. Citizenship behavior and the creation of social capital in organizations. ***Academy of Management Review***, 27: 505-522. .

Borgatta, E. F. 1964. The structure of personality characteristics. ***Behavioral Science***, 9(1): 8-17.

Borgatti, S. P., & Foster, P. 2003. The Network Paradigm in Organizational Research: A Review and Typology. ***Journal of Management***, 29(6): 991-1013.

Borgatti, S. P., & Halgin, D. S. 2011. On Network Theory. ***Organization Science***, 22(5): 1168-1181.

Boyatzis, R. E. 1998. ***Transforming Qualitative Data***: Thousand Oaks: Sage.

Brass, D. J. 1984. Being in the right place: A structural analysis of individual influence in an organization. ***Administrative Science Quarterly***, 29: 518-539.

Brass, D. J. 1985. Men's and women's networks: A study of interaction patterns and influence in an organization. ***Academy of Management journal***, 28(2): 327-343.

Brass, D. J. 1992. Power in organizations: A social network perspective. In G. Moore, & J. A. Whitt (Eds.), ***Research in politics and society: The political consequences of social networks***, Vol. 4: 295-323. Greenwich, CT: JAI Press.

Brass, D. J., Butterfield, K. D., & Skaggs, B. C. 1998. Relationships and Unethical Behavior: A Social Network Perspective. ***The Academy of Management Review***, 23(1): 14-31.

Brass, D. J., Galaskiewicz, J., Greve, H. R., & Tsai, W. 2004. Taking Stock of Networks and Organizations: A Multilevel Perspective. ***The Academy of Management Journal***, 47(6): 795-817.

Briscoe, F., & Tsai, W. 2011. Overcoming relational inertia: How organizational members respond to acquisition events in a law firm. ***Administrative Science Quarterly***,1-33.

Buhrmester, M., Kwang, T., & Gosling, S. D. 2011. Amazon's Mechanical Turk: A New Source of Inexpensive, Yet High-Quality, Data? ***Perspectives on Psychological Science***, 6(1): 3-5.

Bush, A., Walker, A., & Perry, B. 2017. "The framily plan": Characteristics of ties described as both "friend" and "family" in personal networks. ***Network Science***, 5(1), 92-107.

Buono, C., Alvarez-Zuzek, L. G., Macri, P. A., & Braunstein, L. A. 2014. Epidemics in partially overlapped multiplex networks. ***PloS one***, 9(3): e92200.

Burt, R. S. 1992. ***Structural holes: The social structure of competition***. Cambridge: MA: Harvard University Press.

Burt, R. S. 1998. The gender of social capital. ***Rationality and society***, 10(1): 5-46.

Carley, K. 1991. A theory of group stability. ***American Sociological Review***: 331-354.

Casciaro, T. 1998. Seeing things clearly: Social structure, personality, and accuracy in social network perception. ***Social Networks***, 20(4): 331-351.

Casciaro, T., & Lobo, M. S. 2005. Competent jerks, lovable fools, and the formation of social networks. ***Harvard business review***, 83(6): 92-99.

Casciaro, T., & Lobo, M. S. 2008. When competence is irrelevant: The role of interpersonal affect in task-related ties. ***Administrative Science Quarterly***, 53: 655-684.

Casciaro, T., Gino, F., & Kouchaki, M. 2014. The Contaminating Effects of Building Instrumental Ties: How Networking Can Make Us Feel Dirty. ***Administrative Science Quarterly,*** 59 (4): 705-735

Chan, D. 2000. Understanding adaptation to changes in the work environment: Integrating individual difference and learning perspectives. ***Research in personnel and human resources management***, 18: 1-42.

Cheadle, J. E., & Schwadel, P. 2012. The 'friendship dynamics of religion', or the 'religious dynamics of friendship'? A social network analysis of adolescents who attend small schools. ***Social science research***, 41(5): 1198-1212.

Chua, R., Morris, M., & Ingram, P. 2009. Guanxi versus networking: distinctive configurations of affect- and cognition-based trust in the networks of Chinese versus American managers. ***Journal of International Business Studies***, 40: 490-508.

Chua, R. Y. J., Ingram, P., & Morris, M. W. 2008. From the head and the heart: Locating cognition-and affect-based trust in managers' professional networks. ***Academy of Management Journal***, 53(1): 436-452.

Churchman, C. W., & Schainblatt, A. H. 1965. The researcher and the manager: A dialectic of implementation. ***Management Science***, 11(4): B-69.

Cohen, M. D., March, J. G., & Olsen, J. P. 1972. A garbage can model of organizational choice. ***Administrative Science Quarterly***, 17(1): 1-25.

Coleman, K. M. 1990. Fatal charades: Roman executions staged as mythological enactments. ***Journal of Roman Studies***, 80: 44-73.

Coleman, T. F., & Li, Y. 1996. An interior trust region approach for nonlinear minimization subject to bounds. ***SIAM Journal on optimization***, 6(2): 418-445.

Cotton, R. D., Shen, Y., & Livne-Tarandach, R. 2011. On becoming extraordinary: the content and structure of the developmental networks of major league baseball hall of famers. ***Academy of Management Journal***, 54(1): 15-46.

Cummings, J. 2004. Work groups, structural diversity, and knowledge sharing in a global organization. ***Management Science***, 50: 352-364.

Cummings, T. G. 1978. Self-regulating work groups: A socio-technical synthesis. ***Academy of management Review***, 3(3): 625-634.

Dahlander, L., & McFarland, D. A. 2013. Ties that last tie formation and persistence in research collaborations over time. ***Administrative Science Quarterly***, 58(1): 69-110.

David, P. A. 2007. Path dependence: a foundational concept for historical social science. ***Cliometrica***, 1(2): 91-114.

Dekker, D., Krackhardt, D., & Snijders, T. A. 2007. Sensitivity of MRQAP tests to collinearity and autocorrelation conditions. ***Psychometrika***, 72(4): 563-581.

Dinh, J. E., & Lord, R. G. 2012. Implications of dispositional and process views of traits for individual difference research in leadership. ***The Leadership Quarterly***, 23(4): 651-669.

Dubini, P., & Aldrich, H. A. 1991. Personal and extended network and central to the entrepreneurial process. ***Journal of Business Venturing***, 6(5): 305-313.

Duguid, M. 2011. Female tokens in high-prestige work groups: Catalysts or inhibitors of group diversification? ***Organizational Behavior and Human Decision Processes***, 116(1): 104-115.

Ebers, M. 1997. Explaining inter-organizatoinal network formation. In M. Ebers (Ed.), ***The Formation of Inter-Organizational Networks***: 3-40. Oxford, UK: Oxford University Press.

Emirbayer, M., & Goodwin, J. 1994. Network analysis, culture, and the problem of agency. ***American journal of sociology***, 99(6): 1411-1454.

Fang, R., Landis, B., Zhang, Z., Anderson, M. H., Shaw, J. D., Kilduff, M. 2015. Integrating Personality and Social Networks: A Meta-Analysis of Personality, Network Position,and Work Outcomes in Organizations. ***Organizational Science*****,** 26(4): 1243-1260

Farh, J.-L., Lee, C., & Farh, C. I. C. 2010. Task conflict and team creativity: A question of how much and when. ***Journal of Applied Psychology***, 95(6): 1173-1180.

Ferriani, S., Fonti, F., & Corrado, R. 2012. The social and economic bases of network multiplexity: Exploring the emergence of multiplex ties. ***Srategic Organization***, 11(1): 7-34.

Fisher, C., Ilgen, D., & Hoyer, W. 1979. Source credibility, information favorability, and job offer acceptance. ***Academy of Management Journal***, 22: 94-103.

Flynn, F., Chatman, J., & Spataro, S. 2001. Getting to know you: The influence of personality on the impression formation and performance of demographically different people in organizations. ***Administrative Science Quarterly***, 46(3): 414-442.

Funder, D. C. 2001. ***The Personality Puzzle***. New York: Norton.

Gargiulo, M., & Benassi, M. 2000. Trapped in your own net? Network cohesion, structural holes, and the adaptation of social capital. ***Organization science***, 11(2): 183-196.

Gangestad, S. W., & Snyder, M. 2000. Self-monitoring: appraisal and reappraisal. ***Psychological Bulletin***, 126(4): 530-555.

Gibbons, D. E. 2004. Friendship and Advice Networks in the Context of Changing Professional Values. ***Administrative Science Quarterly***, 49(2): 238-262.

Glaser, B. C., & Strauss, A. L. 1967. ***The discovery of grounded theory: Strategies for qualitative research*** New York: Aldine.

Goodreau, S. M., Kitts, J. A., & Morris, M. 2009. Birds of a feather, or friend of a friend? using exponential random graph models to investigate adolescent social networks*. ***Demography***, 46(1): 103-125.

Gouldner, A. W. 1954. ***Patterns of Industrial Bureaucracy***. New York: Free Press.

Granovetter, M. 1983. The Strength of Weak Ties: A Network Theory Revisited. ***Sociological Theory***, 1: 201-233.

Granovetter, M. S. 1973. The Strength of Weak Ties. ***The American Journal of Sociology***, 78(6): 1360-1380.

Granovetter, M. S. 1982. The strength of weak ties: A network theory revisited. In P. V. M. N. Lin (Ed.), ***Social structure and network analysis***. Beverly Hills: Sage.

Gulati, R. 1995. Social structure and alliance formation patterns: A longitudinal analysis. ***Administrative Science Quarterly***, 619-652.

Haas, M. R., & Hansen, M. T. 2007. Different knowledge, different benefits: toward a productivity perspective on knowledge sharing in organizations. ***Strategic Management Journal***, 28(11): 1133-1153.

Hansen, M. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. ***Administrative Science Quarterly***, 44(1): 82-111.

Hansen, M. T., Mors, M. L., & Løvås, B. 2005. Knowledge sharing in organizations: Multiple networks, multiple phases. ***Academy of Management Journal***, 48(5): 776-793.

Harrison, D. A., Price, K. H., & Bell, M. P. 1998. Beyond relational demography: Time and the effects of surface-and deep-level diversity on work group cohesion. ***Academy of management journal***, 41(1): 96-107.

Harrison, D. A., Price, K. H., Gavin, J. H., & Florey, A. T. 2002. Time, teams, and task performance: Changing effects of surface-and deep-level diversity on group functioning. ***Academy of management journal***, 45(5): 1029-1045.

Hartman, R. L., & Johnson, D. J. 1989. Social contagion and multiplexity: networks as predictors of commitment and role ambiguity. ***Human Communication***, 15(4): 523-548.

Heaney, M. T. 2014. Multiplex networks and interest group influence reputation: an exponential random graph model. ***Social Networksx***, 36: 66-81.

Higgins, M. C. 2000. The more, the merrier? Multiple developmental relationships and work satisfaction. ***Journal of Management Development***, 19(4): 277-296.

Higgins, M. C., & Kram, K. E. 2001. Reconceptualizing mentoring at work: A developmental network perspective. ***Academy of Management Review***, 26(2): 264-288.

Hill, C. T., & Stull, D. E. 1987. ***Gender and self-disclosure. In Self-Disclosure***: Springer US.

Hinds, P. J., Carley, K. M., Krackhardt, D., & Wholey, D. 2000. Choosing work group members: Balancing similarity, competence, and familiarity. ***Organizational Behavior and Human Decision Processes***, 82(2): 226-251.

Hogan, C. J. 1983. Magnetohydrodynamic effects of a first-order cosmological phase transition. ***Physical Review Letters***, 51(16): 1488.

Hood, A., Cruz, K. S., & Bachrach, D. G. 2017. Conflicts with Friends: A Multiplex View of Friendship and Conflict and Its Association with Performance in Teams. ***Journal of Business and Psychology***, 32(1):73–86

Huckfeldt, R., & Sprague, J. 1995. ***Citizens, Politics and Social Communication: Information and Influence in an Election Campaign***. New York: Cambridge Univ. Press.

Huston, T. L., & Levinger, G. 1978. Interpersonal attraction and relationships. ***Annual review of psychology***, 29(1): 115-156.

Ibarra, H. 1992. Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm. ***Administrative Science Quarterly***, 37(3): 422-447.

Ibarra, H. 1993. Personal networks of women and minorities in management: A conceptual framework. ***Aademy of Management Review***, 18(1): 56-87.

Ibarra, H. 1995. Race, Opportunity, and Diversity of Social Circles in Managerial Networks. ***The Academy of Management Journal***, 38(3): 673-703.

Ibarra, H., & Andrews, S. B. 1993. Power, Social Influence, and Sense Making: Effects of Network Centrality and Proximity on Employee Perceptions. ***Administrative Science Quarterly***, 38(2): 277-303.

Ingram, P., & Zou, X. 2008. Business friendships. ***Research in organizational behavior***, 28: 167-184.

Johnson-George, C., & Swap, W. C. 1982. Measurement of specific interpersonal trust: Construction and validation of a scale to assess trust in a specific other. ***Journal of Personality and Social Psychology***, 43(6): 1306.

Jonczyk, C., Lee, Y., Galunic, C., & Bensaou, B. M. 2016; Relational Changes During Role Transitions: The Interplay of Efficiency and Cohesion. ***Academy of Management Journal***, 59 (3): 956–982

Judge, T. A., Bono, J. E., Ilies, R., & Gerhardt, M. W. 2002. Personality and leadership: a qualitative and quantitative review. ***Journal of applied psychology***, 87(4): 765.

Kalish, Y., & Robins, G. 2006. Psychological predispositions and network structure: The relationship between individual predispositions, structural holes and network closure. ***Social Networks***, 28(1): 56-84.

Kapferer, B. 1969. Norms and the Manipulation of Relationships in a Work Context. In J. C. Mitchell (Ed.), ***Social Networks in Urban Situations.*** Manchester: Manchester University Press.

Keenan, A., & Newton, T. J. 1984. Frustration in organizations: Relationships to role stress, climate, and psychological strain. ***Journal of Occupational Psychology***, 57(1): 57-65.

Kilduff, M. 1990. The interpersonal structure of decision making: A social comparison approach to organizational choice. ***Organizational behavior and human decision processes***, 47(2): 270-288.

Kilduff, M. 1992. The friendship network as a decision-making resource: Dispositional moderators of social influences on organizational choice. ***Journal of Personality and Social Psychology***, 62: 168-180.

Kilduff, M., & Brass, D. J. 2010. Organizational social network research: core ideas and key debates. ***Academy of Management Annals***, 4(1): 317-357.

Kilduff, M., & Krackhardt, D. 1994. Bringing the individual back in: A structural analysis of the internal market for reputation in organizations. ***Academy of Management Journal***, 37(1): 87-108.

Kilduff, M., & Krackhardt, D. 2008. ***Interpersonal networks in organizations: Cognition, personality, dynamics, and culture***: Cambridge University Press.

Kilduff, M., & Tsai, W. 2003. ***Social networks and organizations***: Sage.

Kim, T.-Y., Oh, H., & Swaminathan, A. 2006. Framing interorganizational network Change: a network inertia perspective. ***Academy of Management Review***, 31(3): 704-720.

Kivelä, M., Arenas, A., Barthelemy, M., Gleeson, J. P., Moreno, Y., & Porter, M. A. 2014. Multilayer networks. ***Journal of Complex Networks***, 2: 203-271.

Klein, K. J., Lim, B. C., Saltz, J. L., & Mayer, D. M. 2004. How do they get there? An examination of the antecedents of centrality in team networks. ***Academy of Management Journal***, 47(6): 952-963.

Kleinbaum, A. M. 2017. Reorganization and Tie Decay Choices. Management Science, 1–19

Knoke, D. 1990. Networks of political action: Toward theory construction. ***Social forces***, 68(4): 1041-1063.

Koka, B. R., Madhavan, R., & Prescott, J. E. 2006. The evolution of interfirm networks: Environmental effects on patterns of network change. ***Academy of Management Review***, 31(3): 721-737.

Krackhardt, D. 1990. Assessing the political landscape: Structure, cognition, and power in organizations. ***Administrative Science Quarterly***, 35: 342-369.

Krackhardt, D. 1992. ***The strength of strong ties: The importance of philos in organizations' [w:] Networks and Organizations: Structure, Form, and Action, ed. EcclesN. N. and R. C.,***. Boston, MA: Harvard Business School Press.

Krackhardt, D., & Hanson, J. R. 1993. Informal Networks: The company behind the chart. ***Harvard Business Review***, July/Aug: 104 111.

Kram, K. E. 1985. ***Mentoring at work: Developmental relationships in organizational life***. Grenview IL: Scott: Foresman.

Kramer, R. M. 1999. Trust and Distrust in Organizations: Emerging Perspectives, Enduring Questions. ***Annual Review of Psychology***, 50: 569-598.

Kuwabara, K., Luo, J., & Sheldon, O. 2010. Multiplex exchange relations. In S. Thye, & E. Lawler (Eds.), ***Advances in Group Processes***: 239-268. Bingley, UK: Emerald Group.

Labianca, G., Brass, D. J., & Gray, B. 1998. Social networks and perceptions of intergroup conflict: The role of negative relationships and third parties. ***Academy of Management journal***, 4(1): 55-67.

Lazarsfeld, P. F., & Merton, R. K. 1954. Friendship as a social process: A substantive and methodological analysis. ***Freedom and control in modern society***, 18(1): 18-66.

Lazega, E., & Pattison, P. E. 1999. Multiplexity, generalized exchange and cooperation in organizations: a case study. ***Social Networks***, 21: 67-90.

Lazer, D., Rubineau, B., Chetkovich, C., Katz, N., & Neblo, M. 2010. The coevolution of networks and political attitudes. ***Political Communication***, 27(3): 248-274.

LePine, J. A., & Van Dyne, L. 2001. Voice and cooperative behavior as contrasting forms of contextual performance: evidence of differential relationships with big five personality characteristics and cognitive ability. ***Journal of Applied Psychology***, 86(2): 326.

Liden, R. C., Erdogan, B., Wayne, S. J., & Sparrowe, R. T. 2006. Leader-member exchange, differentiation, and task interdependence: implications for individual and group performance. ***Journal of Organizational Behavior***, 27(6): 723-746.

Lin, N. 1999. Building a network theory of social capital. ***Connections***, 22: 28-51.

Lincoln, J. R., & Miller, J. 1979. Work and friendship ties in organizations:A comparative analysis of relational networks. ***Administrative Science Quarterly***, 2(4): 181-199.

Lomi, A., & Pattison, P. 2006. Manufacturing relations: an empirical study of the organization of production across multiple networks. ***Organization Science***, 17(3): 313-332.

Lorenzen, M., & Andersen, K. V. 2012. Different creative cities: Exploring Danish data to adapt the creative class argument to small welfare economies. ***Creative Industries Journal,*** 4(2)

Luu, P., Collins, P., & Tucker, D. M. 2000. Mood, personality, and self-monitoring: negative affect and emotionality in relation to frontal lobe mechanisms of error monitoring. ***Journal of experimental psychology: General***, 129(1): 43-60.

March, J. G., & Simon, H. A. 1958. ***Organizations***. New York: Wiley.

Marsden, P. V. 1988. Homogeneity in confiding relations. ***Social networks***, 10(1): 57-76.

Marsden, P. V. 1990. Network Data and Measurement. ***Annual Review of Sociology***, 16: 435-463.

Marsden, P. V., & Campbell, K. E. 1984. Measuring tie strength. Social forces. ***63***, 2(482-501).

Maurer, I., Bartsch, V., & Ebers, M. 2011. The value of intra-organizational social capital: How it fosters knowledge transfer, innovation performance, and growth. ***Organization Studies***, 32(2): 157-185.

Mayhew, B. H., & Levinger, R. L. 1976. Size and the density of interaction in human aggregates. ***American Journal of Sociology***: 86-110.

McAllister, D. J. 1995. Affect-and cognition-based trust as foundations for interpersonal cooperation in organizations. ***Academy of Management Journal***, 38(1): 24-59.

McPherson, J. M., & Smith-Lovin, L. 1987. Homophily in voluntary organizations: Status distance and the composition of face-to-face groups. ***American sociological review***: 370-379.

McPherson, M., Smith-Lovin, L., & Cook, J. M. 2001. Birds of a feather: Homophily in social networks. ***Annual Review of Sociology***, 27: 415-444.

Meglino, B. M., Ravlin, E. C., & Adkins, C. L. 1989. A work values approach to corporate culture: A field test of the value congruence process and its relationship to individual outcomes. ***Journal of applied psychology***, 74(3): 424.

Mehra, A., Kilduff, M., & Brass, D. J. 1998. At the margins: A distinctiveness approach to the social identity and social networks of underrepresented groups. ***Academy of Management Journal***, 41: 441-452.

Mehra, A., Kilduff, M., & Brass, D. J. 2001. The Social Networks of High and Low Self-Monitors: Implications for Workplace Performance. ***Administrative Science Quarterly***, 4(1): 121-146.

Methot, J. R. 2010. ***The effects of instrumental, friendship, and multiplex network ties on job performance: A model of coworker relationships***. University of Florida, ProQuest Dissertations Publishing.

Methot, J. R., Lepine, J. A., Podsakoff, N. P., & Christian, J. S. 2016. Are workplace friendships a mixed blessing? Exploring tradeoffs of multiplex relationships and their associations with job performance. ***Personnel Psychology***, 69(2): 1-45.

Mollica, K. A., Gray, B., & Trevino, L. K. 2003. Racial homophily and its persistence in newcomers' social networks. ***Organization Science***, 14(2): 123-136.

Molloy, J. C. 2005. Development networks: Literature review and future research. ***Career Development International***, 10: 536 -547.

Moran, P., & Ghoshal, S. 1996. Theories of economic organization: The case for realism and balance. ***Academy of Management Review***, 21(1): 58-72.

Morrison, E. W. 2002. Newcomers' relationships: The role of social network ties during socialization. ***Academy of Management Journal***, 45(6): 1149-1160.

Morrison, R. L. 2009. The double edged sword: Organizational outcomes of workplace friendships, ***Friends and Enemies in Organizations***: 122-138. Palgrave Macmillan UK.

Motowildo, S. J., Borman, W. C., & Schmit, M. J. 1997. A theory of individual differences in task and contextual performance. ***Human performance***, 10(2): 71-83.

Mouw, T., & Entwisle, B. 2006. Residential Segregation and Interracial Friendship in Schools1. ***American Journal of Sociology***, 112(2): 394-441.

Mund, M., & Neyer, F. J. 2014. Treating personality-relationship transactions with respect: Narrow facets, advanced models, and extended time frames. ***Journal of Personality and Social Psychology****, 107*(2), 352-368.

Nahapiet, J., & Ghoshal, S. 1998. Social Capital, Intellectual Capital, and the Organizational Advantage. ***The Academy of Management Review,***, 23(2): 242-266.

Nebus, J. 2006. Building collegial information networks: A theory of advice network generation. ***Academy of Management Review***, 31(3): 615-637.

Neimeyer, R. A., & Mitchell, K. A. 1988. Similarity and attraction: A longitudinal study. ***Journal of Social and Personal Relationships***, 5(2): 131-148.

Nerkar, A., & Paruchuri, S. 2005. Evolution of R&D capabilities: The role of knowledge networks within a firm. ***Management Science***, 51(5): 771-785.

Norman, S. M., Avey, J. B., Nimnicht, J. L., & Pigeon, N. G. 2010. The interactive effects of psychological capital and organizational identity on employee citizenship and deviance behaviors. ***Journal of Leadership & Organizational Studies.***: 1-12.

O'Reilly, C. A., & Roberts, K. H. 1976. Relationships among components of credibility and communication behaviors in work units. ***Journal of Applied Psychology***, 61(1): 99-102.

Obstfeld, D. 2005. Social networks, the tertius iungens orientation, and involvement in innovation. ***Administrative science quarterly***, 50(1): 100-130.

Oh, H., Chung, M., & Labianca, G. 2004. Group social capital and group effectiveness: The role of informal socializing ties. ***Academy of Management Journal***, 47: 860-875.

Oh, H., & Kilduff, M. 2008. The ripple effect of personality on social structure? Self-monitoring origins of network brokerage. ***Journal of Applied Psychology***, 93(1155-1164).

Organ, D. W. 1988. ***Organizational citizenship behavior: The good soldier syndrome***. Lexington, MA: Lexington Books.

Patton, M. Q. 2002. ***Qualitative Evaluation and Research Methods***. Newbury Park: Sage.

Patton, M. Q. 2005. *Qualitative Research*. Encyclopedia of Statistics in Behavioral Science.

Patton, M. Q. 2005. ***Qualitative Research***, John Wiley & Sons, Ltd.

Phelps, C., Heidl, R., & Wadhwa, A. 2012. Knowledge, networks, and knowledge networks a review and research agenda. ***Journal of Management***, 38(4): 1115-1166.

Podolny, J. M., & Baron, J. N. 1997. Resources and Relationships: Social Networks and Mobility in the Workplace. ***American Sociological Review***, 62(5): 673-693.

Portes, A., & Sensenbrenner, J. 1993. Embeddedness and immigration: Notes on the social determinants of economic action. ***American journal of sociology***, 1320-1350.

Powell, W. W., & Snellman, K. 2004. The knowledge economy. ***Annual review of sociology***, 30: 199-220.

Rawlings, C. M., & McFarland, D. A. 2011. Influence flows in the academy: Using affiliation networks to assess peer effects among researchers. ***Social Science Research***, 40(3): 1001-1017.

Reagans, R., Argote, L., & Brooks, D. 2005. Individual experience and experience working together: Predicting learning rates from knowing who knows what and knowing how to work together. ***Management Science***, 51(6): 869-881.

Reagans, R., & McEvily, B. 2003. Network structure and knowledge transfer: The effects of cohesion and range. ***Administrative Science Quarterly***, 48(2): 240-267.

Reinholt, M. I. A., Pedersen, T., & Foss, N. J. 2011. Why a central network position isn't enough: the role of motivation and ability for knowledge sharing in employee networks. ***Academy of Management Journal***, 54(6): 1277-1297.

Rivera, M. T., Soderstrom, S. B., & Uzzi, B. 2010. Dynamics of dyads in social networks: Assortative, relational, and proximity mechanisms. ***Annual Review of Sociology***, 36: 91-115.

Roberson, Q. M., & Williamson, I. O. 2012. Justice in self-managing teams: The role of social networks in the emergence of procedural justice climates. ***Academy of Management Journal***, 55(3): 685-701.

Roberts, S. G., Wilson, R., Fedurek, P., & Dunbar, R. I. M. 2008. Individual differences and personal social network size and structure. ***Personality and Individual Differences***, 44(4): 954-964.

Saint-Charles, J., & Mongeau, P. 2009. Different relationships for coping with ambiguity and uncertainty in organizations. ***Social Networks***, 31(1): 33-39.

Sailer K, McCulloh, I. 2012. Social networks and spatial configuration - How office layouts drive social interaction. ***Social Networks***, 34(1):47–58

Sasovova, Z., Mehra, A., Borgatti, S. P., & Schippers, M. C. 2010. Network churn: The effects of self-monitoring personality on brokerage dynamics. ***Administrative Science Quarterly***, 55: 639-670.

Schulz, M. 2003. Pathways of relevance_exploring inflows of knolwedge into subunits of multinational corporations. ***Organization Science***, 14(4): 440-459.

Seibert, S., Kraimer, M., & Liden, R. 2001. A social capital theory of career success. ***Academy of Management Journal***, 44(2): 219-237.

Selfhout, M., Burk, W., Branje, S., Denissen, J., Van Aken, M., & Meeus, W. 2010. Emerging late adolescent friendship networks and Big Five personality traits: A social network approach. ***Journal of personality***, 78(2): 509-538.

Shah, N. P., Parker, A., & Waldsrøm, C. 2017. Examining the Overlap: Individual Performance Benefits of Multiplex Relationships. ***Management Communication Quarterly***, 31(1): 5–38

Shipilov, A. V., & Li, S. X. 2008. Can You Have Your Cake and Eat It Too? Structural Holes' Influence on Status Accumulation and Market Performance in Collaborative Networks ***Administrative Science Quarterly***, 53(1): 73-108.

Sias, P. M., & Cahill, D. J. 1998. From coworkers to friends: The development of peer friendships in the workplace. ***Western Journal of Communication***, 62:273-299.

Smith-Lovin, L. 2007. The strength of weak identities: Social structural sources of self, situation and emotional experience. ***Social Psychology Quarterly***, 70(2): 106-124.

Snijders, T. A. 1996. Stochastic actor-oriented models for network change. ***Journal of mathematical sociology,***, 21(1-2): 149-172.

Snijders, T. A. 2001. The statistical evaluation of social network dynamics. ***Sociological methodology***, 31(1): 361-395.

Snijders, T. A., Lomi, A., & Torló, V. J. 2012. A model for the multiplex dynamics of two-mode and one-mode networks, with an application to employment preference, friendship, and advice. ***Social Networks***, 35(2): 265-276.

Snijders, T. A., Van de Bunt, G. G., & Steglich, C. E. 2010. Introduction to stochastic actor-based models for network dynamics. ***Social Networks***, 32(1): 44-60.

Snyder, M. 1974. Self-monitoring of expressive behavior. ***Journal of Personality and Social Psychology***, 30: 526-537.

Snyder, M. 1987. ***Public appearances, private realities: The psychology of self-monitoring.***: WH Freeman/Times Books/Henry Holt & Co.

Snyder, M., & Cantor, N. 1980. Thinking about ourselves and others: Self-monitoring and social knowledge. ***Journal of Personality and Social Psychology***, 39: 222-234.

Snyder, M., Gangestad, S., & Simpson, J. A. 1983. Choosing friends as activity partners: The role of self- monitoring. ***Journal of Personality and Social Psychology***, 45: 1061-1072.

Snyder, M., & Simpson, J. A. 1984. Self-monitoring and dating relationships. ***Journal of Personality and Social Psychology***, 47(6): 1281-1291.

Soda, G., & Zaheer, A. 2012. A network perspective on organizational architecture: Performance effects of the interplay of formal and informal organization. ***Strategic Management Journal***, *33*, 751-771.

Sosa, M. E. 2011. Where Do Creative Interactions Come From? The Role of Tie Content and Social Networks. ***Organization Science,*** 22(1): 1–21

Sparrowe, R. T., Liden, R. C., Wayne, S. J., & Kraimer, M. L. 2001. Social networks and the performance of individuals and groups. ***Academy of Management Journal***, 44(2): 316-325.

Spector, P. E., & Fox, S. 2002. An emotion-centered model of voluntary work behavior: Some parallels between counterproductive work behavior and organizational citizenship behavior. ***Human Resource management review***, 12(2): 269-292.

Stockman, F. N., & Doreian, P. 1997. Evolution of Social Networks: Processes and Principles. In P. Doreian, & F. N. Stockman (Eds.), ***Evolution of Social Networks.***: 233-250. Amsterdam: Routledge.

Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. ***Strategic management journal***, 17(52): 27-43.

Tsai, W., & Ghoshal, S. 1998. Social Capital and Value Creation: The Role of Intrafirm Networks. ***The Academy of Management Journal***, 41(4): 464-476.

Tsui, A. S., Egan, T. D., & O'Reilly III, C. A. 1992. Being different: Relational demography and organizational attachment. ***Administrative science quarterly***: 549-579.

Tsui, A. S., & O'Reilly, C. A. 1989. Beyond simple demographic effects: the importance of relational demography in superior-subordinate dyads. ***Academy of Management Journal***, 32(2): 402-423.

Turban, D. B., & Dougherty, T. W. 1994. Role of protégé personality in receipt of mentoring and career success. ***Academy of Management Journal***, 37(3): 688-702.

Turban, D. B., Dougherty, T. W., & Lee, F. K. 2002. Gender, race, and perceived similarity effects in developmental relationships: The moderating role of relationship duration. ***Journal of Vocational Behavior***, 61(2): 240-262.

Turnley, W. H., & Bolino, M. C. 2001. Achieving Desired Images While Avoiding Undesired Images: Exploring the Role of Self-Monitoring in Impression Management. ***Journal of Applied Psychology***, 86(2): 351-360.

Umphress, E. E., Labianca, G. J., Brass, D. J., Kass, E. E., & Scholten, L. 2003. The Role of Instrumental and Expressive Social Ties in Employees' Perceptions of Organizational Justice. ***Organization Science*** 14(6): 738-753.

Uzzi, B. 1996. The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. ***American Sociological Review***, 61(4): 674-698.

Uzzi, B. 1997. Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness. ***Administrative Science Quarterly***, 42(1): 35-67.

Verbrugge, L. M. 1979. Multiplexity in adult friendships. ***Social Forces***, 57(4): 1286-1309.

Verbrugge, L. M. 1997. The structure of adult friendship choices. ***Social Forces***, 56(2): 576-597.

Vissa, B. 2011. A Matching Theory of Entrepreneurs' Tie Formation Intentions and Initiation of Economic Exchange. ***Academy of Management Journal***, 54(1): 137-158

Vissa, B. 2012. Entrepreneurs' networking style and initiation of economic exchange. ***Organization Science***, 23(2): 492-510

Wellman, B. 1992. Which types of ties and networks provide what kinds of social support? ***Advances in group processes***, 9: 207-235.

Wellman, B., & Wortley, S. 1990. Different strokes from different folks: Community ties and social support. ***American journal of Sociology***: 558-588.

Wheeldon, P. D. 1969. The operation of voluntary associations and personal networks in the political processes of an inter-ethnic community. In J. D. Mitchell (Ed.), ***Social Networks in Urban Situations***. Manchester: Manchester: University Press.

White, H. C. 2008. ***Identity and Control: How Social Formations Emerge***. Princeton, NJ: Princeton University Press.

Wimmer, A., & Lewis, K. 2010. Beyond and below racial homophily: Erg models of a friendship network documented on facebook1. ***American Journal of Sociology***, 116(2): 583-642.

Zelizer, V. A. 2005. ***The purchase of intimacy***. Princeton, NJ: Princeton University Press.

Zenger, T. R., & Lawrence, B. S. 1989. Organizational demography: The differential effects of age and tenure distributions on technical communication. ***Academy of Management journal***, 32(2): 353-376.

APPENDIX

Pilot Study Interview Protocol

Interview Protocol for Research on the Development of Multiplex Ties

Pre-Interview Dialogue

1. Review purpose of study and focus of interview - answer questions

Suggested Script: The purpose of this study is to promote greater understanding of the developmental process of individuals' interpersonal relationships in organizations. Specifically, this study focuses on how and why people develop their existing relationships into overlapping relationships that include diverse types of interactions. I want to hear about how you initiate, maintain, develop, and terminate your social relationships in your work organization. Everything you tell me will be considered strictly confidential, and you may decline to answer any question or withdraw from the study at any time. In my analysis I will focus on aggregate results and recurrent themes across all of those interviewed; the anonymity of each interviewee will be protected. Once the study is completed, all of those who have participated in interviews of this study will receive a report describing a summary of my findings.

I. SOCIAL RELATIONSHIPS IN ORGANIZATIONS

Overall Relationships

1. I am going to ask you to tell me about your relationships in the organization. Let's talk about who you usually interact with, and then select a few (up to 5) that we can discuss in depth.

2. When you need help, whom will you ask for help?

    1) Do you prefer some types of relationships more than the others, depending on the types of help you need? Why?

Specific Relationships

3. Now I want us to talk in depth about your key relationships. We will talk about each in turn. Let's start with the first one. Tell me how you met this person. Who is he/she? How was the relationship initiated? What are the kinds of things you talk about with this person?

The Change of Relationships

4. Now I will ask you about how these relationships have changed over time. Have you experienced changes within these key relationships? If so,

1) What kind of change did you experience? (e.g., the time you spend with them, the topics you talk about, or the meaning of this person to you, etc.). Again, let's think about each of your key relationships in turn [person A, person B, etc.]

2) Does it happen that you become friends with coworkers or supervisors or that you started to work together with your friends within the organization? How did that change that relationship? 3) What do you think caused these changes in your relationships?

Obligation (Reciprocity) of Relationships

5. What aspects of this relationship do you appreciate the most?

6. What would you say this relationship brings to your career or personal/social life?

1) What would you say that you bring to this relationship?

2) If you ask for help, do you feel any obligation that you should repay for their help in future? Conversely, do you expect that they will return your favor when you will ask them?

3) If so, what type of return of the helps between you and this person do you expect?

7. As the relationship with this person has been changed, have you felt more comfortable to ask for help or experienced any change in your sense of obligation to them?

Trust of Relationships

Finally, I want to learn about how you feel about the trustworthiness of these relationships.

Let's talk about them in turn again: [person A, person B, etc.]

8. How much do you trust this person in terms of their ability to help you with work-related questions?

9. How much do you trust this person to ask for career related advice?

10. How much do you trust this person to talk about your personal life issues?

11. Can you think of an instance when you felt conflicted towards this person? (e.g., "Even if Jane is the trustful friend who I can share my secrets, I cannot depend on her ability for working together")

12. Have you felt a change in how much you trusted this person depending on the changes in your relationship with him/her?

Closing Questions

13. Do you have something else to tell me about your relationships in organizations?

Vignette Survey

INSTRUCTION: Please imagine that you have the following four social relationships in you workplace.

The text below describes your relationship with one of your hypothetical co-workers, named Casey:

[I type]

Casey is one of your co-workers. In the past, you have sought work-related information and advice to enhance your effectiveness on the job from Casey. You continue to seek out this kind of information and advice from Casey, but you do not consider Casey to be a friend. That is, except for work-related advice, you would not currently feel comfortable discussing personal matters with Casey.

[Instrumental-first type]

Casey is one of your co-workers. In the past, you have sought work-related information and advice to enhance your effectiveness on the job from Casey. You continue to seek out this kind of information and advice from Casey, and have come to consider Casey to be a friend. That is, in addition to work-related advice you now would feel comfortable discussing personal matters with Casey.

[E type]

Casey is one of your co-workers. In the past, you have considered Casey to be a friend. That is, you felt comfortable discussing personal matters with Casey. You continue to consider Casey to be your friend, but except for personal matters, you do not currently consult Casey when you need work-related information and advice to enhance your effectiveness on the job.

[Expressive-first type]

Casey is one of your co-workers. In the past, you have considered Casey to be a friend. That is, you felt comfortable discussing personal matters with Casey. You continue to consider Casey to be your friend, and in addition to personal matters, you now also consult Casey when you need sought work-related information and advice to enhance your effectiveness on the job.

Knowledge Sharing

<u>INSTRUCTIONS</u>: After reading a scenario, please answer the following questions.

When you need information or knowledge on work-related topics, how likely is it that you will seek relevant information and knowledge from Casey?

1 - Never
2 - Rarely
3 - Occasionally
4 – Frequently
5 - Very frequently

When Casey asks you for information or knowledge on work-related topics, how likely is it that you will provide the relevant information and knowledge to Casey?

1 - Never
2 - Rarely
3 - Occasionally
4 – Frequently
5 - Very frequently

<u>INSTRUCTIONS</u>: Please answer the following questions ABOUT THE RELATIONSHIP BETWEEN YOU and CASEY that you understood from the description in this survey.

What option of relationship best describes your ***<u>original</u>*** relationship with Casey?

a. Friend
b. Advisor
c. **Both** friend and advisor

Which option best describes your ***<u>current</u>*** relationship with Casey?

a. Friend
b. Advisor
c. **Both** friend and advisor
d. **Neither** friend nor advisor

Covering

<u>INSTRUCTIONS</u>: After reading a scenario, please answer the following questions.

If Casey made a decision or took some action that needed defense or justification, how likely is it that you would defend or justify Casey's decision to others in your organization even if Casey were not present at the time?

1 - Extremely unlikely
2 - Somewhat Unlikely
3 - Neutral
4 - Somewhat Likely
5 - Extremely likely

How likely is it that you would be willing to go out of your way to "bail out" Casey, if Casey needed it, within your organization?

1 - Extremely unlikely
2 - Somewhat Unlikely
3 - Neutral
4 - Somewhat Likely
5 - Extremely likely

<u>INSTRUCTIONS</u>: Please answer the following questions ABOUT THE RELATIONSHIP BETWEEN YOU and CASEY that you understood from the description in this survey.
What option of relationship best describes your ***<u>original</u>*** relationship with Casey?

a. Friend
b. Advisor
c. **Both** friend and advisor

Which option best describes your ***<u>current</u>*** relationship with Casey?

a. Friend
b. Advisor
c. **Both** friend and advisor
d. **Neither** friend or advisor

Table 13. Repeated measures Analysis of Variance

	Effect (Greenhouse-Geisser)	Type III Sum of Squares	df	Mean Square	F	Sig.
Extraversion	Time	215.665	1.461	83.462	83.462	.000
	Error(Time)	813.960	460.205	1.769		
Agreeableness	Time	.307	1.847	.436	.436	.631
	Error(Time)	220.130	576.292	.382		
Conscientiousness	Time	1096.061	1.786	613.668	595.119	.000
	Error(Time)	574.626	557.257	1.031		
Neuroticism	Time	.811	1.850	.439	1.227	.292
	Error(Time)	205.751	575.293	.358		
Openness to experience	Time	639.347	1.775	360.159	379.528	.000
	Error(Time)	525.590	553.857	.949		
Political View	Time	.137	2.747	.050	.106	.946
	Error(Time)	422.863	898.124	.471		

(all significant at $p < .001$)

Table 14. Individual attributes effects on the formation of Multiplex Ties (With Openness)

	Model 1	Model 2	Model 3
	Multiplex	Expressive-First	Instrumental-first
(intercept)	-1.224	0.491	-4.162*
Extroversion Ego	0.111	-2.909*	-0.321
Extroversion Alter	-0.718	-1.815	-1.732
Extroversion Similarity	-3.645*	-1.087	0.503
Agreeableness Ego	-3.997*	-0.529	-1.020
Agreeableness Alter	1.858	0.987	1.191
Agreeableness Similarity	-0.310	-2.065*	-1.365
Conscientiousness Ego	-0.658	-0.671	0.698
Conscientiousness Alter	-2.882*	-2.247*	-0.948
Conscientiousness Similarity	-2.663*	-2.438*	-0.200
Neuroticism Ego	-1.802	-1.249	-1.185
Neuroticism Alter	-0.223	0.208	-1.971*
Neuroticism Similarity	-0.595	-3.281*	0.341
Openness Ego	-1.922	0.891	1.520
Openness Alter	-0.738	2.433*	1.478
Openness Similarity	-1.344	-1.450	-1.455
Female Ego	-0.281	1.377	-0.919
Female Alter	-1.666	0.853	-0.212
Same Gender	6.668*	4.313*	0.968
White Ego	0.832	-1.115	0.160
White Alter	-0.772	-1.743	-0.033
Same Race	3.237*	1.951	0.770
Christian Ego	1.364	-1.123	-0.343
Christian Alter	-0.803	-0.542	-1.117
Same Religion	1.810	1.982*	1.601
Conservativeness Ego	-0.335	-0.467	1.717
Conservativeness Alter	-0.566	-0.102	-0.707
Conservativeness Similarity	-1.306	-1.190	2.029*

$p < 0.05$*

Table 15. Results of the Hypotheses Test (with Openness)

	Without Openness			With Openness		
	Supported	Not supported	Opposite Effect	Supported	Not supported	Opposite Effect
H5. Extroversion Ego – (-) Multiplex ties	Supported				Not	
H6a. Conscientiousness Alter - Expressive-first ties		Not	Opposite		Not	Opposite
H6b. Conscientiousness Sim - Expressive-first ties		Not	Opposite		Not	Opposite
H7. Agreeableness Alter – Instrumental-first ties		Not	Opposite		Not	
H8a Neuroticism Ego – Multiplex ties		Not	Opposite		Not	
H8b. Neuroticism Alter – (-) Multiplex		Not	Opposite		Not	Opposite
H9a. Female Ego – (-) Multiplex ties		Not			Not	
H9b. Female Alter – (-) Multiplex ties		Not			Not	
H9c. Gender Sim – Multiplex ties	Supported			Supported		
H10. Race Sim- Multiplex ties		Not		Supported		
H11. Religion Sim – Multiples ties	Supported				Not	
H12. Conservativeness Sim – Instrumental-first ties		Not		Supported		