

On Getting Along and Getting Ahead:

How Personality Affects Social Network Dynamics

**On Getting Along and Getting Ahead:
How Personality Affects Social Network Dynamics**

Hoe mensen met elkaar omgaan en vooruit komen:
Het effect van persoonlijkheidskenmerken op de dynamiek van sociale netwerken

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Table of Contents

Acknowledgements	11
Chapter 1. Introduction.....	23
1.1 Theoretical foundation for modeling network change.....	26
1.2 Theory of networks:	
Consequences of social network dynamics.....	31
1.3 Network theory: Antecedents of social network dynamics	33
1.3.1 Antecedents of tie formation	33
1.3.2 Antecedents of social network structure.....	35
1.4 Network theory of networks: Co-evolution thinking	38
1.5 Modelling social network dynamics	39
1.6 Overview of the dissertation.....	43
1.6.1 Chapter 2.....	44
1.6.2 Chapter 3.....	45
Chapter 2. On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship. ...	55
2.1 Introduction.....	57
2.2 Theory and Hypotheses	60
2.2.1 Perceptions of competence and friendship in workgroups	60
2.2.2 Proactive personality and network evolution.....	64
2.2.3 Proactive personality and perceptions of competence.....	68
2.3 Methodology	71
2.3.1 Data and Sample.....	71
2.3.2 Measures.....	73
2.3.3 Analysis.....	76
2.4 Results	82
2.4.1 Descriptive statistics at individual level of analysis.....	82
2.4.2 Descriptive statistics at network level of analysis	83

2.4.1	Results of Co-evolution analysis with RSiena	83
2.5	Discussion	91
2.5.1	Theoretical and Practical Implications	93
2.5.2	Post-Hoc Analyses	96
2.5.3	Limitations and Future Directions	99
2.6	Conclusion.....	103
Chapter 3. Getting Along: How Five Factor personality traits		
contribute to friendship and conflict network dynamics.		
		113
3.1	Introduction.....	114
3.2	Personality and social network dynamics.....	117
3.2.1	Mechanisms of social network selection related to the individual characteristics of ego	120
3.2.2	Mechanisms of social network selection related to the individual characteristics of alter	121
3.2.3	Mechanisms of social network formation related to the interaction between ego and alter.....	122
3.2.4	The effects of Big Five personality traits on friendship network selection	122
3.2.5	The effect of Big Five personality traits on conflict network selection	131
3.3	Data and Methodology	136
3.3.1	Participants, setting and procedure	136
3.3.2	Measures	138
3.3.3	Analysis.....	139
3.3.4	Model specification	141
3.1	Results	145
3.1.1	Descriptive statistics.....	145
3.1.2	Results of RSiena analysis	153
3.1.3	Effects on Friendship Dynamics.....	153
3.1.4	Effects on Conflict Dynamics	156
3.1.5	Cross-network effects.....	157

3.1.6	Assessing goodness of fit.....	158
3.2	Discussion	158
3.2.1	Theoretical implications.....	159
3.2.2	Strengths, limitations and directions for future research	169
3.3	Conclusion.....	172
Executive Summary		183
3.3.1	Study 1.....	184
3.3.2	Study 2.....	185
Samenvatting		187
3.3.3	Onderzoek 1	188
3.3.4	Onderzoek 2	189
Автореферат.....		193
3.3.5	Первое исследование	194
3.3.6	Второе исследование	195
Zusammenfassung.....		197
3.3.7	Studie 1.....	198
3.3.8	Studie 2.....	199
Exposé général de la thèse.....		201
About the author		207
Portfolio		209
The ERIM PhD Series		221

List of Tables

Table 1:	Descriptive statistics and correlations of study variables	85
Table 2:	Results of the stochastic actor-based modeling of network dynamics (RSiena): Effect of proactive personality on co-evolution between friendship and perceptions of competence	87
Table 3:	Mechanisms of social network selection related to individual characteristics.....	119
Table 4:	Descriptive statistics and Spearman correlations	148
Table 5:	Descriptive statistics for network change	150
Table 6:	Results of RSiena estimation.....	151

List of Figures

Figure 1:	Negotiation Network	38
Figure 2:	Negotiation network with unionization of nodes	38
Figure 3:	Social selection function for extraversion on friendship.	162
Figure 4:	Social selection function for neuroticism on friendship.	163
Figure 5:	Social selection function for agreeableness on friendship.....	163
Figure 6:	Social selection function for conscientiousness on friendship.....	164
Figure 7:	Social selection function for openness to experience on friendship	164
Figure 8:	Social selection function for openness on conflict.....	165

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Chapter 1. Introduction

Social network dynamics is at the core of social life: alliances and trade, advice and gossip, work coordination and political mobilization, daily Twitter storms and Arab spring, disease transmission and social support in times of hardship, - all of these phenomena capture dynamic processes unfolding in social networks that affect lives of individuals and organizations. In social sciences the network dynamics allows to address some of the fundamental questions, such as the creation of social order -how do autonomous individuals create enduring, functioning societies? - and to seek explanations to a variety of social phenomena, from individual creativity to corporate performance (Borgatti et al., 2009; Rivera, Soderstrom and Uzzi, 2010). This universality of the social network perspective accounts for the rapid growth of academic attention devoted to social networks - since 2000 the amount of publications per year devoted to social networks in the Web of Science grew exponentially. The research on networks proliferated in the recent years (for reviews see Borgatti, Mehra, Brass & Labianca, 2009; Burt, Kilduff & Tasselli, 2013; Newman, Watts & Barabasi, 2006), extending from disciplines such as mathematics and physics to sociology, management studies and economics.

Some researchers have even argued that social network analysis constitutes a new paradigm in social sciences that accounts

for interdependence of interactions in complex systems (Granovetter, 2005; Rivera et al., 2010). A network is defined as a set of individual entities (called actors, nodes or vertices) connected by relationships (called links or edges). Thus, network approach considers not only individual entities, but also patterns of relationships among them. Social networks also differ from other types of networks (such as internet or power grids) in social mechanisms that drive how patterns of relationships emerge. Stretching beyond the impact of individual factors on human behavior, the social network perspective demonstrates how relationships affect various outcomes such as obesity, mortality, community cohesion, political mobilization, state formation, markets, prices, digital ties, and the competitiveness of firms and states (Granovetter, 2005). In organization studies the social network paradigm has been used to explain a variety of social phenomena, such as performance, career progression and innovation (Brass et al., 2004; Borgatti, Mehra, Brass & Labianca, 2009; Kilduff & Brass, 2011). Social networks form a structure that helps to transfer information, direct information flows and affect the speed of information dissemination (McPherson, Smith-Lovin and Cook, 2010).

Nonwithstanding the prevalence of dynamic network phenomena in our lives, the scientific understanding of the driving factors behind network dynamics is limited. Traditionally, social network analysis relied on static networks with nodes connected by

stable links (Li, Cornelius, Liu, Wang & Barabasi, 2017), focusing its attention to the patterns of relationships and the impact these patterns play on other phenomena of interest. The growing recognition that social networks considerably influence society also requires theory that explains *how and why social networks evolve* in the first place (Rivera, Soderstrom and Uzzi, 2010; Emirbayer and Goodwin, 1994). Why and how do people form, maintain and dissolve relationships? As network formation and change are processes, network evolution invites longitudinal investigation.

Few factors enable the transition from static to dynamic thinking in network science: methodological advances in modeling social network dynamics (Block, Stadtfeld & Snijders, 2019; Block et al., 2018; Nestler et al., 2015; Li et al., 2017), radical increases in computational power, and availability of ‘digital traces’ – new types of data - that provide an insight in how networks evolve (Ruths & Pfeffer, 2014). These developments fostered a growing conceptual clarity that sharpens our understanding how interpersonal interactions over time shape social networks. These new dynamic approaches open up exciting opportunities for management scholars to explore how social processes in organizations contribute to emergence of organizational phenomena.

This dissertation contributes to the investigation of how social networks evolve in three ways. First, it unravels how individual psychological characteristics contribute to the processes of how relationships form and develop over time (Chapter 2 and 3). Second,

it clarifies how multiplex network evolve –how two different networks influence each other. Chapter 2 looks at the interplay between interpersonal perceptions (perceptions of competence) and actual relationships (friendship). Chapter 3 zooms on the interplay between positive and negative networks (between friendship and conflict). Finally, we apply new developments in stochastic actor-based modelling for analysing social network dynamics to organizational setting (Chapter 2 and 3). To place these contributions into context, in this chapter we first review the theoretical considerations that inform our understanding of social network evolution. While this review does not aim at completeness, the main objective of this chapter is to review key conceptual developments that shaped our theoretical understanding of how network processes unfold.

1.1 Theoretical foundation for modeling network change

The idea on what constitutes the theoretical basis for the (social) network analysis and dynamics varies vastly among the fields that engage in social network modelling. Mathematics, statistics, complexity theory, physics, anthropology, sociological and organizational theories contribute to our understanding of network evolution. While each of the disciplines has its own take on what theory is and why it matters for understanding the phenomenon, all of these perspectives inform each other and help us understand the social network dynamics.

Taking complexity science and physics as a base, Barabasi (2015) states that in order to understand the network dynamics, the properties of the network structure need to take center stage. Network structure forms a foundation for the dynamic processes that unfold in networks; the interplay between the structure and dynamics allows us to understand the behavior of the whole system.

To make sense of SNA theorizing in organizational theory, Borgatti & Halgin (2011) distinguish between “network theory” and “theory of networks”. Network theory zooms in on processes that evolve on the network structure affecting outcomes for agents and systems. In essence, this stream explains how network dynamics impacts individual and organizational performance and outcomes. Theory of networks, on the other hand, investigates why and how the network structures came into being in the first place. In other words, while the ‘theory of networks’ could be seen as the theory that addresses the consequences of social network processes, the ‘network theory’ focusses on antecedents of social network structures. Nevertheless, Borgatti & Halgin (2011) concluded that antecedents and consequences are not clearly separated streams, and that there could be a “network theory of networks” – a situation when both independent and dependent variables feature network properties. This perspective is echoed by the recent developments in agent-based modelling, where network properties co-evolve with network outcomes (Snijders, Lomi & Torlo, 2013).

Advancing this emergent research stream on microfoundations of social networks in organizational studies, Tasselli, Kilduff & Menges (2015) develop these ideas further and focus on the role of individual agency and structure in conceptualizing the network change. Tasselli et al. (2015) suggest three theoretical positions: (1) an individual agency perspective in which people, through their individual characteristics and cognitions, shape networks; (2) a network patterning perspective, in which networks, through their structural configuration, impact people; and a (3) coevolution perspective in which individual characteristics and cognitions coevolve with network structures. The authors conclude that in order to understand the interplay between social network evolution and key organizational phenomena, psychology of purposive individuals needs to take center stage. The authors also call for extended research on “how individual actions and network structures coevolve in a dynamic process of reciprocal influence” (Tasselli et al., 2015: 1361).

While the understanding of theory and its role differs across disciplines, there is a fundamental debate on what is a theory characteristic to SNA. In fact, critics frequently suggested that network analysis is merely a methodology and does not have a theory of its own, borrowing the theory from neighbouring fields (Borgatti & Halgin, 2011; Salancik, 1995). Social network analysis has been labeled an ‘umbrella term’ (Kilduff & Brass, 2010) that stretches over disparate research programmes. Social network scholars refute

this criticism by stating that SNA theory building constitutes a ‘research program’ (Lakatos, 1980): a nuclear core of key ideas that are protected by assumptions and by a ring of developing theories (Borgatti & Halgin, 2011; Kilduff & Brass, 2010) to address novel phenomena with original methods. This protective ring transforms theories to meet key theoretical challenges and translates core ideas to new settings.

Spelling out these core ideas for scholars in organization science, Kilduff & Brass (2010) identify four ‘core’ ideas that drive social network theorizing: social relations, embeddedness, structural patterning, and utility of network connections. The first core idea – social relations – emphasizes that social network theory looks beyond the individualistic effects and stresses the impact of relationships, which create interdependence between agents. The embeddedness idea stems from the insight that activity of agents is constrained by interaction with other agents; for instance, that the relationships affect economic interactions among individuals or firms. Structural patterning corresponds to idea that certain structural properties of the whole network matter beyond that of agents’ direct relations (ego-networks). The final core idea - the utility of network connections – conveys that the social network structures yield important consequences for individuals and groups in society. While the first three ideas address the social network structure that forms the base for the dynamics that unfolds over it in

terms of Barabasi (2015), the fourth idea - outcomes - resonates with “theory of networks” (Borgatti & Halgin, 2011).

Contributing to the theories that constitute ‘the belt’ of network theorizing, explanations of how networks change also evolved as the field of social network analysis developed.

Social network analysis has been applied at first in sociology and anthropology, and many initial explanations of how (kinship) networks emerge relied on structural-functional theories (Scott, 2012). Employing mostly static methods, these structural-functional explanations nevertheless suggested that (social network) structures are created as by-products of individuals’ activity, as ‘unintended consequences of purposeful action’ (Scott, 2012; Ch. 8).

Subsequently sociologists adopted from classical political economy (e.g. Adam Smith) the theory that incorporates both agency (purposeful individual action) and limitations imposed by structure (Scott, 2012). The structural functionalism thus posits that individuals choose their goals and are guided by the norms and rules that they consider applicable; individuals also adjust their actions according to the conditions they face. In network terminology, while the ego-centered networks reflect actors’ intentions, the global network structure - which is composed from the individual ego-centered networks - may have features that are unforeseen by the participants (Scott, 2012). The theory assumes that agents have limited knowledge for decision making and implies that individuals usually hold vague ideas about the actual structure

of their group. In sum, while participants pursue their intentions, the resulting change on the network level constitutes an unanticipated consequence of these individual actions (Scott, 2012).

In parallel, the developments in physics helped to shed light on the phenomena that contribute to network dynamics. When thinking about the properties that could co-evolve with the social network dynamics, multiple characteristics come to mind. First, there are structural characteristics, such as actor-level variables (e.g. the number and properties of agents in the system), number and type of ties, network components, structural network configurations and properties of complete networks. Secondly, we could also think of different type processes that (co-)evolve with the network structures. Finally, we could also think of various mechanisms that guide these processes (e.g. selection vs influence). Thus, we organize the subsequent parts of the chapter by paying attention to structural mechanisms first, and then devoting out attention to the dynamic side.

1.2 Theory of networks: Consequences of social network dynamics

Certain structural properties substantially impact the consequences of social network dynamics. Watts & Strogatz (1998) looked into how network structure fosters connectivity and affects dynamic properties of networks. Watts & Strogatz (1998) found that there is a particular type of network structure – which they labeled

‘small-world networks’ – that amplifies connectivity in networks. ‘Small world’ means that ‘almost every element in the network is somehow “close” to every other element, even those that are perceived as likely to be far apart’ (Watts, 1999). In other words, small-world networks feature a large number of short-cuts through a system. Watts & Strogatz (1998) investigated the interplay between the path length and clustering in networks and concluded that small networks exist in a particular range of conditions: the upper range would correspond to globally sparse, locally dense structure, and the lower limit would reflect the situation when each actor is connected to a large number of actors, but his /her acquaintances would not be connected to each other. Small changes in ties can have profound effects on connectivity. Watts also observed that network components – not whole networks – have small-world properties.

Applying these insights to organizational contexts, Uzzi & Spiro (2005) investigated whether small world effects also impact system dynamics in show business. They looked into how connections among artists impacted creative and financial performance of Broadway musicals. In this fascinating study that covered 45 years of the industry Uzzi & Spiro (2005) found that “small world” properties of the system positively impacted musicals’ creative performance up to a threshold, after which the performance decreased. Another illustration of the small world phenomena in organizational context is a multi-team system (Lanaj,

Hollenbeck, Ilgen, Barnes, & Harmon, 2013). Examples of multi-team systems include military deployment teams (Lanaj et al. 2013), emergency response teams (Mathieu, Luciano, & DeChurch, 2018; Mathieu, Marks, & Zaccaro 2001), and product development teams. How teams are connected matters: the structure of relationships between teams (multi-team system) impacts productivity on the system level (Lanaj et al. 2013).

1.3 Network theory: Antecedents of social network dynamics

1.3.1 Antecedents of tie formation

Rivera et al (2010) suggest three “distinct yet intimately interwoven” (p. 93) theoretical perspectives that explain how networks develop focusing on how two individuals establish a relationship: (a) assortative perspective highlights how similarities and differences of individuals affect network formation; (b) relational perspective explores how earlier social network constellations impact later ones and (c) proximity perspective looks on the effect of space and time on the evolution of social networks.

Supporting the assortative view, current studies indicate that individual characteristics such as personality are related to structure and dynamics of interpersonal social networks (Fang et al., 2015; Tasselli, Kilduff, & Menges 2015; Kleinbaum, Jordan, & Audia, 2015; Selfhout et al., 2010; Mehra, Kilduff, and Brass, 2001; Klein et al., 2004; Sasovova et al., 2010; Oh and Kilduff, 2008; Casciaro, 1998;

Kalish and Robins, 2006). In particular, self-monitoring personality has been linked to the social network structures (Fang et al., 2015; Kleinbaum, Jordan, & Audia, 2015; Mehra et al., 2001; Oh and Kilduff, 2008; Casciaro, 1998) and their dynamics (Sasovova et al., 2010). Other examples of assortative view in organizational settings include analysis of gender inequalities in the organizational distribution of power (Ibarra, 1992), investigation of how grades affect advice seeking during MBA (Snijders and Lomi, 2019), and study of when blirtatiousness endangers trust (Tasselli & Kilduff, 2017).

Relational perspective looks on how existing patterns of social relationships impact subsequent network transformation, placing a paramount importance on the structure of social networks (Rivera et al., 2010). This stream of research focuses on dyadic processes such as reciprocity (Doreian et al., 1996; Hallinan, 1978; Runger & Wasserman, 1980) or repetition, effects that reflect the local structure (e.g. impact of a third party, see Block, 2015; Newman, 2001; Kossinets & Watts, 2006), and mechanisms that reflect more extended network structure (Burt, 2000; Jones, Wuchty, & Uzzi, 2008; Milgram, 1967; Uzzi, 2008). Examples in organizational context include impact of brokerage and closure (Burt, 2007), and how performance feedback impacts relationships (Parker, Halgin, & Borgatti, 2016).

Proximity mechanisms attribute network development to actors' social and cultural environments (Rivera et al., 2010), arguing

that interaction increases with physical proximity. In other words, being in the vicinity of one another helps to meet and interact with each other. The cultural explanation states that social activities - called social foci - generate opportunities to bring people together, let them interact to achieve common goals, infuse these occasions with positive emotions and create norms that would smoothen social interaction. Proximity also makes it easier to maintain relationships.

1.3.2 Antecedents of social network structure

Barabasi & Albert (1999) investigate antecedents of network structure by focusing their attention on two mechanisms of complex system formation: growth and preferential attachment. They posit that these two mechanisms are essential for the emergence of a particular structural property - scale-free power law distribution - observed in a wide variety of networks (e.g. many unconnected components and large hubs with many connections). Barabasi & Albert (1999) extend the assumptions of previous authors (Erdos & Renyi, 1960; Watts & Strogatz, 1998) who kept the number of nodes constant in their analyses by pointing out that new nodes are created in most of the complex systems. Subsequently, they analyze the impact of the preferential attachment - in this case that the nodes that already feature many connections would attract new ones with higher probability than the nodes that feature only few links. In other words, authors observe the “rich get richer” effect as older

nodes increase connectivity at the expense of younger ones. While preferential attachment has been previously identified as one of the mechanisms leading to emergence of power-law distributions observed in social networks (Price, 1976), Barabasi & Albert (1999) established that along with the network growth it is an essential component for the emergence of network structures that are characterized by large hubs and many poorly connected components.

In the early work on emergence of power laws Price (1976) adopted the cumulative advantage idea developed in economics by Herbert Simon (1955), who investigated the 'rich get richer' effect on a set of data unrelated to networks. The 'rich-get-richer' idea means that wealthy individuals accumulate more wealth at the rate proportional to what they already own. This effect is sometimes also labeled "Matthew effect". Price adopted this idea to bibliometric citation networks and with help of the mathematical modelling showed that the 'rich get richer' effect also holds in citation networks. Although this model has been criticized for simplicity and neglect of important controls such as quality and importance of the work, reputation of the author and the journal, trends in the field of study, etc. (Newman, 2010: 495), - it still constitutes a powerful explanation of how the preferential attachment is responsible for the emergence of power law degree distributions that can be observed in empirical settings.

Watts & Strogatz (1998) also observe that relatively small changes in ties could bring about a significant change on the scale of whole networks - e.g. by linking previously separated components, - that drastically improve the connectivity. In some instances that could bring a transformation of the network - in complexity terms a “phase transition” (Bohman, 2009; Scott, 2012). Borgatti & Halgin (2011) illustrate how rewiring of connections could also lead to the transformation in the nature of network by zooming on the process of unionization.

An illustration of the ‘phase transition’ in organizational setting is the unionization example (Borgatti & Halgin, 2011): the nodes A1 - A4 that previously negotiated with node B separately (Figure 1) join forces to conduct negotiations together (Figure 2). While the node B had a lot of negotiation leverage in the first case (Figure 1) in line with the structural holes theory (Burt, 1992), this advantage disappears in the unionization case. When acting together, the nodes could achieve more than when acting alone: the bonds between united nodes allow them to assign the capabilities to each other without the actual transfer. The unionization example represents the transformation in the nature of the ties from negotiation ties into the solidarity ties. We could also see A’s form a single node that deals with B on the equal basis - the process of ‘virtual amalgamation’ (Borgatti & Halgin, 2011). Thus, the formation of the ties changes the nature of the network.

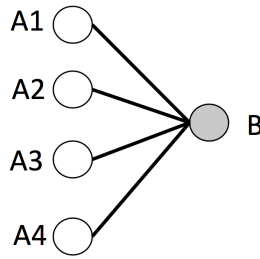


Figure 1: Negotiation Network (adopted from Borgatti & Halgin, 2011)

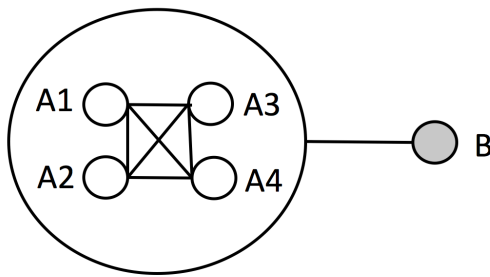


Figure 2: Negotiation network with unionization of nodes (adopted from Borgatti & Halgin, 2011)

1.4 Network theory of networks: Co-evolution thinking

Network dynamics allows to model situations where multiple networks co-evolve with other predictors and outcomes. Borgatti & Halgin (2011) label it “network theory of networks”. While this perspective is widely adopted in other disciplines (e.g. developmental psychology and educational sociology), organizational scholarship with limited exceptions has been slow to adopt this approach. Examples relevant to organizational scholars include co-evolution between gossip and friendship networks

(Ellwardt, Steglich, & Wittek, 2012), investigation of social influence and selection based on academic performance in friendship and advice seeking networks (Snijders, Lomi, & Torlo, 2013). Organizational scholarship recently recognized the benefits of co-evolution approach in advancing our understanding of the processes within the organizations. Tasselli et al. (2015) call to extend research efforts aimed at improving understanding of how individuals' behavior and network structures mutually influence each other and co-evolve. Within this dissertation we contribute to these efforts.

1.5 Modelling social network dynamics

The first techniques for studying the social network dynamics originated in the field of mathematics (e.g. Price, 1976). Before the onset of the computational revolution, this was one of the few techniques available to researchers (Newman, 2010: 495). Subsequently, simulations - and in particular, agent-based modelling - emerged to provide the insights into the dynamics of complex systems such as networks.

Agent-based modeling represents the process of how individuals' actions result in systemic change. In agent-based simulations, agents follow simple rules of action taking into account the circumstances that they face. After performing simulations, the outcomes of the model can be compared to the empirical evidence. If the results differ substantially, the hypothesized rules do not describe

reality adequately, and the hypothesis is rejected. If the simulated results closely match empirical observations, it could be concluded that the model assumptions approximate rules followed by actual agents in the real world. Depending on the research question, various approaches could be applied to model social network dynamics (e.g. Butts, 2009; Block, Koskinen, Hollway, Steglich, & Stadtfeld, 2018; Block, Stadtfeld, & Snijders, 2019; Karrer, Newman, & Zdeborova, 2014; Li et al., 2017; Quintane, Pattison, Robins, & Mol 2013; Snijders, van der Bunt, & Steglich, 2010; Stadfeldt, Hollway, & Block, 2017).

One of the most statistically rigorous techniques is stochastic actor-based modelling of social network dynamics – RSiena (Snijders, van der Bunt, & Steglich, 2010). RSiena models how social relationships are established and modified using a stochastic (step-by-step) Markov-chain model. At each step, the agents decide if they would like to create, maintain, dissolve a relationship to a particular counterpart or do nothing. This decision is guided by various considerations such as own preferences, counterpart characteristics, general mechanisms that usually guide social behavior (e.g. tendency to reciprocate relationships) as well as the social structure in the proximity of an actor. To illustrate the last point, the model accounts for such known effects as ‘the rich get richer’ effect described earlier (Matthew effect), which in social network terms means that actors with many ties attract even more ties. Thus, although the model assumes agency on behalf of the participants, it

also allows for adjustment to the evolving social environment around the actor.

RSiena follows a set of assumptions and allows for the statistical inference testing. First, the researcher specifies rules followed by agents that presumably guide the network behavior. Agents do not need to follow solely rational choice assumptions; they could also behave altruistically. Subsequently, the model selects the most plausible set of rules that fits the available empirical data. Various applications of the RSiena model exist: this approach allows to model antecedents of network dynamics (e.g. how actor characteristics affect network dynamics), co-evolution of networks and behavior, the mutual influence of multiple networks on each other (Snijders, Lomi, & Torlo, 2013). The family of RSiena models has been recently extended with multilevel modeling of social network dynamics (Lazega & Snijders, 2016; Weihua, 2015).

Multilevel reasoning allows to identify and to separate influences from different levels of analysis as various systems of influence (agency). An example of a multilevel system would be individual members within a team, which is a part of a department within the company within an industry. Here, individuals, teams, departments, companies and industries constitute various levels of analysis. Adding network reasoning to the system adds an additional layer of complexity, as we then also consider relationships within and across different levels of analysis. For example, we could consider relationships between individuals

within the team, within and across the departments, within and across companies, but also relationships between different departments in the effort to coordinate their work, and relationships between different companies (i.e. within a strategic alliance). In multilevel network modeling this could mean separating peer influence from the impact of team climate, for example. In other words, “levels of agency can be examined separately and jointly since the link between them is affiliation of members of one level to collective actors at the superior level” (Lazega & Snijders, 2016). These new methods could advance organizational theory by explaining behavior within the organizations through different ways of contextualizing it.

Simulations have been criticized for simplifying agents’ properties and rules that guide agents’ interactions (Venturini, Jensen, & Latour, 2015). Empirical varification is a necessary remedy for the 'confirmatory bias' that could be at play when researchers solely rely on the internal coherence of the models. Fortunately, RSiena allows to assess how applicable are the suggested rules to empirical observations. While the behavior of complex systems could be derived from the ineractions of agents according to pre-defined rules and factors, researchers need to identify and specify such predictors prior to estimation (Venturini, Jensen, & Latour, 2015). To this end, ethnography and grounded theory offer an alternative that allows scientists to derive potential factors that affect the dynamics during and after the process.

In this dissertation I aim to contribute to our understanding of how people within the organizations form and maintain relationships, looking on the role of personality in social network evolution processes. To this end, I apply stochastic agent based modeling of social network dynamics to shed light into the origins of social network emergence within organizations. In doing so, I pay due credit to network theory (Borgatti & Halgin, 2011) and take into account the individual agency perspective (Tasselli et al., 2015). The following section elaborates on the contributions of this investigation.

1.6 Overview of the dissertation

This dissertation zooms on how people get along and get ahead socially within the organizations by focusing on the role of personality and interpersonal perceptions in friendship formation. Both studies contribute to organizational and social network literature in few ways. First, the dissertation specifies the mechanisms through which personality affects social network dynamics, answering calls to specify how individual actions contribute to formation of social structures (Tasselli et al., 2015). Second, the following two studies investigate how two types of networks mutually influence each other (perceptions of competence and friendship, Chapter 2; friendship and conflict, Chapter 3), advancing our understanding of co-evolution of multiplex networks. Finally, we apply stochastic actor-based modeling of

social network dynamics that allows us to separate structural influences from individual actions in a more refined way.

1.6.1 Chapter 2

The next chapter zooms in on social networks in the small systems - teams - and investigates the factors that affect interpersonal network dynamics. We investigate how cognitive networks co-evolve with actual relationships, and how stable individual differences affect this process. In particular, we address how perceptions of competence and proactive personality influence friendship formation in teams. We hypothesize that friendship co-evolves with perceptions of competence: people initiate and maintain friendship to those individuals whom they see as competent, and that friends receive higher competence attributions. We also suggest that individuals who score high on proactiveness appear to be more competent. We test these hypotheses with data obtained from 650 members in 130 teams. Stochastic actor based modeling of network dynamics (RSIENA) helps us to simultaneously analyze the influence of perceptions of competence on friendship, and vice versa, and to assess how proactive personality contributes to this process on both sides of the loop. The evidence suggests that there is a self-reinforcing loop between perceptions of competence and friendship: seeing others as competent fosters friendship, and being friends helps to establish and maintain a competent image of others. The results suggest that

proactive individuals can leverage on this process by exerting more effort initially to create and maintain their friendship relationships and by conveying a competent image of themselves.

This study contributes to the stream of research that investigates the antecedents of network evolution by highlighting the interplay between personality and perceptions. The presented evidence demonstrates that team members co-create their social network positions: proactive individuals convey an image of competence that the others choose to follow upon in developing friendships.

1.6.2 Chapter 3

Chapter 3 addresses how the Five Factor personality traits affect friendship and conflict dynamics. We advance different interpersonal mechanisms through which personality manifests itself in social interaction: (a) activity / withdrawal, (b) aspiration / rejection, (c) homophily/ heterophily, and (d) conformity/normative activity. Further, we explore the interplay between friendship and conflict dynamics, testing whether people adopt conflicts held by their friends or extend friendship to enemies of their own enemies. Results reveal that personality shapes friendship formation through a range of mechanisms: activity holds for agreeableness, withdrawal for openness, (b) aspiration for extraversion / rejection for openness, (c) homophily for extraversion/ heterophily for neuroticism and (d) normative activity

for extraversion. Open individuals withdraw from conflict. Conflict was more likely with others who scored in a mid-range of extraversion, and more likely with those who scores at the extreme ends of the openness scale. We find that conflict within groups spreads through friendship ('an enemy of my friend is my enemy'), which contributes to our understanding of how clustering and separation within groups happens. These results also shed light into how individual characteristics affect social dynamics within organizations.

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Chapter 2. On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship¹.

Abstract

To understand how people form relationships in teams, we explore how proactive personality affects the interplay between perceptions of competence and friendship formation. We theorize a reciprocal relation between perceptions of task competence and friendship – perceiving others as competent fosters friendship formation and team members attribute higher competence to their friends – and explore how proactive personality influences this loop. We use longitudinal data obtained from 650 individuals working in 130 project teams to analyze these processes. Stochastic actor-based modeling of network dynamics (RSiena) indicates that proactive individuals change their friends more frequently, and people attribute higher competence and befriend proactive individuals. Proactive individuals also recognize actual competence of their peers better. Our findings extend existing research on microfoundations of social network formation by highlighting how proactive individuals leverage on the self-reinforcing loop between perceptions of competence and friendship. Doing so, we contribute to better

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On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship.

understanding of how proactive individuals shape their social environment through their perceptions and behaviors.

2.1 Introduction

To understand antecedents that influence relationship formation in organizations, an emerging debate is devoted to the microfoundations of social network dynamics (Tasselli et al., 2015). This debate focuses on three key theoretical approaches that echo longstanding structure-agency debate within the network literature (Burt et al., 2013). First, an individual agency perspective suggests that people form networks based on their individual characteristics, such as personality (e.g., Fang, Landis, Zhang, Anderson, Shaw, & Kilduff, 2015) and the process may be influenced by their (biased) cognitions (e.g., Kilduff, Crossland, Tsai & Krackhardt, 2008). Second, the network patterning perspective states that networks through their structure constrain and enable individuals' action and influence people. Third, the coevolution perspective posits that people and networks coevolve: peoples' individual characteristics contribute to relationship formation, and the resulting networks, in turn, influence individuals. The coevolution perspective recognizes that "networks can facilitate or inhibit action, but people are the source of action" (Burt et al., 2013: p. 536). In other words, individuals are seen as active agents who choose to pursue some relationships and forgo others, thereby actively shaping the social structure and forming perceptions of it; perceptions that, in turn, influence their actions.

This debate is particularly relevant when understanding the role of individual characteristics such as personality within social network dynamics (Burt et al., 2015; Tasselli et al., 2013). Recent research indicated that personality - such as Big Five personality traits and self-monitoring - emerged as a significant predictor of advantageous positions in both expressive and instrumental networks (Fang et al., 2015). However, many fundamental questions remain unanswered. What are the underlying processes that lead to the emergence of the beneficial positions for individuals with certain personality traits? Do individuals undertake action themselves to form and foster beneficial relations? Do they trigger others to establish and maintain friendship ties with them? What about compatibility or complementarity between individuals? Do people prefer others with similar personality traits? Do people vary in their tendency to leverage on opportunities available within their social environment?

Proactive personality is a personality trait that can help us address these questions as it is likely to explain attainment of beneficial network positions. Proactive personality captures individuals' inclination to shape their environment and foster change. It is defined as "individuals' stable tendency to effect environmental change relatively unconstrained by the situational factors" (Bateman & Crant, 1993: 105). This trait relates to networking behaviors (Liang & Gong, 2013), is visible to others, and comes closest to the concept of agency as understood in network research. Meta-analytic

evidence indicates that proactive personality positively influences success of individuals and their organizations (Fuller & Marler, 2009; Jiang, Hu & Crant, 2016; Spitzmuller, Sin, Howe, & Fatimah, 2015; Thomas, Whitman & Viswesvaran, 2010). Previous research established that the relationship between proactive personality and desired organizational outcomes is mediated by networking behaviors and relationship building (e.g., Li, Liang & Crant, 2010; Thompson, 2005). However, we know little about how exactly proactive individuals develop high quality interpersonal relationships with others.

In this study, we contribute to the debate on the microfoundations of social network dynamics (Tasselli, Kilduff & Menges, 2015) by examining the role of proactive personality in the evolution of friendship and perceptions of competence in teams over time. We posit that people befriend competent individuals, and attribute competence to their friends. We also suggest that proactive individuals leverage on this loop. First, people see proactive individuals as competent, which—combined with the preference to befriend competent people—helps proactive individuals to attract more friendship ties. Second, we posit that proactive people recognize competence better than their peers and adapt their relationships more frequently, which helps proactive individuals to befriend competent people.

2.2 Theory and Hypotheses

2.2.1 Perceptions of competence and friendship in workgroups

In social situations people instantly form judgments about others and often (unconsciously) assess whether the other person would be inclined to help or harm them, which in turn impacts how they react to each other (Cuddy et al., 2011; Cuddy et al. 2008; Fiske, Cuddy, & Glick 2007). Interpersonal perceptions thus affect how people form relationships over time. Previous research across various fields of psychology identified two fundamental criteria that lie beneath these interpersonal judgments: liking and competence (Cuddy et al., 2011; Fiske et al., 2007). Whereas liking – also labeled as warmth – is associated with positive interpersonal affect and is used to assess other persons' intentions towards the self, perceptions of competence indicates the ability to realize these intentions (Cuddy et al., 2011; Fiske et al., 2007; Porath, Gerbasi, & Schorch, 2015).

Previous research identified benefit to self as an important criterion in distinguishing whether competence or liking would affect relationships more in a particular context. Whereas liking serves as a general indicator of the intentions of the other person (do they intend to help or harm me?), evaluations of competence are used to assess the ability to follow up on these intentions. Although liking affects evaluations more heavily than competence in evaluations of strangers, people prefer competence over liking in

situations where they evaluate themselves or closely related others, especially if they see a benefit for themselves (Cuddy et al., 2011). In contrast to the findings of Casciaro and Lobo (2008, 2015) that centered on the primacy of affect, Cuddy et al. (2011) argued that particularly in organizational settings, competence may play a primary role. Organizational members fulfill assigned roles and are expected to be competent in their job. This may be especially the case in small teams, as goals of team members are closely aligned and the benefit to self depends on the achievement of the goal(s) by the team.

The subjective perceptions of competence also form a foundation for status formation in interdependent settings. The social status perspective posits that competence-based status lives “in the eyes of the beholder” and is a property of co-actors and observers (Magee & Galinsky, 2008). In this view, status is subjective, it is not “owned” by focal actors, but it is granted to them by an audience (Canales, 2012; Pearce, 2011). In task-oriented groups and organizations respect and status are grounded on subjective perceptions of competence (Magee & Galinsky, 2008; Ridgeway, 1991) that derive from direct and observed interaction between group members. Moreover, status hierarchies are dynamic and fluid (Magee & Galinsky, 2008), “evolving social constructions, open to manipulation through efforts of parties involved” (Chen et al., 2012).

Competence judgments affect friendship in that we are more likely to befriend a person we perceive as more competent (i.e. instrumental approach), unless this person is highly unlikable (cf. Casciaro & Lobo, 2008). Previous research demonstrated that positive information about competence was viewed as transitive. In other words, if we perceive someone as competent, this competence also ‘extends’ to the social network, so that the friends of this person are also being perceived as competent (Cuddy et al., 2011). Perceptions of competence are also more robust: they respond more quickly to positive information, and tend to decay slower than liking (Skowronski & Carlston, 1987; Tausch, Kenworthy & Hewstone, 2007).

Hypothesis 1: Perceptions of competence affect the friendship formation in teams over time in such a way that team members create and maintain ties to those, whom they perceive as competent.

The work of Casciaro and Lobo (2008, 2015) sheds light on how affect colors competence perceptions and shapes development of instrumental ties. More specifically, they found that affective value may precede perceived instrumental value when evaluating social relationships and that positive interpersonal affect increases reliance on competence perceptions in shaping work-related relationships such as advice and problem solving. Casciaro and Lobo (2008, 2015) focused on more immediate affective evaluations of liking rather than affect-intensive ties with more relational depth

such as friendship. It is possible that a similar pattern can be found for friendship, perhaps even be exacerbated. This is because friendship requires more frequent interaction and mutual confiding (cf. Casciaro & Lobo, 2008) so friends spend more time together and have an opportunity to get to know each other better. Because any positive behaviors related to ability are generally seen as more diagnostic of competence (Skowronski & Carlston, 1987), it is also more likely that their (potential) friends will get to appreciate their competence more.

Reasoning from a cognitive dissonance perspective (Festinger, 1957), people will be more likely to attribute competence to their friends. People have a tendency to reconcile incongruous beliefs. If the belief “I like my friends” is incongruous with “my friends are incompetent”, it is likely that people adjust their opinion to “my friends are competent” (cf. Krackhardt & Kilduff, 1990; Matz & Wood, 2005) because perceptions of competence respond more quickly to positive information (Tausch, Kenworthy, & Hewstone, 2007). So as the friendship ties are formed, these interpersonal relationships create a context for conveying a broader range of expertise over time.

Hypothesis 2: Friendship affects the formation of competence perceptions in teams over time in such a way that team members attribute (create and maintain) positive competence perceptions of their friends.

2.2.2 Proactive personality and network evolution

Proactive personality is a “dispositional construct” related to how individuals “take action to influence their environment” (Crant, Hu & Jiang 2016: 194) that contributes to important outcomes for teams and organizations. In line with state and trait approaches to personality (Hogan, 1991), proactiveness also has two conceptualizations (Crant, Hu & Jiang, 2016): proactive personality as a trait, and proactive behavior as a state. Personality as trait focuses on stable individual cognitive and affective dispositional tendencies that characterize a person over time and across situations (House, Shane, & Herold, 1996). Proactive personality demonstrated relatively high test-retest reliability of 0.72 (Bateman & Crant, 1993).

Fuller & Marler (2009) have established a positive link between proactive personality and workplace outcomes. Meta-analyzing 313 correlations reported in 107 studies, they concluded that proactive personality is positively related to both objective and subjective measures of career progress (i.e., salary increases, promotions and job satisfaction) as well as overall job performance. Proactive personality accounted for unique variance in overall job performance, task performance, and organizational citizenship behaviors after controlling for the Big Five personality traits and general mental ability (Spitzmuller, Sin, Howe, & Fatimah, 2015). Meta-analytic results also provide a strong case for the incremental and discriminant validity of proactive personality construct (Fuller

& Marler 2009; Spitzmuller, Sin, Howe, & Fatimah 2015). Proactive personality, although related to constructs such as self-monitoring and locus of control, is well-differentiated from these other dispositional constructs (Fuller & Marler, 2009). Allen, Weeks and Moffitt (2005) reported weak and non-significant correlations between proactive personality and these two constructs ($r = .03$ and $r = .04$, respectively).

Recent studies provide evidence that social capital mediates the relationship between proactive personality and positive organizational outcomes. Proactive employees performed better due to information-seeking behavior and by nurturing beneficial relationships and networks with colleagues and managers (Crant, Hu & Jiang, 2017). Thompson (2005) showed that proactive individuals attain higher performance by building up networks and taking initiative, which provides access to necessary resources and opportunities to bring about change. Proactive personality also helped employees to build high-quality leader -member exchange relationships that fostered organizational citizenship behaviors (Li et al., 2010). These studies relied on cross-sectional settings, and called upon future researchers to unravel longitudinal processes of how proactive personality contributes to network building. Yang, Gong and Huo (2011) took a longitudinal approach to demonstrate that proactive individuals nurture social capital, which promoted interpersonal helping behaviors and reduced turnover intentions. While these studies established a valuable insight that proactive

personality is related to networking behaviors, they also relied on self-reports of possibly unconnected individuals about their relationships. However, relationships do not form unilaterally. In order to understand why a relationship is present, we need to take into account dyadic processes such as reciprocity or complementarity, as well as other structural influences, such as triadic closure or popularity effects. To understand the process that helps proactive individuals to network better, we need to capture a complete network longitudinally, and specify this process more precisely.

Multiple pathways could explain why proactive individuals network better. First, they could be reaching out to others more. In other words, the resulting situation could be attributable to the actions of proactive individuals themselves. Similarly, passive individuals might forgo the opportunities to connect to others, leaving the path open for proactive individuals to lead. Alternatively, others may be attracted to proactive individuals and try to befriend them more, thereby (co)-creating the structure around proactive individuals. Or others may consciously or unconsciously avoid passive people, so that the relations with proactive individuals have a higher chance to develop and be maintained, while the ties to those who score low on proactive personality form at a slower rate.

Extant work suggests that in general proactive individuals are more active in seeking and maintaining instrumental relationships (Fuller & Marler, 2009; Li et al., 2010; Thomas, Whitman & Viswesvaran, 2010; Thompson, 2005; Yang, Gong & Huo, 2011). They are portrayed in the literature as agents who actively seek out opportunities, initiate situations to alter their environments and create favorable conditions (Crant, Hu & Jiang, 2017). Meta-analytic findings indicate that proactive personality is related to interpersonal proactive behavior (Crant, Hu & Jiang, 2017), such as feedback seeking and socialization (Spitzmuller, Sin, Howe, & Fatimah, 2015), and to networking (Fuller & Marler, 2009; Thomas, Whitman & Viswesvaran, 2010) and initiative taking (Fuller & Marler, 2009).

In particular, twenty years of empirical evidence established that proactive personality is related to active socialization and the career management tactics (Chiaburu, Baker, & Pitariu, 2006; Gruman & Sacks, 2011), scope and quality of voice behaviors in the workplace (Crant, Kim, & Wang, 2011; Detert & Burris, 2007; Parker & Collins, 2010) and feedback seeking (Porath & Bateman, 2006). Similarly, several studies indicate that proactive personality positively affects workplace relationships: proactive personality facilitated group integration of newcomers and fostered organizational commitment (Kammeyer-Mueller & Wanberg, 2003), contributed to the high quality leader-member exchange (LMX)

relationships (Li et al., 2010), and was indirectly related to career-related and psychosocial mentoring through networking and voice behaviors (Liang & Gong, 2013). In other words, we expect that proactive individuals demonstrate higher dynamism in their ties and may change their relationships more frequently than people who score lower on proactive personality, as proactive people are more likely to initiate change to improve unfavorable circumstances (Crant, 2000; Bakker et al., 2012).

2.2.3 Proactive personality and perceptions of competence

Although most individuals find it important to be perceived as competent, valuable members of the group, proactive individuals may appear competent in the eyes of the others for several reasons. The activity of proactive individuals leading to higher performance (Crant, Hu & Jiang, 2016; Fuller & Marler, 2009; Thomas, Whitman & Viswesvaran, 2010; Spitzmuller, Sin, Howe, & Fatimah, 2015) may enhance a competent image in the eyes of their teammates. As proactive personality is consistently associated with high levels of task and job performance (Crant, Hu & Jiang, 2016), we suggest that in settings in which there is task interdependence between members of the group people will attribute competence to proactive individuals. A study among 151 Chinese newcomer-manager dyads suggested that coworkers appreciated proactive personality and were more inclined to help proactive individuals (Li, Harris, Boswell, & Xie, 2011). In 70 teams of the 672 United States air force

officers peers and observers attributed high advancement potential to officers with high team-oriented dispositional proactivity (Hirschfeld et al., 2011). Moreover, people are likely to attribute competence to those who dare to take action in uncertain circumstances to improve the situation for themselves and others. Finally, there are indications that proactive individuals are more effective in knowledge attainment: proactive personality has been related also to occupational prestige through educational attainment (Converse et al., 2012).

However, not all people view proactive personality positively: proactive behavior might entail political risks, and others may see it as socially inappropriate (Bateman and Crant, 1993, 1999). Proactive personality of the air force officers negatively affected evaluations by peers, when they saw proactive behavior as self-centered acts (Hirschfeld et al., 2011). Fuller, Marler and Hester (2012) indicated that a degree of compatibility between people may be necessary to appreciate proactive personality: in their study highly proactive supervisors valued employees “taking charge” more than less proactive supervisors. Wanberg et al. (2006) indicate that perceived similarity in terms of the proactive personality between mentors and mentees contributes to better mentoring outcomes. These findings suggest that personality-based homophily (preference to connect to similar others) is likely to influence competence perceptions.

Context plays a role in determining how people appraise proactive individuals (Crant, Hu & Jiang, 2016). People appreciate proactive personality more in contexts that require individuals to understand the situation and determine an appropriate course of action (as in our research setting) and less in contexts that require conformity to (strict) procedures, such as the military. Knowing what is needed allows proactive individuals to have a more accurate assessment of which skills could be relevant for the situation at hand and who has them. Therefore, proactive individuals may attribute competence to team members more accurately than those who are passive. As proactive individuals actively seek out opportunities, they are more likely to collect detailed information about the situation and teammates' skills and abilities. This in turn not only improves their own, but also team performance.

In sum, we suggest that proactive individuals could leverage on the preference to befriend competent individuals through higher dynamism in their relationships and by recognizing competence better. Moreover, people would attribute competence to proactive individuals, which would foster the preference to befriend competent people more.

2.3 Methodology

2.3.1 Data and Sample

Panel data were collected at three points in time from second-year business students enrolled in a Strategy class at a large university in the Netherlands. As part of the Strategy class, students took part in the Business Strategy Game, in which participants have been running a virtual company that competed with companies managed by other teams in a computer simulated industry environment. Participating teams determined their own firm's strategy. In each round of the game, team members take decisions across few business areas. The goal of the game was to run a profitable business and to outperform other firms. As in most experiential learning settings, participants were deeply involved in the game because it was very true to life. The company's performance comprised 35 percent of the participants' course grade, which further enhanced participants' engagement. Thus, students were strongly motivated to perform well (Chen et al., 2010). For this reason, the simulation creates a realistic, multifaceted and challenging representation of business environment.

As a rule, the teams worked in groups of five. Participants could select their team members before the start of the project. Students who could not find a team themselves, could ask the course coordinator for help, who would then assign them to teams that lacked team members. In total, 650 individuals comprising 130

project teams enlisted for the Strategy class. They worked together for a period of ten weeks. The response rate for the first survey round was 89% (580 students), for the second round 86% (557 students) and 90% for the third round (584). Several participants (in total 33) provided answers with a wrong self-identification tag resulting, in some cases, in double entries for the same person. Their answers were treated as missing values. Since the overall response rate was well above 80 percent for all three rounds of data collection, we assume that missing data did not affect subsequent estimations (Ripley et al., 2019).

Procedure. Data collection took place by means of three online survey rounds. The authors were not involved in teaching the class. The teachers introduced the surveys in class and assured students that their answers would remain confidential and unknown to the teachers. The sociometric survey was administered in weeks two, five and nine of the project. During the first week students formed teams and practiced the game. To achieve the high response rate, we wanted to avoid measurements in the final week of the study as students had to complete the assignments. We chose the middle measurement half way through the project as previous research indicated that team dynamics might change half way throughout the project (Gersick, 1988, 1989). This data collection was part of a larger data-gathering effort.

2.3.2 Measures

Proactive personality. Proactive personality was measured with seven items derived from the Dutch translation (Schippers, Den Hartog & Koopman, 2007) of Bateman and Crant (1993). We applied a 5-point Likert scale. Factor analysis showed a one-dimensional construct, the underlying factor explained 43% of the variance. All criteria for factor analysis were satisfied (KMO = .82, sign. at $p < .001$). Anti-image correlation matrix shows no abnormalities, but the communality of the reverse scored item was too low (.06). While the scale exhibits sufficient internal consistency (Cronbach's alpha .75), internal consistency was also improved by removing the reverse scored item (Cronbach's alpha .79). We relied on factor scores (principal axis factoring) based on the six-item index in further analyses.

Friendship network. In all three waves of data collection each respondent was asked to rate each of his/her team members on the following item: "Please indicate for each of your colleagues to what degree this person is a good friend of yours. Your name is also on the list, please select "not applicable" for yourself". The 5-point Likert scale from "do not agree at all" to "totally agree" has been used. As stochastic actor-based modeling of network dynamics (RSiena) requires dichotomized dependent variables for the analysis, we recoded the answers in such a way that a 1 indicated a friendly relationship (level 4) or a friend (level 5) and all other

categories were recoded as 0. As we are interested in relationships within the team, we collected information only on within-team relationships, and not on relationships between the teams. The data on friendship relations were organized in a 5x5 adjacency matrix for each team and measurement point and integrated with the 'structural zeros' (Ripley et al., 2019) approach to indicate that only within-team data has been collected. This allowed us to include all available responses in the analysis.

Perceptions of competence. We measured perceptions of competence with the following item: "This team member is very competent in the areas in which we work together". Answers were given on a 6-point Likert scale from "totally disagree" to "totally agree", with an additional option "not applicable" that is used to exclude the respondent from self-evaluation. Similar to friendship, the data for each team has been arranged first in a 5x5 adjacency matrix for each team, and subsequently integrated with 'structural zeros' (Ripley et al., 2019). Since perceived competence also constituted a dependent variable in the co-evolution analysis, we dichotomized (Ripley et al., 2019) the answers into 0 ("totally disagree", "disagree", "neutral") and 1 ("agree" and "totally agree").

Actual competence: Grades. Since the students were in their second year, we included grade point average (GPA) from the previous year. These were obtained from official university transcripts and were used as a proxy for actual competence. Grades ranged from 6

(satisfactory) to 9 (very good), with a mean grade of 6.93 (SD 0.45). Note that although the theoretical range for grades in the Dutch system is 1–10, in practice the range for student assignments is in general often between roughly 4.5 and 10 (e.g., Schippers, 2014; Schippers, Homan & van Knippenberg, 2013).

Control variables.

Familiarity of the participants before the project. As participants could select other team members before the project or be assigned to the group by course coordinator, we control for the degree of familiarity with each other by asking them “How well did you know your team members before joining this team?” Answers were given on a 5-point Likert scale from “not at all” to “very well”. The variable has been used as a dyadic covariate in the subsequent analysis

Gender. Prior research demonstrated that gender affects relationship formation in social settings (e.g. Brass 1985; Ibarra 1992; Selfhout et al. 2010). In particular, the gender homophily effect has been found in similar settings. Therefore, we control for gender of respondent (ego), gender of the alter, and gender homophily in the analysis.

Group assignment. We retrieved the data from program management files to control whether the participant self-selected into a student team or was assigned to work on the simulation game with other

team members by including a dummy variable (1= assigned by program management; 312 participants).

2.3.3 *Analysis*

R-based Simulation Investigation of Empirical Network Analysis (RSiena). In our analysis we were interested to distinguish between different mechanisms that affect emergence of relationships. We apply stochastic actor-based modeling of network dynamics (Snijders, van de Bunt & Steglich, 2010) to simultaneously assess how actors' characteristics affect network formation and to disentangle effects that result from the differences in proactive personality from relational mechanisms that foster and sustain social networks. All the research participants were exposed to the similar time and space conditions (i.e. working co-located on the same project) throughout the data collection period.

We use stochastic actor-based modeling of network dynamics - R-based Simulation Investigation for Empirical Network Analysis (RSiena) for our analysis. This method allows to analyze how actor attributes affect network evolution based on panel network data (Snijders, van de Bunt & Steglich, 2010; Snijders & Lomi, 2018). Within management science, this method has been used previously to model how perceptions of team psychological safety and network ties co-evolved (Schulte, Cohen & Klein, 2010), how social networks and thoughts of quitting influenced each other (Tröster, Parker, van

Knippenberg & Sahlmüller, 2018), and how informal leadership emerged (Carnabucci, Emery & Brinberg, 2018). After introducing the rationale for selecting the method (Snijders, van de Bunt & Steglich, 2010; Block, Koskinen, Hollway, Steglich & Stadtfeld, 2018), we elaborate upon the model specifications applied in this study.

RSiena offers multiple advantages for testing our hypotheses. First, RSiena models continuous network change, benchmarked to the actual measurements of the network at separate measurement points. This feature represents the reality well as team members develop friendships and modify the perceptions of others' competence throughout the project and not merely at the three points of measurement. Additionally, this method allows modeling how multiple networks – in our case, perceptions of competence and friendship – co-evolve. RSiena assumes that actors are in charge of their outgoing ties: thus, the method addresses actor-driven theories of network change and accounts for actor characteristics (such as proactive personality). In other words, it captures agentic behavior. Moreover, the method models structural influences on the network evolution, such as reciprocity, triadic closure or popularity. This feature allows us to separate structural influences on network dynamics from the agentic influences of proactive personality.

Co-evolution analysis of multiplex networks. In our analysis we use perceptions of competence and friendship as two networks that co-evolve simultaneously – and apply so called multiplex testing

(Skvoretz & Agneessens, 2006) in RSiena. This test reveals “whether a change in one co-dependent network causes a change in another co-dependent network” (Ellwardt, Steglich & Wittek, 2012: 627). In RSiena terms, “change” means creation, maintenance, and dissolution of ties (Ripley et al., 2019). In other words, we model how change in perceptions of competence influences change in friendship, and vice versa, operating on assumption that relationships in teams and team members’ perceptions of each other are emergent phenomena.

Model specification. To understand the emergence of friendship and perceptions of competence, we use evaluation function that models the probability of tie creation and maintenance versus the probability of tie absence or dissolution. We use a fixed effect assumption, assuming that processes in all teams evolve under the same rules, as all groups were exposed to the same conditions, were of equal size and had the same incentives.

Main effects.

To understand the emergence of friendship and perceptions of competence, we use evaluation function that models the probability of tie creation and maintenance versus the probability of tie absence or dissolution. We use a fixed effect assumption, assuming that processes in all teams evolve under the same rules, as all groups were exposed to the same conditions, were of equal size and had the same incentives.

Main effects.

To test whether thinking of others as competent helps to create and maintain friendship (H1), we model the main effect of influence of one network on another (specified in RSiena as a *crprod* command, Ripley et al., 2019). The same effect is used to test the reverse causation: the effect of being friends on attributing competence (H2).

We included an effect of proactive personality on rate of change to capture dynamism in the relationships of proactive individuals, as empirical evidence suggested that proactive individuals are more active in networking behaviors (Thompson, 2005). We specified effects of proactive personality on formation of friendship and competence perceptions with a five-parameter specification for individual covariates (Snijders & Lomi, 2019) to capture non-linear effects of proactive personality on friendship (ego, ego squared, alter, alter squared and interaction between alter and ego). Among these alter and squared alter effects of proactive personality on perceptions of competence assess whether proactive individuals would be perceived as more competent. Two effects assess whether proactive individuals would recognize competent team members over time: the proactive personality ego effect on perceptions of competence and the interaction between proactive personality ego and grades alter. We also include main effect of grades alter to enable the interaction assessment. To check whether proactive individuals would be more inclined to befriend those whom they

perceive as competent, we include a cross-network interaction effect between proactive personality of the perceiver (proactive personality ego) and competence perceptions on friendship.

Structural effects on competence perceptions. RSiena allows to account for endogenous network processes - such as reciprocity and transitive closure - that may affect tie formation. Ripley et al. (2019) suggested including the following effects as structural controls, which we use on both dependent networks.

1) *Out-degree effect.* The outdegree parameter has a function of an intercept and signifies the tendency to establish friendship at all, on the logistic scale.

2) *Reciprocity.* People have a tendency to reciprocate offers of friendship, which means that if person A extends friendship to person B, person B would also be likely to extend friendship to person A (Skvoretz & Agneessens, 2007).

3) *Network closure effects* represent the dynamics between three actors, which characterize local network structure. *Transitive triplets effect* reveals the tendency to establish relationships to the friends of one's friends (e.g., Davis, 1970). *Transitive reciprocated triplets* captures the tendency to reciprocate friendships that are already embedded in closed groups less frequently (Block, 2015).

4) *Popularity effects.* We include two degree related effects on the friendship side: indegree popularity (also called Matthew effect or the tendency of popular people to attract even more connections over time) and outdegree popularity (the tendency of actors to become popular after sending out a lot of ties). The model also contains indegree popularity effect on the perceptions of competence to assess whether competent people would accumulate even more nominations of competence over time.

Controls. When determining the probabilities of tie changes, we take into account individual characteristics ('actor covariates'), characteristics of ties between people ('dyadic covariates'), and properties of the current network structure.

Constant actor covariate: We added the effects of gender for sender (ego), receiver (alter), and similarity (ego*alter) between sender and receiver as control variables.

Constant dyadic covariate: Familiarity allowed us to control how well the students knew each other before to the course started, as familiarity of team members may make a difference in how the team works together (e.g., Harrison, Mohammed, McGrath, Florey, & Vanderstoep, 2003; Hinds, Carley, Krackhardt, & Wholey, 2000). Team members indicated for each of their fellow team members how well they knew each other before they started working together on the current task (1 = not at all; 5 = very well).

Rate effects (control): To control for potential effects of self-selection of individuals into groups on network dynamics by including an effect of the group assignment on friendship rate and on the rate of change in perceptions of competence.

2.4 Results²

2.4.1 Descriptive statistics at individual level of analysis

Table 1 summarizes the relationships among variables included into the model. Male participants composed 64.5 percent of the sample, female – 35.5 percent. Grades and group assignment are negatively correlated ($-.24, p < 0.001$), suggesting that people with lower grades did not find a team and had to be assigned. Proactive personality is not significantly correlated to group assignment, suggesting there were no differences between proactive and reactive people looking for groups. Proactive personality is moderately related to grades in our sample ($.21, p < .01$). Women scored slightly less on the proactive personality ($-.11, p < .05$). The results of an independent t-

² While the latest theory informed our theorizing prior to including the proactive personality into the study, the first set of results has been obtained due to serendipity when two variables got mixed up in coding. Therefore, the p-values found could not be interpreted in a straightforward manner. In line with Hollenbeck & Wright (2017), we embrace serendipity of scientific discovery and rely on theoretical plausibility and the strength of the effects in interpreting the results. We report actual estimates and standard errors in order to convey complete picture, and report customary conservative significance levels.

test indicate that men and women did not differ in terms of the previous performance as measured by the GPA for the previous year.

2.4.2 Descriptive statistics at network level of analysis

Friendship network slightly contracted in the middle of the project, but then grew again: the average degree (average number of friendship nominations per respondent) in friendship networks went from 1.38 at the first measurement point to 1.26 at time point two, and then to 1.58 at the end of the project. Similar dynamics took place in competence perceptions: participants on average nominated 2.08 of their team members as competent the start of the project, 2.02 in the middle, and 2.15 at the end of the project. Jaccard coefficients indicate moderate stability in friendship networks: 0.73 in the first half of the project (between first and second measurement points), 0.68 in the second half. For the networks of competence perceptions, the Jaccard coefficients were 0.65 (first half), and 0.68 (second half) respectively.

2.4.1 Results of Co-evolution analysis with RSiena

The estimation converged well: all t-ratios below 0.1 indicated convergence (Ripley et al., 2019) and the overall convergence ratio was 0.08 (less than the threshold of 0.25).

Friendship dynamics

Main effect of perceptions of competence on friendship formation. Hypothesis 1 stated that perceptions of competence foster creation and maintenance of friendship ties. Our results indicate that the effect of perceptions of competence on creation and maintenance of friendship holds in our setting (positive competence perceptions effect, est. = 1.43, $p < 0.001$). In other words, if a person thought that her/his counterpart has been competent, (s)he has been more likely to initiate and maintain friendship to him /her.

Main effect of proactive personality on friendship formation. We checked whether proactive individuals would be more inclined than passive individuals to befriend those whom they perceived as competent. Our results show that this cross-network interaction effect between proactive personality ego and perceptions of competence on friendship is not significant (est. = 0.27, *ns*), which means that proactive individuals did not differ from their team members in their preference to befriending competent people. We also tested whether proactive personality affects the rate in friendship formations (the speed of change in friendship network) and found that proactive individuals change friends more throughout the course of the project (proactive personality on rate, est. = 0.17, $p < 0.01$) (the summary is presented in Table 3).

Table 1: Descriptive statistics and correlations of study variables

	Min	Max	Mean	SD	1	2	3
1 GPA	6	9	6.93	0.46			
2 Proactive personality (PAF)	-4.92	2.72	0	1.12	.21**	-	
3 Gender	1	2	1.36	0.48	0.04	-.11*	-
4 Outdegree Friendship T1	0	4	1.38	1.34	.12**	0.08	-0.02
5 Indegree Friendship T1	0	4	1.38	1.12	.12**	-0.03	-0.01
6 Outdegree Friendship T2	0	4	1.33	1.37	0.08	0.06	-0.03
7 Indegree Friendship T2	0	4	1.33	1.08	.13**	0.06	-0.02
8 Outdegree Friendship T3	0	4	1.58	1.5	.15**	.14**	-0.05
9 Indegree Friendship T3	0	4	1.58	1.2	.21**	0.08	-0.05
10 Outdegree Competence T1	0	4	2.08	1.59	.11**	0.08	.10*
11 Indegree Competence T1	0	4	2.08	1.27	.27**	.15**	-.16**
12 Outdegree Competence T2	0	4	2.02	1.58	.12**	0.06	0.04
13 Indegree Competence T2	0	4	2.02	1.22	.25**	.18**	-.18**
14 Outdegree Competence T3	0	4	2.15	1.63	.18**	.26**	0
15 Indegree Competence T3	0	4	2.15	1.29	.33**	.26**	-.14**

On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship.

	4	5	6	7	8	9	10	11	12	13	14
1											
2											
3											
4	-										
5	.53**	-									
6	.63**	.48**	-								
7	.47**	.72**	.45**	-							
8	.54**	.39**	.50**	.38**	-						
9	.41**	.62**	.40**	.64**	.42**	-					
10	.43**	.18**	.30**	.17**	.31**	.18**	-				
11	.26**	.44**	.22**	.35**	.24**	.40**	.13**	-			
12	.23**	.18**	.50**	.18**	.28**	.17**	.41**	.09*	-		
13	.22**	.29**	.21**	.41**	.20**	.36**	0.07	.57**	.09*	-	
14	.25**	.13**	.24**	.14**	.58**	.23**	.39**	.13**	.42**	.13**	-
15	.16**	.25**	.16**	.27**	.24**	.51**	.13**	.51**	.16**	.60**	.20**

Table 2: Results of the stochastic actor-based modeling of network dynamics (RSiena): Effect of proactive personality on co-evolution between friendship and perceptions of competence

DV: Friendship

Effect	Estimate	St. error	Sig. level
<i>rate of change</i>			
period 1	1.1682	0.0994	
period 2	1.8193	0.151	
Proactive personality on rate	0.1668	0.0579	**
group assignment on rate	-0.4605	0.1199	**
<i>basic dyadic effects</i>			
outdegree	-0.5292	0.378	
reciprocity	3.4319	0.4277	***
<i>closure-related effects</i>			
transitive triplets	1.4743	0.1532	***
transitive reciprocated triplets	-0.5021	0.2208	*
indegree popularity (Matthew effect)	0.0181	0.1055	
outdegree popularity	-1.3982	0.204	***
<i>controls</i>			
familiarity	0.2198	0.0378	**
gender alter (female)	0.1304	0.1456	
gender ego (female)	-0.167	0.1307	
same gender (female)	0.5211	0.1278	**
grades alter	0.285	0.1473	†
<i>Proactive personality effects</i>			
proactiveness alter	0.1102	0.0596	†
proactiveness squared alter	-0.0141	0.0261	
proactiveness ego	-0.0684	0.1258	
proactiveness squared ego	0.0069	0.033	
proactiveness similarity (ego * alter)	0.0841	0.059	
<i>cross-network effects</i>			

On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship.

DV: Perceptions of competence	Estimate	st. error	Sig. level
Proactive ego x comp. perceptions	0.268	0.2021	
competence perceptions	1.428	0.2556	***
<i>rate of change</i>			
period 1	2.847	0.2067	
period 2	2.3897	0.1604	
group assignment on rate	-0.1973	0.1038	†
<i>basic dyadic effects</i>			
outdegree	-1.7812	0.2722	***
reciprocity	0.18	0.1658	
<i>closure-related effects</i>			
transitive triplets	1.0543	0.1048	***
transitive reciprocated triplets	-0.653	0.125	**
indegree - popularity	0.0224	0.0623	
<i>controls</i>			
familiarity	-0.0585	0.0252	*
gender alter (female)	-0.4775	0.0914	**
gender ego (female)	-0.1197	0.0885	
same gender (female)	-0.1003	0.0845	
grades alter	0.5348	0.0996	**
<i>proactive personality effects</i>			
proactive personality alter	0.1253	0.0401	**
proactive personality sq. alter	0.0846	0.023	**
proactive personality ego	0.1936	0.0396	**
proactive personality sq. ego	-0.0171	0.0219	
proactive personality similarity	0.0498	0.0371	
<i>cross-network effects</i>			
proactive ego x grades alter	0.1907	0.0904	*
Friendship (H2)	0.8916	0.1488	***

Significance: † $p < 0.1$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

When controlling for structural effects and the influence of perceptions of competence, we found indications that team members preferred to befriend their proactive counterparts (proactiveness alter effect, est. = 0.06, $p < 0.1$). Other effects of proactive personality of friendship formation were not significant.

Structural influences. We observed that relationships in work groups were reciprocated (reciprocity effect, est. = 3.43, $p < 0.001$) – this effect is in line with previous empirical evidence (Rank, Robins & Pattison, 2009). In other words, reciprocity contributed to friendship formation in this sample. Team members in our sample befriended friends of own friends (transitive triplets parameter, est. = 1.47, $p < 0.001$). However, the research participants were reluctant to reciprocate friendships embedded into these dense groups (Block, 2015), as signified by the negative transitive reciprocated triplets parameter (est. = -0.50, $p < 0.05$).

Effects of controls. Familiarity with the group members helped to build good relationships within the team throughout the course of the project (est. = 0.22, $p < 0.01$). Consistent with previous research (Ibarra 1992; Rivera, Soderstrom, & Uzzi, 2010), team members befriended others of the same gender (gender homophily effect, est. = 0.52, $p < 0.01$).

Dynamics of the perceptions of competence

Main effect of friendship on creation and maintenance of perceptions of competence. Do people attribute higher competence to their friends?

Supporting our hypothesis 2, our data suggested so: a friendship tie affected creation and maintenance of a competent perception of counterpart (friendship effect, est. = 0.89, $p < 0.001$) throughout the course of the project.

Main effect of proactive personality on the perceptions of competence. People perceived proactive others as more competent (effects proactive personality alter, est. = 0.13, $p < 0.01$, and proactive personality squared alter est. = 0.08, $p < 0.01$). Also, proactive individuals recognized actual competence of their counterparts (proactive personality ego, est. = 0.19, $p < 0.01$), and interaction effect between proactive personality ego and grades alter parameter, est. = 0.19, $p < 0.05$).

Structural influences. We observed that the reciprocity parameter (est. = 0.18, *ns*) is not significant: if a person A thinks that his / her team mate B is competent, that does not mean that person B would attribute competence to person A. Additionally, looking at the local triadic structures beyond the dyad, our analysis revealed that research participants attributed competence to those, who have been perceived as competent by their team members (transitive triplets, est. = 1.05, $p < 0.001$). Again, there was a slight tendency not to reciprocate competence attributions in embedded triads, which in this case could also be interpreted as evidence of hierarchy in competence perceptions (transitive reciprocated triplets, est. = -0.65, $p < 0.01$). Estimates for the Matthew effect (indegree popularity, est.

= 0.02, *ns*) suggest that individuals perceived as competent would not accumulate competence perceptions even more.

Effects of controls. Familiarity among team members negatively affected the formation of competence perceptions (est. = -0.05, $p < 0.05$). We also found a gender bias effect: women were perceived to be less competent (gender alter effect, est. = -0.48, $p < 0.01$). We found that in general team members accurately identified actual competence during the project (grades alter effect, est. = 0.53, $p < 0.01$).

2.5 Discussion

The present study examined the interplay between interpersonal perceptions and actual relationships by zooming in on co-evolution between perceptions of competence and friendship, and explored the role of proactive personality in this process. Our longitudinal investigation allowed us to unravel how perceptions of competence and friendship mutually co-evolve, taking structural social network effects into account. Applying recently developed methods - co-evolution analysis of multiplex networks with the aid of stochastic actor-based modeling of network dynamics (Ripley et al., 2019) - on longitudinal network data, we demonstrate that friendship fosters perceptions of competence and vice-versa. These findings shed light on how interpersonal perceptions co-evolve with relationships (Tasselli, Kilduff & Menges, 2015), thus also contributing to the

literature on the evolution of multiplex networks (Ellwardt, Steglich & Wittek, 2012; Lomi, Snijders, Steglich & Torlo, 2011).

Previous research established that proactive personality is a significant predictor of work outcomes (Fuller & Marler, 2009; Thomas, Whitman & Visweswaran, 2010; Spitzmuller et al., 2015), and that networking behaviors of proactive individuals mediate this relationship. We contribute to this stream of research by being more specific on *how* proactive individuals relate to others. Our findings suggest that proactive individuals leverage on peoples' tendency to befriend competent others: proactive individuals project a competent image and have a superior ability to recognize actual competence of their peers. Perceptions of competence helped us to explain why people are attracted to proactive individuals. Our findings suggest that proactive individuals convey an image of competence to their teammates that goes beyond actual competence, in this case GPA. We could infer that team members' tendency to build friendship to others who could potentially enhance their performance allows proactive individuals to attract friends and thus establish relationships that allow them to capitalize on valuable connections over time.

In our analyses we also incorporated structural mechanisms that contribute to social network evolution, accounting for the out-degree effects, tendency of individuals to reciprocate relationships, and network closure effects. We extended previous research on the effects of perceived competence on relationships by incorporating

the indicators of social structure beyond the dyad (triadic effects such as transitive triplets and popularity effects). This allowed us not only to more clearly pinpoint the effect of personality and perceptions of team members of each other within the dyad, but it also allowed us to spell out how broader social structures emerge (triadic effects indicated that there is an emerging hierarchy in perceptions of competence and friendship). In addition, we found that team members were selective in attributing competence (main effects of friendship on competence, accompanied by proactiveness alter effects). The results extend our insights into the pathways of social network dynamics, contributing to the literature on micro-foundations of structural patterns emergence (Tasselli, Kilduff & Menges 2015), and extending the relational perspective of network evolution.

Consistent with previous research we also found gender homophily in friendship, and gender bias in competence perceptions (women were perceived as less competent) in our sample (Ellemers, 2018, Joshi et al., 2015, Leslie et al., 2015).

2.5.1 Theoretical and Practical Implications

Our study contributes to the literature in several key ways. The results extend the existing research on antecedents of network structure evolution by emphasizing how proactive personality contributes to interpersonal relationships. Most work on personality and networks so far has assumed that human personality consists of

stable traits that exert effects on outcomes, effects that are (with the exception of self-monitoring personality) often shown to be rather small (cf. Fang et al., 2015; Klein et al., 2004). Because of the lack of well-established literature that connects proactive personality to networking behaviors, we chose to explore the link between proactive personality and networking behaviors in a more exploratory fashion as our understanding of how proactive personality contributes to emergence of friendship and interpersonal competence perceptions within the organizations has been limited. While prior research indicated that proactive personality was related to the networking behavior (e.g. Liang & Gong, 2013), there was a lack of empirical research on how proactive personality is related to friendship or competence perceptions.

In sum, we observed intact project teams across their ten-week lifespan. The scope and longitudinal nature of our data helped us to investigate and establish that perceptions and relationships co-evolve, constituting one of the major strengths of this study. The notable strengths of our study lie in its longitudinal, three-wave design and actor-based modeling of social network dynamics that allowed us to unravel the co-evolution between two multiplex networks: perceptions of competence and friendship. We were also able to accurately pin-point the mechanisms that allow us to measure how proactive personality manifests in networking behaviors, specifying effects on both the tie sender, tie receiver and complementarity between both parties. We were also able to capture

the non-linear nature of these effects. Additionally, the adopted analytical framework allowed us to distinguish the effects of personality from other social processes that impact relationship formation in teams, such as reciprocity, transitivity or popularity effects. Moreover, we were able to control for actual competence, separating its effects from the perceived competence. We also explore some of the alternative explanations for the secondary findings on gender bias in the subsequent section on additional post-hock analyses.

Our analysis also enhances our understanding of how social processes operate in small project teams, which are very prevalent in contemporary organizational life. Previous research investigated the evolution of relationships in medium-sized organizations and communities. In the current paper, we investigated if the established principles of network evolution would also hold in smaller, more constrained and dense social settings. One of the intriguing questions in network literature is the question of scaling (Barabasi & Albert, 1999): do the rules of network evolution remain the same across different scales of the system? Do small, socially and organizationally constrained settings such as teams exhibit similar rules of self-organization as larger social systems? Our research provides some evidence for the social network evolution processes in small systems. We focused our investigation on teams, where individuals are interdependent, and have limited possibilities to choose whom they communicate with. We find that perceptions of

competence and personality (proactive personality) affect the team dynamics over time. Team setting at the same time also provides a boundary condition for the generalizability of our findings, although we assumed that competence perceptions are more likely to play a role in contexts, where performance depends on the ability of group members to contribute to joint performance.

2.5.2 *Post-Hoc Analyses*

In line with Hollenbeck & Wright (2017) we conducted several post-hoc analyses to establish the robustness of our findings. To this end, we tested the model with different measures of proactiveness, relying on the seven item and six item indices. This did not alter our pattern of results. While selecting the effects for the model, we relied on theoretical considerations and state-of-the-art methodological recommendations (Ripley et al., 2019; Snijders & Lomi, 2019). We also tried simpler, parsimonious models, excluding some of the non-significant results, also demonstrating the same pattern. Ultimately, we chose the reported model in this manuscript, as we believe that it is theoretically and methodologically rigorous, conveys a comprehensive understanding of the phenomenon, and balances parsimony with a good model fit.

While previous research (Ellemers, 2018, Joshi et al., 2015) established the prevalence of implicit gender bias in competence perceptions in academic (Leslie et al., 2015; Moss-Racusin, Dovidio, Brescoll, Graham & Handelsman, 2012), entrepreneurial (Lee &

Huang, 2018), and industrial settings (Joshi et al., 2015), we also conducted additional analysis to understand the nature of gender bias with respect to competence in our sample. We were able to rule out that previous performance differed between men and women in our sample: an independent-samples t-test indicated that there was not a significant difference in GPA for men ($M=6.93$, $SD=.46$) and women ($M=6.97$, $SD=.49$); $t(-.94)$, *ns*. While women tend to do better than men in most educational settings (Schippers et al., 2015), our results are consistent with meta-analytic evidence of nearly 100 empirical studies of over 378850 participants (Joshi et al., 2015) that people (both men and women) consistently undervalue work performance by women. As gender stereotypes impact the evaluations of actual work performed by men and women, these differences accumulate into substantial inequalities in terms of career development, income and opportunities available (Ellemers, 2018). We advocate for the increased awareness of gender bias that perpetuates the disadvantages that women face and inhibit the opportunities to contribute. Implicit or unintended gender biases stem from “repeated exposure to pervasive cultural stereotypes (Devine, 1989) that portray women as less competent” (Moss-Racusin et al., 2012: 16474). We join the call upon educational and professional organizations to adopt interventions that acknowledge and address gender bias and educate people on how pervasive implicit bias perpetuate inequality (Ellemers, 2018).

Moreover, in our sample men and women significantly differed in their levels of reported proactive personality (women scored lower; Spearman rho = $-.11$, $p < .05$). Previous meta-analytic findings indicated that proactive personality was not related to demographic characteristics such as gender, age, education and tenure (Thornau & Frese, 2013). However, Spitzmuller and colleagues (2015) argued that subgroup differences for gender in proactive personality occur because individuals belonging to a minority group might be less likely to express their proactive personality. In particular, perceptions of a lower power position that are associated with the minority group membership undermine the potential to exhibit proactive personality. As low power positions are associated with behavioral constraint and avoidance tendencies, minority group members might be less likely to challenge the status quo and undertake other change directed behaviors. Thus, according to Spitzmuller and colleagues (2015), when proactive personality forms a base for evaluation, minority members might experience adverse impact. Future research might want to differentiate perceptions of competence that form a foundation for status from the perceptions of power (Magee & Galinsky, 2008) in shaping the relationship dynamics. Business educators might also want to examine the norms that guide the expression of proactive personality in the educational context and explore the (self)-selection bias during admission procedures into the business program.

2.5.3 *Limitations and Future Directions*

While obvious strengths of our study are its longitudinal nature and the project-based team setting, it also has certain limitations. First, recent research highlighted that positive interpersonal affect increases reliance on competence perceptions in shaping work-related relationships (Casciaro & Lobo, 2008) and affective value may precede perceived instrumental value (Casciaro & Lobo, 2015). This situation is reversed, however, in organizational settings with an interdependence of performance among group members (e.g. teams): here competence, as opposed to affect, plays a key role (Cuddy et al., 2011). By shifting the focus from an immediate affective evaluation to affective ties with more relational depth such as friendship (which requires more frequent interaction and mutual confiding), we are better equipped to investigate the role of competence perceptions in the dynamics of tie formation. However, we did not directly measure liking as a construct to control for its impact on friendship relations. Future studies could address more the interplay and dynamics of liking – along with competence – with work relationships. Additionally, future research could focus more explicitly on this intriguing interplay between actual and perceived competence and the consequences for team functioning over time.

Second, the effects related to proactive personality might be dependent on the team context in which this study took place – the team setting implied interdependence among team members in

terms of performance and flat hierarchies—that might have altered the importance of competence perceptions and proactive personality. Crant, Hu, & Jiang (2016) indicate that perceptions of proactive personality might vary across contexts: people might appreciate proactive personality in unclear situations that require participants to determine a course of action as opposed to contexts that emphasize adherence to prescribed norms and routines (e.g. hierarchical and military settings). To understand the scope of generalizability of our findings, future research might test how network dynamics would unfold in other strong and weak contexts, characterized by various degrees of autonomy / interdependence among group members, strong / weak group norms, in various degrees of hierarchies, and across industries characterized by different environmental dynamism.

Another interesting venue for future research is the effect of proactive personality and perceptions of competence on the ties stretching beyond the team, the multilevel effects that (multiple) team memberships exert on the relationships among individuals (Belotti, 2012, Lazega et al., 2008) and other types of relationships, in particular the advice seeking and conflict. Because proactive personality might not be appreciated by all (Hirschfeld et al., 2011), identifying the boundary conditions on when it fosters positive or negative relationships at work could inform managerial practice.

Third, we addressed a relatively new personality variable with respect to networks, namely proactive personality. However,

other personality variables may also play a role in shaping the perceptions of competence, for instance conscientiousness and extraversion. Individuals high on conscientiousness are reliable, methodical, disciplined and organized (Costa and McCrae, 1992), and this trait has been consistently linked to enhanced (work) performance (for meta-analyses see Barrick & Mount, 1991; Hurtz, & Donovan, 2000). Combined with proactiveness, the conveyed image of competence may be even higher. Another personality variable that may add to this picture would be extraversion. People high on extraversion are outgoing, talkative, assertive and gregarious (Costa & McCrae, 1992). These aspects of their personality may also help them paint a picture of competence. Future research could further unravel the intricate interplay between of personality, friendship and perceived competence, also assessing the co-evolution of this variable.

Future research might also distinguish more precisely proactive personality from proactive behaviour. We view proactive personality as a “trait” that exhibits relatively high stability, and proactive behaviours as a “state” of proactivity (Crant, Hu, & Jiang, 2016). However, in line with Tasselli, Kilduff & Landis (2018) we call upon researchers to evaluate how proactive behaviour co-evolves in interactions with others. Does congruence between co-workers on proactive personality foster positive workplace relationships and amplifies proactive behaviour in the workplace? This might inform

the person-environment fit debate with respect to proactive personality more (Parker & Collins, 2010).

Managers might be cautious in creating a setting that is congruent with proactive personality, also in interactions with others. Proactive people will thrive more in organizations with supportive organizational climate that would permit them to display proactive behavior and flourish (Crant, Hu & Jiang, 2016). A final limitation may be causality between our constructs. Although we observed intact project teams across their ten-week lifespan, and the longitudinal nature of our data helped us to investigate and establish the direction of influence between perceptions of competence and friendship, constituting one of the major strengths of this study, we are cautious to claim causality between our constructs because unobserved constructs could potentially have affected our results. Previous research also established proactive personality as a relatively stable individual characteristic, which informed our measurement of proactive personality during the third survey. Recent research (Tasselli & Kilduff, 2018) suggested that proactiveness might change over longer time frames; future research could address whether proactive personality is a subject of selection or influence forces operating in social networks. Extended and different samples could establish generalizability of our findings to other organizational contexts. Therefore, we restrain from generalizations of our results to other settings as our findings could

be contingent on the student sample that we have used in our research.

2.6 Conclusion

Shedding light on the antecedents of social network formation, this article examined how perceptions of competence co-evolve with friendship, and the role of proactive personality in this process. Our study showed that people have a tendency to befriend competent people, and attribute higher competence to their friends. Moreover, we found that proactive individuals are perceived as competent, and thus could leverage on the preference of people to relate to competent others. We also found indications that proactive individuals might correctly identify and befriend competent team members. We hope that these findings would enable a more profound understanding of how personality contributes to the interplay between perceptions and interpersonal relationships and provide an important insight into the microfoundations of social network dynamics.

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Chapter 3. Getting Along: How Five Factor personality traits contribute to friendship and conflict network dynamics.³⁴

Abstract

How do the Five Factor personality traits shape friendship and conflict relationships? We examine interpersonal mechanisms through which personality could manifest itself in social networks: (a) sociability/withdrawal, (b) aspiration/avoidance, (c) homophily/heterophily, and (d) attachment conformity/normative activity. We explore these mechanisms by analyzing longitudinal data collected from members of a marching band (n = 193; 53% female; M age = 19.4 years, 62.1% European-American). Results of the stochastic actor-based modeling of social network dynamics (RSiena) reveal that Five Factor traits impact the formation of friendship and conflict networks through these mechanisms. Agreeableness is related to sociability in friendship networks, openness – to withdrawal and avoidance, extraversion – to aspiration, normative activity, attachment conformity and homophily. Neuroticism manifested in heterophily – preference for dissimilar others – during the formation of friendship networks. In conflict networks, band members exhibited avoidance for openness, and attachment conformity for openness and extraversion. These results demonstrate how personality contributes to intra-organizational dynamics of positive and negative networks.

Keywords: social network dynamics, friendship, conflict, Big Five, stochastic actor-based modeling of social network dynamics

³ with Olga Kornienko, George Mason University, currently under review

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3.1 Introduction

Social networks matter for individuals, organizations and society at large (Borgatti et al. 2009, Fang et al. 2015, Kilduff and Brass 2010). Social networks promote individuals' performance (Fang et al., 2015), career progression, and creativity (Burt et al. 2013, Kilduff and Brass 2010). Whereas research provided insights into the consequences of network structures, our understanding of how networks form is still limited (Tasselli et al. 2015). However, networks emerge over time from social interactions characterized by patterns, content, and quality that shape enduring patterns of social ties (Hinde 1976). Management scholars only recently began to explore how social networks form (Schulte et al. 2012; Soltis et al. 2018; Parker et al. 2016) and the drivers and outcomes of network dynamics (Troester et al. 2018; Carnabuci et al. 2018). To understand this process better, we need a fresh look at the mechanisms that shape the evolution of social networks.

Among the predictors of relationship formation (Burt et al. 2013, Kilduff and Brass 2010), personality emerged as an important antecedent (Fang et al. 2015, Klein et al. 2004, Landis 2016, Selden and Goodie 2018, Selfhout et al. 2010). Although previous research generated valuable insights that personality affects social network structures differently depending on the type of the relationship (e.g. friendship, advice: Klein et al. 2004, Selden and Goodie 2018), it is currently unclear how personality manifests in the interpersonal *processes* that lead to observed networks (Hampson 2012, Schulte et al. 2012). Recent studies (Fang et al. 2015, Feiler and Kleinbaum 2015, Tasselli et al. 2015) started to unpack how personality 'gets outside the skin' (Hampson 2012: 316) and how it impacts the way people construct their social networks. Whereas research has

established that personality is related to the structure of social relationships (Selden and Goodie 2017), most of the studies – with a few rare exceptions that looked at mechanisms such as popularity and homophily (Selfhout et al. 2010, Feiler and Kleinbaum 2015) – have adopted a static view of networks. However, multiple, competing explanations could operate and shape network outcomes (Kalish 2018, Nestler et al. 2015). Thus, to understand better how change unfolds – and potentially to manage it better, –we need to focus on the mechanisms that drive change.

The current study integrates personality and social networks theory to advance research by specifying and testing the *interpersonal mechanisms* through which personality shapes social networks. To specify, our goal is to examine *how Big Five personality traits contribute to the mechanisms of friendship and conflict network formation*. Following the calls to extend the scope of effects that expand our understanding of social network dynamics (Snijders and Lomi 2019), we investigate the mechanisms such as sociability/withdrawal, aspiration/avoidance, homophily/heterophily, normative activity and attachment conformity among others shape the emergence of social networks. We study how Big Five personality traits are associated with these mechanisms because this taxonomy is a dominant personality theory (Goldberg 1992, Digman 1990, McCrae and Costa 2008) and has a wealth of empirical evidence linking it to the patterns of social network structure (Fang et al. 2015) and important organizational outcomes (Judge & Zapata 2014). The Big Five includes traits of extraversion, agreeableness, conscientiousness, neuroticism (also called emotional stability), and openness to experience (also called intellect).

Our focus on how Big Five personality traits shape the mechanisms of friendship and conflict dynamics in an organization contributes to clarifying the current debate on micro-foundations of social network formation (Tasselli et al. 2015) in three key ways. First, we shed light on interpersonal *processes* by which personality traits manifest themselves in interpersonal interactions (Feiler and Kleinbaum 2015, Hampson 2012, Nestler et al. 2015). We adopt and extend the previous work by Snijders and Lomi (2019) and suggest different interpersonal mechanisms through which personality contributes to social network dynamics: sociability/withdrawal, aspiration/avoidance, homophily/heterophily, normative activity and attachment conformity. In doing so, we specify the antecedents of social network dynamics (Burt et al. 2013, Klein et al. 2004) by elaborating on the role of personality in friendship and conflict emergence in an organizational setting. Second, as positive and negative ties coexist in an organizational setting and negative interactions affect personal relationships (Labianca 2014, Labianca and Brass 2006), we address the interplay between friendship and conflict and thus advance our understanding of how different types of networks coevolve (Schulte et al. 2012, Selden and Goodie 2018). We explore how friendship embeddedness contributes to the emergence of conflict and explore whether conflict among group members hinders the development of friendship. These insights help us understand how subgroups and social divides emerge among group members. Third, by using the longitudinal social network analysis approach (Kalish 2018, Snijders et al. 2010) to address these questions, we are able to explicitly model how personality manifests itself in relationship formation, separating its contributions from other structural dynamics unfolding in the social network (Nestler et al.

2015). Our longitudinal design and analytic approach allow us to represent friendship and conflict selection and the interplay between these two co-evolving networks to understand how positive and negative networks co-evolve in organizational settings.

3.2 Personality and social network dynamics

Latest studies on how personality contributes to social networks provided revealing insights into how individual patterns of behavior contribute to social networks in organizations (Landis 2016, Tasselli 2015). Social networks shape a range of essential outcomes for organizations (Cross & Prusack 2002, Kilduff & Brass 2010, Brass et al. 2004, Borgatti & Foster 2003), such as social support, creativity and innovation (Cattani & Feriani 2008, Perry-Smith & Manucci 2017, Zhou et al. 2019 and enable and constrain individuals within groups (Burt et al. 2013). Personality traits are associated with network structures (Fang et al. 2015, Selden and Goodie 2018), but we know little about their consequences for network dynamics. Thus, we integrate personality and social networks theory (Snijders & Lomi, 2019) to advance the understanding of how personality traits contribute to social network dynamics. Of what is known about network dynamics, personality traits affect them in three key ways (Feiler and Kleinbaum 2015, Selfhout et al. 2010). First, individuals differ in their preference to send out friendship nominations (sociability effect), e.g., extraverts report having more friends. Second, personality traits affect whether an individual is selected as a friend (popularity effect), e.g., people prefer agreeable and extraverted friends. Third, similarity on a particular trait (e.g., agreeableness, extraversion, or openness) could foster relationship formation (homophily effect).

Recent advances in conceptualizing and testing how continuous actor characteristics (such as personality) shape network selection (Snijders & Lomi 2019) emphasize the need to extend the range of network mechanisms beyond sociability, popularity and homophily effects. These new mechanisms include aspiration, attachment conformity and sociability. *Aspiration* is the preference to befriend others with higher value on a particular characteristic. *Attachment conformity* is the preference to befriend others whose characteristics are in line with established norm. *Sociability* is the tendency of people with high values on a particular trait to send more ties generally. Additionally, *complementarity, or heterophily* (a mirror image of homophily) is a “social selection mechanism in which relations are more likely to be observed between actors with different attributes, and the combination of attributes is especially valuable” (Snijders and Lomi 2019, p.6). Given that these new mechanisms jointly operate to shape ties, they need to be specified in a model to convey an accurate process of network emergence.

To unravel how the Big Five personality variables play out in the formation of friendship and conflict, we adopt and extend Snijders and Lomi (2019) suggestions, define a typology of interpersonal mechanisms at play that could be related to personality, and subsequently test these mechanisms in an organizational context. In particular, we also introduce a mechanism of *normative activity* – a tendency of an individual to behave him or herself with respect to the established norm.

To introduce the typology of considered mechanisms, we first focus on how the properties of individuals (which in social network parlance are labeled *ego*), properties of others (labeled *alter*), and interaction between tie sender and receiver (ego and alter) characteristics

contribute to tie formation. We summarize these mechanisms in Table 3 and then theorize how personality traits shape friendship and conflict network selection via these interpersonal mechanisms.

Table 3: Mechanisms of social network selection related to individual characteristics

Effect	Characteristics of ego (sender)	Characteristics of alter (receiver)
Linear	<i>Sociability</i> (+): tendency to initiate and maintain relationships	<i>Aspiration</i> (+): tendency to initiate and maintain relationships to others with particular characteristics
	<i>Withdrawal</i> (-): tendency to forego relationships	<i>Avoidance</i> (-): tendency to forego relationships to others with particular characteristics
Curvilinear	<i>Normative activity</i> : preference to behave as others within the group	<i>Attachment conformity</i> : tendency to form relationships with others who fall in the range of desirable - or normative - characteristics
Interaction term	<i>Homophily</i> : tendency to form relationships with others who are similar on a particular characteristic / <i>Heterophily</i> : tendency to form relationships with others who are different on a particular characteristic	

3.2.1 *Mechanisms of social network selection related to the individual characteristics of ego*

Sociability and withdrawal. One stream of network literature asserts that individuals prefer to pursue some relationships and forgo others (McPherson and Smith-Lovin 1987, Tasselli et al. 2015). We distinguish between the tendency to select relationships with a peer as “*sociability*” and the tendency to forego and drop the tie as “*withdrawal*”. These tendencies depend on inclinations of *actors themselves* regardless of the characteristics of the alters. We specify these mechanisms using linear effects - positive (*sociability*) or negative (*withdrawal*) - between the sender characteristics and tendencies to select a relationship (see Table 3). For example, as extraverts enjoy social interaction, they might be more active in pursuing friendship; as people who score high on neuroticism perceive more social threats, they might withdraw from social situations and select fewer friends.

Normative activity. *Normative activity* is the tendency to form ties when the senders’ characteristics are closer to the groups existing norm or what is considered appropriate within the group. In other words, an individual adjusts tie forming in line with the normative value within the group. In friendship groups, individuals’ preference to behave in line with perceived group norms (Abrams et al. 1990) is a well-established phenomenon (Cohen 1977, Snijders and Lomi 2019). This normative tendency is represented by curvilinear effects on the sender side (Table 3). For example, extraversion could be related to normative activity, as introverts are less active in befriending others, and highly extraverted individuals might face saturation in social ties -- as peers prefer to befriend

extraverts restricting extraverts' ability to befriend others at increasing rates.

3.2.2 *Mechanisms of social network selection related to the individual characteristics of alter*

Aspiration and avoidance. Some characteristics of alters could also play a role in determining how attractive they are as a potential friend or a source of conflict. We refer to an inclination to initiate and maintain ties with others with particular characteristics as *aspiration* (i.e., attraction to those with high values on an attribute; Snijders and Lomi 2019) and the tendency to avoid others -- as *avoidance*. For example, people might aspire to connect to extraverts due to their positive emotionality, they might also avoid others high on neuroticism due to their negative emotionality. Similarly, aspiration is captured by a positive linear receiver effect, whereas avoidance is depicted by a negative linear effect on the receiver side (Table 3).

Attachment conformity. Individuals may prefer to develop ties with others who have characteristics that are close to a particular value that is considered desirable that is called 'social norm'. In other words, a person may choose to befriend someone who is 'just like everyone else'. We label this as *attachment conformity*. In contrast to aspiration, which focuses on an attraction to others with high levels of a trait, *attachment conformity* describes a tendency to gravitate towards desirable social norm (captured by a curvilinear effect on the receiver side in Table 3). For example, when choosing among peers, a person qualifies to belong to the circle of friends' by not standing out from the crowd. Attachment conformity could also be reversed, and a person might prefer to develop

(e.g. conflict) ties to others who stand out, 'not like everyone else', or are 'mavericks'".

3.2.3 *Mechanisms of social network formation related to the interaction between ego and alter*

Homophily/heterophily. "Similarity breeds connection" (McPherson et al. 2001, p. 415): *homophily* is a well-established preference to affiliate with similar others (Brass et al. 2004). Because similar people are more predictable, homophily smoothens communication, nurtures trust, and improves the odds that the relationship is mutual (Brass et al. 2004). Similarity takes both individuals into account; it is a relational characteristic. Therefore, homophily zooms in on the similarity of two individuals in comparison to everyone else (Mehra et al. 1998). In contrast, *heterophily* is the preference to affiliate with others who are dissimilar on a particular characteristic – captured by the adage that opposites attract. Feiler and Kleinbaum (2015) found homophily on extraversion. We model these tendencies as an interaction term between the characteristics of the sender and the receiver; a positive term stands for homophily, a negative one – for heterophily (Table 1).

3.2.4 *The effects of Big Five personality traits on friendship network selection*

Personality shapes network dynamics (Fang et al. 2015, Selden and Goodie 2018) because personality most clearly reveals itself in how people "get along and get ahead in social life" (McAdams 2015, p. 4). Extraversion and neuroticism manifest in positive and negative emotionality that impacts social bonding, whereas conscientiousness and agreeableness mark successful self-regulation that has implications for success in social relationships (McAdams 2015). Together, these abilities to experience,

express, and regulate emotions shape interpersonal interactions and relationships, while subsequently contributing to the evolution of broader social network structures. Openness to experience marks individuals' tolerance to differences in how people think (McAdams 2015) with limited impact on social relationships, as suggested by prior research.

Mechanisms related to extraversion. The trait of extraversion encompasses positive emotionality, excitement seeking, assertiveness, warmth, and gregariousness (Costa and McCrae 1992). Extraversion forms a cornerstone of sociality: extraverts find social situations rewarding, motivating, and energizing (McAdams 2015). Extraverts seek social situations and initiate encounters (Shipilov et al. 2014). Extraversion captures (1) drive and social dominance, which is conveyed through excitement seeking, activity and assertiveness; and (2) sociability and positive emotionality, which is conveyed through warmth, positive emotions, and gregariousness (De Young, 2010). Extraversion is, essentially, seeking and enjoying social rewards (McAdams 2015). Over time, extraversion yields a wide range of social benefits in comparison to introversion (McAdams 2015): better performance as leaders, greater social support, higher social competence (Argyle and Lu 1990), greater popularity (Paunonen 2003), and subjective well-being (Lucas et al. 2008). Extraverts' positive affect promotes friend networks (Demir and Weitekamp 2007). In sum, extraversion boosts the ability to get along and get ahead in social groups (McAdams 2015).

Extraversion sociability. Extraversion impacts social relationships in profound ways and leads to more fulfilling friendships (McAdams 2015). Extraverts engage in more daily social interactions (Srivastava et al. 2008), pursue social goals (King 1995), and enjoy socializing with others

(Hampson 2012). Therefore, they are more likely to have larger networks (Feiler and Kleinbaum 2015) and to select many friends (Selfhout et al. 2010). Extraverts thus would exhibit a higher tendency for sociability in befriending others.

Normative activity for extraversion. We argue that extraverts exhibit normative activity. In other words, the friendship selection effect is curvilinear: at the extreme sides of the scale, the tendency to befriend others would be lower because introverts are judicious in spending energy on socializing; thus, they would be careful in selecting friends. For highly extraverted individuals, we would observe a saturation effect: because of aspiration tendencies—people would like to befriend those who score higher on extraversion, —extraverts would receive a proportionally higher number of requests and would encounter their limits in terms of time and energy that they could devote to befriending even more people. In other words, they could start to be selective with respect to their friendship.

Extraversion aspiration. We suggest that individuals could have a preference to befriend extraverted others, exhibiting aspiration. Extraverts are energetic and experience greater happiness than introverts (Hampson 2012). Evidence suggests that extraverts tend to be more popular (Paunonen 2003), achieve higher status and peer acceptance (Ozer and Benet-Martinez 2006, Scholte et al. 1997). Extraverts create a positive social environment for others (Eaton and Funder 2003) and master the art of savoring positive emotional experiences (Hemenover 2003). Extraverts thrive in social situations, seek and attract more social attention (Ashton et al. 2002). Outgoing and energetic, they welcome friendship from others (Klein et al. 2004). It is even argued that the primary evolutionary function of extraversion is to *attract and hold attention of others* (Ashton et al. 2002,

McAdams 2015). While in higher educational setting students did not exhibit a tendency to select extraverts as friends (Selfhout et al. 2010), we nevertheless argue that extraverts might be preferred as friends. Extraverts are nominated as friends and enjoy high in-degree centrality (Feiler and Kleinbaum 2015), which grants them influence over communication and facilitates access to resources (Freeman 1978). We argue for the aspiration tendencies for extraversion: in social settings extraversion would be viewed as a socially desirable trait and people would prefer to affiliate with others with higher extraversion.

The aspirational tendencies in extraversion might emerge due to extraversion bias: on average, peoples' networks are composed of more extraverted individuals than the overall social environment (Feiler and Kleinbaum 2015). This paradoxical phenomenon emerges due to the popularity of extraversion: because extraverts have larger social networks, they are overrepresented in other peoples' networks, which leads other people to believe that others are more extraverted than they themselves are. Extraversion bias is weaker for introverts such that they are more objective in assessing the extraversion of a population (Feiler and Kleinbaum 2015). It is plausible that extraversion bias contributes to aspiration tendencies on extraversion.

Extraversion homophily. People befriend others who are similar to them in terms of extraversion (Feiler and Kleinbaum 2015, Selfhout et al. 2010)—a phenomenon called *extraversion homophily*. Homophily might emerge through two processes: (1) similarity attraction (Byrne 1971), i.e. people prefer others who are similar to themselves or (2) people seek similar social situations that foster social bonds (Feiler and Kleinbaum 2015). Similarity attraction emerges as similar opinions, feelings, and

views surface and trigger implicit affection that amplifies interpersonal attraction (Clore and Byrne 1974). Similarity also reduces uncertainty; predictability in reactions smoothens communications and boosts confidence in the future of a relationship (Berger and Calabrese 1975). These processes –reinforcement of affect, uncertainty reduction, and selection of social situations –might be at play for the trait of extraversion, as extraversion is expressed in how people communicate (Selfhout et al. 2010). As traits surface when people get to know each other, higher enjoyment and predictability between people with similar levels of extraversion might contribute to stronger social bonds.

Hypothesis 1: Extraversion is related to the mechanisms of (a) sociability (b) normative activity, (c) aspiration, and (d) homophily in friendship formation.

Mechanisms related to neuroticism. The trait of neuroticism captures the persistent tendency for some people to experience more negative thoughts and emotions than others, to be emotionally volatile, and to hold a low opinion of themselves (Hampson 2012). Neuroticism encompasses facets of anxiety, anger, depression, self-consciousness, impulsiveness, and vulnerability (Costa and McCrae 1992). We also refer to the polar opposite of high neuroticism as emotional stability.

Neuroticism negatively affects interpersonal experiences (McAdams 2015). People who score high on neuroticism are more receptive to the signals of threat and negative emotion in their surroundings and thus encounter more negative stimuli, which reinforces their tendency to reappraise their own experiences in negative terms (Suls and Martin 2005). In turn, others often perceive individuals low on emotional stability in negative terms, which makes it difficult to initiate and maintain friendships (Creed and Funder 1998, Demir and Weitekamp

2007), leading to smaller friendship networks (Selden and Goodie 2018). People who score high on neuroticism nominate fewer friends (Schulte et al. 2012) and are nominated as friends less frequently (Klein et al. 2004). Conversely, emotionally stable individuals attained and navigated brokerage positions in workplace networks (Battistoni and Fronzetti Colladon 2014, Kalish 2008, Klein et al. 2004). However, the negative experiences of individuals scoring high on neuroticism do not necessarily affect friendship selection in longitudinal samples (Baams et al. 2015, Selden and Goodie 2018, Selfhout et al. 2010). Despite these inconsistencies in empirical findings, theory suggests that neuroticism is related to *withdrawal* and *avoidance* in friendship networks, which we explore in the present study.

Hypothesis 2: Neuroticism is related to the mechanisms of (a) withdrawal and (b) avoidance in friendship formation.

Mechanisms related to agreeableness. Trust, straightforwardness, altruism, and modesty are the facets of agreeableness (Costa and McCrae 1992). People who score high on agreeableness are kind, empathetic, and helpful (Goldberg 1990, John and Srivastava 1999). In the domain of social relationships, higher agreeableness is associated with secure attachment (Noffle and Shaver 2006) and prosocial behavior (Graziano and Eisenberg 1997).

Agreeableness aspiration. Prosocial and altruistic behavior of agreeable individuals (Denissen and Penke 2008) improves the chances of becoming friends. Thus, people befriend agreeable others (Selfhout et al. 2010) and we expect *aspiration tendencies* for agreeableness.

Homophily. Personality-based homophily has also been shown for agreeableness (Selfhout et al. 2010): people similar in agreeableness are

more likely to become friends. Evidence that altruism guides agreeable people to select each other comes from studies in evolutionary game theory (Gilchrist 2007). Similarity in altruistic behavior generates better outcomes for both parties, and agreeable people are more likely to behave altruistically, which in turn amplifies friendship selection.

Hypothesis 3: Agreeableness is related to (a) aspiration and (b) homophily in friendship formation.

Moreover, we anticipate that agreeable individuals would be quicker to befriend others, which would affect the *rate of change* in friendship networks. Previous research indicated that individual differences shape the dynamic formation of networks (Sasovova et al. 2010) in such a way that people with particular personality traits, such as self-monitoring, differ in how quickly they initiate and develop relationships. We argue that empathy, altruism and prosocial behavior of agreeable people function as a social lubricant and allow them to establish understanding and trust quicker, speeding up the friendship formation.

Mechanisms related to conscientiousness. The trait of conscientiousness captures individual differences in impulse control or the lack thereof (Hampson 2012): following socially expected norms and rules for restraint, focusing on tasks and goals, and postponing rewards (John and Srivastava 1999). It differentiates people who exert self-control and are industrious, orderly, and goal-oriented from others who are undisciplined, unreliable and impulsive. Conscientiousness captures the dimensions of competence, order, dutifulness, achievement striving, self-discipline, and deliberation (Costa and McCrae 1992).

Conscientiousness is a significant predictor of work performance (Barrick and Mount 1991), but we have inconsistent evidence whether or

how conscientiousness affects the structure of social relationships. Selden and Goodie (2018) conclude after reviewing empirical evidence of 30 studies that conscientiousness is associated with relationship quality and helps to maintain relationships, but its effects on social network dynamics are unlikely to be as strong and reliable as those of extraversion, agreeableness and neuroticism. Indeed, past research suggests that conscientiousness is neither related to the size of interpersonal networks (Klein et al. 2004, Totterdell et al. 2008), nor to the friendship dynamics (Baams et al. 2015, Selfhout et al. 2010). However, conscientiousness supports familiar relationships (Selden and Goodie 2018), whereas in the professional realm, conscientious individuals emerge as key players when employees care about reliability and performance (Battistoni and Fronzetti Colladon 2014, Daly et al. 2014, Emery 2012, Emery et al. 2013).

Hypothesis 4: Conscientiousness is unrelated to friendship formation.

Mechanisms related to openness. Openness to experience involves individual differences in peoples' interests, values, thoughts (McAdams 2015), and particularly captures the original thinking patterns in individuals (De Young et al. 2012). The trait manifests as an exploration of fantasy, aesthetics, feelings, actions, ideas, and values (Costa and McCrae 1992). The individuals high on openness to experience are described as original, creative, curious, imaginative, and having a broad range of interests; those who score low are usually down-to-earth, conventional, conforming, traditional, and conservative (McCrae and Costa 1987). In work settings, openness manifests itself in contexts that require creativity and ability to adapt to change, and when the group norms emphasize appreciation of diversity (Barrick 2005, Selden and Goodie 2018, Tett and Burnett 2003).

Openness captures individuals' differences in how the mind operates (McAdams 2015) and thought to have little relevance for social relationships. However, empirical evidence challenges this view: individuals who score high on openness to experience were at the center of the adversarial networks, and at the periphery of the friendship networks (Klein et al. 2004). The authors suggested that open individuals might challenge established norms, routines and expectations, irritating their colleagues. Consistently with this finding, we argue that group members might *avoid* open individuals as friends.

We also suggest that open individuals might *withdraw* from befriending others, as they are more interested in ideas and less in relationships, investing less effort in befriending others and more in exploring ideas. Whereas Selfhout et al. (2010) did not find any differences in terms of making and maintaining relationships among individuals high and low on openness, they did find evidence for personality-based homophily for openness: people with similar levels of openness form friendship bonds. The authors argue that a match in openness enhances friendship selection due to similarity in vocational choices. In other words, open individuals who are interested in exploring similar ideas together would befriend each other. Open individuals might tend to select others who also have a preference for originality (Emery et al. 2013, Selfhout et al. 2010) –in other words, we could anticipate *openness-based homophily*.

Hypothesis 5: Openness to experience is related to the mechanisms of (a) withdrawal, (b) avoidance, and (c) homophily in friendship dynamics.

3.2.5 *The effect of Big Five personality traits on conflict network selection*

Research that links Big Five traits to social structure of conflict relationships focused mostly on individual self-reports and examined whether individuals with a particular trait get into conflict with others (Labianca 2014). Thus, any trait related to larger positive networks – such as extraversion (e.g., Klein et al. 2004) – would be related to the number of negative ties such as conflict, as increasing interaction boosts chances to reveal differences and conflict.

Mechanisms related to extraversion. In line with Labianca (2014), we argue that extraverts would ‘get into trouble’ (come into conflict) more frequently – and faster – than introverts. In particular, extraverts have a tendency towards anger (Carver 2004) and might initiate conflict more often. Additionally, extraverts tend to disregard negative feedback (Pearce-McCall and Newman 1986) and often fail to learn from their mistakes. In other words, extraversion would be related to higher *sociability* in conflict networks.

Hypothesis 6: Extraversion is related to sociability in conflict formation.

We also anticipate that extraverts might get into conflict at the higher rate than other people.

Extraversion avoidance. Conflicting evidence exists on whether group members would find extraverts difficult people to work with. On one hand, in two samples group members indicated that they had difficult relationship with extraverts. (Klein et al. 2004, Schulte et al. 2012) in service-learning groups. On the other hand, in a sample of students working in small teams, extraversion was negatively correlated to the in-degree in adversarial networks (Xia et al. 2009). Thus, context - the type of group setting - could play a role in whether group members find

extraverted individuals to be helpful or problematic to group processes. Therefore, we do not advance any hypotheses with respect to avoidance of extraverts.

Mechanisms related to neuroticism. Individuals who score low on emotional stability tend to be irritable, fearful, and envious. They tend to deal poorly with social stress, and this would extend into the interpersonal relationships. Labianca and Brass (2006) showed that low emotional stability was associated with higher number of negative relationships. Neuroticism was positively associated with centrality in adversarial networks (Klein et al. 2004). Because they are very receptive to negative cues, individuals low in emotional stability would be quicker to form conflict ties. We suggest that individuals low in emotional stability would perceive and report conflict more easily, thus exhibiting *sociability* in conflict networks.

Neuroticism aspiration. Other team members might also get in conflict with those who are high in neuroticism. Individuals who score low on emotional stability perform poorly when stressed and express anxiety, anger, insecurity, and irritation (Klein et al. 2004), which would frustrate and drain the energy of their team members. We suggest that conflict ties would form with those people who score higher on neuroticism (*aspiration*).

Hypothesis 7: Neuroticism is related to (a) sociability and (b) aspiration in conflict formation.

Mechanisms related to agreeableness. Labianca (2014) suggests that negative ties would be more likely with individuals scoring low on agreeableness. Highly agreeable people are kind, sympathetic, warm, and considerate and thus tend to avoid conflict. Lower agreeableness is

associated with lack of empathy and concern with others' well-being, which increases the odds of conflict. Evidence suggests that those who do not care for others (score low on agreeableness) find themselves at the center of adversarial networks (Klein et al. 2004). In the domain of personal relationships, higher agreeableness is associated with lower levels of conflict (Asendorf and Wilpers 1998). Agreeable people are also more skilled in resolving conflicts and avoiding disputes in friendship (McAdams, 2015), demonstrating empathy (Nettle, 2006), willingness to cooperate (Denissen and Penke 2008) and to integrate both parties' needs in conflict resolution (Jensen-Campbell et al. 2003).

Hypothesis 8: Agreeableness is positively related to withdrawal in conflict formation.

Mechanisms related to conscientiousness. Labianca and Brass (2006) also argued that those who score low on conscientiousness would have more negative ties: less conscious employees are disorganized and unreliable, which leads to lower performance (Barrick and Mount 1991) and provokes conflict. Klein et al. (2004) also suggested that members of work groups would feel resentment, conflict and tension towards others who are low on conscientiousness (*reverse aspiration*) – lack of commitment or hard work leads to poor performance and has consequences for everyone in interdependent tasks. However, Klein et al. (2004) did not find empirical evidence for the link between low conscientiousness and centrality in adversarial networks, which has been explained by contextual factors (the study has been conducted in a service organization). We suggest that group members would experience more conflict with those, who score lower on conscientiousness. We also suggest *heterophily* in terms

of conscientiousness: people with different levels of conscientiousness would be more likely to develop conflict ties with each other.

Hypothesis 9a: Low conscientiousness is related to aspiration in conflict formation.

Hypothesis 9b: Differences in conscientiousness (heterophily) would foster conflict formation.

Mechanisms related to openness. A few studies that explored the connection of openness to adversarial networks found contradictory results: in service-learning teams people had difficulty working with open individuals (Klein et al. 2004) and openness was not related to difficult ties (Schulte et al. 2012). In small project groups, people who are central in adversarial networks scored low on openness (Xia et al. 2009).

Openness: withdrawal. Openness to experience is associated with intellectual curiosity. Thus, individuals who score high on openness to experience would be more inclined to consider a range of different perspectives and would be less likely to see disagreement as conflict – more like a debate. Also, they would perceive more ways to resolve the conflict and prevent it from escalating. Therefore, we suggest that open individuals would prefer to withdraw from conflict.

Openness: aspiration. Open individuals nevertheless end up in central positions in adversarial networks: group members reported that they have a ‘difficult relationship’ with open individuals (Klein et al. 2004). Apparently, open colleagues display non-conformity, autonomy and intellectualism, which frequently annoys their team members: open individuals are likely to challenge the expectations and not to conform to the norms prevalent in the group. Thus, this suggests that group members might get into conflict more with open individuals.

Attachment conformity for openness. We argue that this effect would be more pronounced at the extreme ends of the openness scale: conflict would be more likely with those others who score either very low or very high on the openness scale. Those who are very high on openness defy the norms that are prevalent in the society and thus irritate others (Klein et al. 2004); those who score very low on openness have difficulty in perspective taking and stubbornly hold on to rigid opinions. In other words, group members would have a attachment conformity for others' openness. Highly open individuals sometimes also attempt to mediate conflict (Labianca 2014), which might attract more negative ties.

Hypothesis 10: Openness to experience is positively related to (a) withdrawal, (b) aspiration, and (c) attachment conformity in conflict formation.

To summarize, we suggest that personality manifests in several key mechanisms that shape the emergence of relationships in the workplace: sociability/withdrawal, aspiration/avoidance, normative activity / attachment conformity, homophily, and heterophily. We suggest that Big Five traits would impact friendship formation as follows: extraversion would manifest itself in sociability, normative activity, aspiration and homophily; agreeableness would manifest itself in aspiration and homophily; openness as avoidance, withdrawal and homophily; neuroticism as withdrawal and avoidance. Conscientiousness would be unrelated to friendship formation. We also examine how Big Five factor personality traits shape conflict dynamics. In particular, we suggest that extraversion would reveal themselves as sociability in conflict networks, neuroticism - as sociability and aspiration, conscientiousness - as aspiration and heterophily, openness - as withdrawal, aspiration, and attachment conformity for others' openness, and agreeableness -as

withdrawal and avoidance. We also anticipate that personality traits would affect the speed of relationship formation in social networks: agreeable individuals would befriend others faster, and extraverted individuals would be more likely to get into conflict quicker. Because friendship and conflict relationships are interdependent among members of the group, our secondary goal is to examine the association between friendships and conflict ties as they co-evolved. We investigate these associations in a model system representing a large mixed-sex social organization.

3.3 Data and Methodology

3.3.1 *Participants, setting and procedure*

Setting. We studied friendship and conflict relationships among the members of the top collegiate marching band from a large public university in the southwest of the United States. The band consists of 11 sections (11-28 members each) organized by instrument. Highest-ranked performers prior to the start of band season hold leadership positions. Participants rehearse for 8-12 hours (4 practice sessions) and perform for 6-10 hours a week. We choose the marching band setting to study network dynamics for the following reasons. Social relations within the marching band are of paramount importance – band members are very engaged in a marching band and spend substantial time together. They are also highly intrinsically motivated to contribute to broader organization and community and also depict social motivation to build meaningful relationships with other band member. Moreover, a marching band is an example of a self-organizing complex social system, which can help us

understand how the properties of individuals impact processes and social relations that in turn shape collective behavior. The marching band is representative of organizations in other industries (e.g., the creative industries field), where interpersonal connections are essential to create and deliver the superior creative performance to maintain competitive advantage. Such organizations can help us understand how creative work is done these days in organizations that rely on agile teams and temporary team membership.

Participants. 220 students (72 % of active marching band members) granted consent to take part in the study, and 193 of them (63% of active band participants) completed questionnaires containing social network and personality data. Sample was gender-balanced (53% female) with mixed racial and ethnic background: 5.2% of African-American, 5.2% Asian-American, 63.7% European-American, 19.7% Latino/a, 3.6% Native American, and 2.1% other. The mean age of the participants was 19.44 ($SD = 1.51$, range 18-30 years). Respondents reported being members of the band for one to six seasons ($M = 2.17$, $SD = 1.19$).

Procedure. As a part of the larger data collection at the start (September) and the end (November) of the season, participants completed an online survey containing personality and socio-demographic questions. Additionally, respondents completed peer nomination inventory after the regularly scheduled in-person rehearsal within one week after each online assessment. Informed consent was obtained from all study participants and the data collection received approval from the University's Office of Research Integrity and Assurance.

3.3.2 Measures

Personality. At the start of the season in the online survey participants filled in a 20-item instrument from the International Personality Items Pool (Mini IPIP Big Five Personality Scale, Donnellan et al. 2006) - to assess the five-factor personality of respondents (Goldberg 1992). We choose this measure because it balances the reasonable measurement of construct content, adequate internal consistency and provides practical benefits. Each factor of the model –conscientiousness, extraversion, agreeableness, neuroticism and openness / intellect⁵ – was measured with help of 4 items. Respondents provided answers with help of the five-point scale that ranges from 1 (very inaccurate) to 5 (very accurate). The mean Cronbach alpha for factors were 0.64 for neuroticism, 0.72 for conscientiousness, 0.74 for agreeableness, 0.76 openness to experience / intellect, and 0.85 for extraversion.

Friendship. Study participants received a list with names and ID codes of all band members that provided consent for the study and were requested to write down ID codes of “band-mates who are your closest friends with whom you spend a lot of time doing different activities and whom you could count on when you need help”. Respondents could provide as many nominations as they wished. Subsequently, we constructed a binary matrix of directed friendship ties, where a friendship tie was coded as 1. Friendship has been measured twice at face-to-face data collection points after the rehearsal at the start and the end of the season.

⁵ Researchers disagree over the fifth factor in Big Five inventory. While lexical studies often use the label “Intellect / Imagination”, questionnaire studies often use “openness” or “openness to experience”. Some researchers apply these terms interchangeably (e.g. John and Srivastava, 1999); we choose to follow their lead.

Conflict. Same approach was employed to assess conflict among the band members. The item has been formulated as: “Please list the codes of the band-mates with whom you had experienced interpersonal conflict, tension, or with whom you just did not get along.” Respondents could provide as many nominations as they wished. Subsequently, we constructed a binary matrix of directed conflict ties, where a conflict tie was coded as 1. Conflict has been measured at the face-to-face data collection points at the start and the end of the season.

Socio-Demographic Controls. Consistent with past research (Brass 1985, Ibarra 1992, Selfhout et al. 2010), we controlled for selection on socio-demographic characteristics - gender (female = 1) and ethnicity/race. Because practice within the same section provided more opportunities for interaction, we controlled for whether belonging to the same section and being in a leadership position contributed to friendship selection.

3.3.3 Analysis

R-based Simulation Investigation of Empirical Network Analysis (RSiena). To account for processes of friendship and conflict network selection, we used *R-based Simulation Investigation for Empirical Network Analysis (RSiena)*, version 1.2.4. This method allows to obtain estimates of network selection processes as a function of actors’ characteristics, while statistically controlling for potentially confounding network structural processes and selection on socio-demographic variables (Snijders et al. 2010). In our analysis, we separate the impact of five personality factors - extraversion, openness to experience, conscientiousness, neuroticism and agreeableness - from network structural mechanisms (e.g., reciprocity, popularity) contribute to friendship and conflict network dynamics.

RSiena operates on assumptions that are particularly valuable for modeling network selection (Snijders et al. 2010). First, stochastic actor-oriented modeling of network dynamics views relationships as enduring states (not as brief events), which is consistent with conceptualization of friendship and conflict. Next, the model assumes that networks continuously change between two observations, and that this change follows a Markov process: the current state of the network affects the next one. Also, the model accounts for the directionality of the relationships, distinguishing between ego (person who nominates a friend) and alter (person who is being nominated). Finally, the model assumes that actors are aware of other network members, which is consistent with the marching band setting.

The model requires at least two observations to model network dynamics (Kalish, 2018). It estimates changes between these observed networks using a continuous-time Markov process that allows for a sequence of a large number of unobserved microsteps to be taken between the observation points. An evaluation function describes the “rules” that guide actors’ decisions, which are the model parameters for the hypothesized selection effects. A rate function determines how many opportunities for change occurs between waves. Model estimation uses a method of moments procedure to estimate parameters. This procedure calculates summary statistics based on the effects included in the model. These statistics are counts that represent various network structures, such as the number of gender homophilous dyads, observed at Time 2 (for details, see Snijders, Steglich, & Schweinberger, 2007). The goal during estimation is to identify parameter values that allow the model to produce networks whose summary statistics match those observed in the data (i.e.,

at Time 2). The estimation algorithm reaches convergence when t statistics representing deviations between the observed and model-implied networks are less than 0.1 for each model parameter and less than 0.25 across all of the model parameters. Model parameters are tested for significance based on a t-ratio (estimate divided by the standard error).

Selection in multiplex networks. In this study, we explore how multiple networks - friendship and conflict - contribute to each other. This co-evolution of various co-dependent networks is called multiplex testing (Skvoretz and Agneessens 2006). RSiena allows us to perform multiplex testing and assess whether change in one of the networks (e.g., conflict) leads to a change in another network (e.g., friendship). In RSiena terms “change” implies creation, maintenance, and dissolution of relationships over time (Ripley et al. 2019). In modeling multiplex network selection, both network variables act as predictor and dependent variables. Because a band member has an opportunity to consider conflict relationships when deciding on changes in friendship, and vice versa. RSiena approach supports our assumptions that friendship and conflict relationships among group members are interdependent phenomena.

3.3.4 *Model specification*

To estimate the influence of Big Five traits on friendship and conflict selection, we include rate, actor covariate, network structural, and cross-network effects in the model.

Actor covariate effects. We use the following individual covariate-related effects to shed light on network selection processes: (1) *personality trait ego effect* models the tendency for an individual with a certain level of a personality trait to send ties and represents *sociability* (positive valence of

coefficient, or +) and *withdrawal* (negative valence of coefficient, or -) mechanisms, (2) *personality trait alter effect* captures the tendency to form relationship to others who have a particular value of a personality trait and captures *aspiration* (+) or *avoidance* (-) mechanisms. The ego and alter could be interpreted as follows. A significant and positive personality trait ego parameter means that individuals with greater levels of this personality trait sent out a higher number of friendship or conflict ties over time. Negative ego parameter stands for avoidance – tendency for an individual with a certain level of a personality trait not to create or maintain network ties over time. If an alter parameter is positive (negative), it means that a person with a particular personality trait would be more likely (less likely) to be nominated by others as a friend.

We also enhance the model specification with curvilinear effects, specified as squared ego and squared alter effects, along with an interaction term between ego and alter effects (Snijders and Lomi 2019). *Ego squared effect* accounts for the curvilinear preferences in sending out ties and stands for *normative activity*. *Alter squared effect* captures *attachment conformity* –tendency to form relationships with others who fall within the desirable range of a particular trait) and accounts for the curvilinear effect on the receiver end. The positive valence in squared effects indicates a U-shaped relationship (e.g., preference for higher and lower values), and the negative valence stands for the inverted U-shape (preference for values in the middle range). For example, a negative squared ego effect for extraversion on friendship would indicate that the tendency to create and maintain friendship relationships would be lower at the extreme ends of the extraversion scale (for introverts and extraverts) and would be higher in the mid-range of extraversion. A positive squared alter effect on

openness to experience on conflict would mean that the odds of being selected as a counterpart for conflict would be higher for individuals who score low and high on openness to experience than for those scoring in the mid-range of openness to experience. An additional dyadic effect, *ego*alter effect* captures the interaction between the ego and alter parameters and indicates *homophily* (+) - the tendency of individuals to affiliate to others who are like themselves on a particular characteristic in question, -- or *heterophily* (-) - the tendency to connect to others who are dissimilar.

Structural effects. We include the following structural effects on both dependent networks acting as controls (Ripley et al. 2019): outdegree (intercept), reciprocity (tendency to reciprocate offered relationships), and transitivity. We include into the model *indegree - popularity (square root)* to model the Matthew effect for reputation - actors with a lot of incoming ties receive even more ties overtime (Merton 1968). Applied to our model, we test whether individuals nominated by many as friends would continue accumulating friends at a higher rate. Similarly, for conflict this effect also assesses whether individuals nominated by many as conflicted counterparts would continue to receive even more conflict nominations. *Outdegree popularity (square root)* indicates whether being active in making friends helps in becoming popular such that the band members who nominate more friends be nominated more often as friends by others. Applied to the conflict network, it signifies whether individuals who indicate many conflicted relationships would become popular "targets" of incoming conflict nominations. *Outdegree activity (square root)* captures whether "haters gonna hate" - people indicating many conflicted relationships would keep up their activity of engaging into conflict more than others. For friendship network, outdegree activity effect indicates

whether people active in nominating many friends would keep up nominating more friends than others (expansiveness bias, Feld and Carter 2002). We choose the square root versions of these effects to give more weight to degrees at the lower end of the continuum. We model transitivity using the following specification (Ripley et al. 2019). To assess whether the presence of multiple friends in common increased the likelihood of tie formation (“friends of my friends are my friends”, Davis 1970), we include a *geometrically weighted edgewise shared partners (GWESP)* effects. We select GWESP forward-forward (*GWESP FF*) effect to capture the tendency for transitive closure that also corrects for the number of available intermediaries. We also include GWESP backward-backward (*GWESP BB*) effect to model the tendency to form cyclical unreciprocated relationships. Additionally, a GWESP backward-forward effect (*GWESP BF*) is included to model the tendency to close structural holes. As friendships within transitive groups are usually less frequently reciprocated than friendships not embedded into groups (Block 2015), we also include a *transitive reciprocated triplets parameter*.

Cross-network effects. We account for how the dynamics in a conflict network influences the evolution of friendship, and vice versa. In particular, we test two Heiders’ suggestions (1958, 2015): (1) an enemy of an enemy is a friend, and (2) an enemy of a friend is an enemy. To model the first one, we test whether band member A would likely befriend individuals, who were named as targets of conflict by those, with whom band member A previously had conflict. We specify this effect with a cross-network effect *GWESP Forward-Forward Mix* (*gwesppFFMix*, DV: friend, IV: conflict), because we also want to weight all available opportunities for such ties. Also, to test the second hypothesis, we model

whether band members develop conflicted relationships to others with whom these friends previously had conflict using a cross-network W to agreement effect (DV: conflict, IV: friend).

Rate parameters. Network rate parameter is included in all RSiena estimations and stands for frequency with which actors could change their relationships in our friendship and conflict networks. Additionally, we test whether agreeable individuals are quicker in establishing friendships (effect of agreeableness on rate in friendship network), and whether extraverts get more frequently into conflict (effect of extraversion on rate in conflict network).

3.1 Results

3.1.1 Descriptive statistics

Descriptive statistics for the key variables are presented in Table 4. Most variables with exception of in- and out-degrees are approximately normally distributed (skewness ± 1). As in most social networks, degrees distributions are right-skewed. RSiena is a precisely a method designed to model processes of tie formation that lead to such degree distributions (e.g., the processes of preferential attachment, such as so-called Matthew effect).

Since some of the variables are skewed, we relax the assumption of normality and report Spearman's correlation coefficients. Our bivariate correlation analyses suggest that women score slightly lower on emotional stability ($r(186) = 0.26, p < 0.01$) and higher on agreeableness ($r(186) = 0.15, p < 0.05$). Neuroticism is negatively correlated with conscientiousness ($r(186) = -0.18, p < 0.05$) and extraversion ($r(186) = -0.20, p < 0.01$),

agreeableness is positively related to extraversion ($r(186) = 0.24, p < 0.01$) and openness to experience ($r(186) = 0.25, p < 0.01$).

We can observe that individuals in band leadership positions receive significantly more friendship (t1: $r(187) = 0.36, p < 0.01$; t2: $r(187) = 0.35, p < 0.01$) and conflict (t2: $r(187) = 0.24, p < 0.01$) nominations (in-degrees); the effect is stronger for friendship. Band section leaders also nominate more friends (t1: $r(187) = 0.15, p < 0.05$; t2: $r(187) = 0.17, p < 0.05$) and report more conflicted relationships (t1: $r(187) = 0.16, p < 0.05$; t2: $r(187) = 0.22, p < 0.01$).

Conscientious band mates send slightly more friendship ties during first measurement ($r(178) = 0.15, p < 0.05$). Extraverted individuals are more likely to send and receive both friendship indegrees (t1: $r(178) = 0.23, p < 0.01$; t2: $r(178) = 0.28, p < 0.01$) and outdegrees (t1: $r(178) = 0.26, p < 0.01$; t2: $r(178) = 0.20, p < 0.01$) as well as conflict indegrees (t1: $r(178) = 0.15, p < 0.05$; t2: $r(178) = 0.21, p < 0.01$) and outdegrees (t1: $r(178) = 0.21, p < 0.01$; t2: $r(178) = 0.13, ns$). Participants who score high on neuroticism reported more conflict with their band mates by the second measurement ($r(178) = 0.17, p < 0.05$).

Openness to experience was not related to friendship and conflict in- and out-degrees. Agreeable individuals sent more friendship ties (t1: $r(178) = 0.16, p < 0.05$; t2: $r(178) = 0.18, p < 0.05$) and received more friendship ties (t2: $r(178) = 0.18, p < 0.05$).

As previously established in the literature, the measurements of the same variable (e.g., number of friendship in- and out-degrees) at both measurement points are highly correlated. For example, the number of people band members nominate at measurement point 1 and 2 is positively correlated for friendship ($r(187) = 0.37, p < 0.01$) and conflict

($r(187) = 0.56, p < 0.01$). The number of friendship ties is even correlated with the number of conflict ties (t1: $r(187) = 0.34, p < 0.01$; t2: $r(187) = 0.41, p < 0.01$). Because *RSiena* is designed to model dynamic processes of tie evolution between two measurement points and our analysis is not based on multiple regression, we are not concerned with multicollinearity.

Descriptive statistics: network change. 193 band members reported 1204 unilateral friendship ties at time 1, and 1117 friendship ties at time 2. Conflict ties were less frequent but increased over time: participants indicated 241 conflict ties at time 1, and 285 conflict ties at time 2. As captured in Table 5, the density and average degree in friendship network slightly decreased and in conflict network slightly increased over time. The Jaccard indices (0.32 for friendship, 0.23 for conflict) indicate sufficient stability for *RSiena* (Ripley et al. 2019).

The estimation converged well: t-ratios for convergence are all below 0.1 and the overall maximum convergence ratio is 0.15.

Table 4: Descriptive statistics and Spearman correlations

	Mean	SD	1	2	3	4	5
1. Gender	0.52	0.50	--				
2. Band Section Leader	0.12	0.33	.05	--			
3. Conscientiousness	3.51	0.86	.02	.04	--		
4. Extraversion	3.16	1.08	.01	.07	.07	--	
5. Neuroticism	2.73	0.89	.26**	-.04	-.18*	-.20**	--
6. Agreeableness	4.08	0.68	.15*	.10	-.03	.24**	.05
7. Openness	4.01	0.68	.08	.03	-.08	.10	.05
8. In-degrees friendship t1	6.26	5.09	.07	.26**	.09	.23**	-.05
9. In-degrees friendship t2	5.71	4.57	.12	.35**	.03	.28**	.04
10. In-degrees conflict t1	1.26	2.49	.04	.14	.03	.15*	.03
11. In-degrees conflict t2	1.45	3.35	.07	.24**	-.01	.21**	.05
12. Out-degrees friendship t1	6.31	4.92	-.04	.15*	.15*	.26**	-.03
13. Out-degrees friendship t2	5.75	4.75	.12	.17*	.12	.20**	.03
14. Out-degrees conflict t1	1.25	1.86	.08	.16*	-.10	.21**	.09
15. Out-degrees conflict t2	1.45	1.87	.15*	.22**	-.02	.13	.17*

Significance levels: * $p < 0.05$, ** $p < 0.01$

Getting Along: How Five Factor personality traits contribute to friendship and conflict network dynamics.

	6	7	8	9	10	11	12	13	14
1.									
2.									
3.									
4.									
5.									
6.	--								
7.	.25**	--							
8.	.11	.07	--						
9.	.18*	.06	.57**	--					
10.	.04	-.08	.20**	.02	--				
11.	.06	-.05	.14	.25**	.50**	--			
12.	.16*	.02	.58**	.31**	.21**	.20**	--		
13.	.18*	.06	.26**	.60**	.08	.34**	.37**	--	
14.	.14	-.07	.38**	.25**	.39**	.36**	.34**	.18*	--
15.	.05	-.08	.20**	.40**	.27**	.50**	.11	.42**	.57**

Table 5: Descriptive statistics for network change

	Time 1	Time 2
Friendship		
Density	0.032	0.030
Average degree	6.24	5.78
Number of ties	1204	1117
Jaccard index	0.32	
Conflict		
Density	0.007	0.008
Average degree	1.25	1.48
Number of ties	241	285
Jaccard index	0.24	

Table 6: Results of RSiena estimation

Parameter	Est.	SE		Est.	SE		
DV: Friendship				DV: Conflict			
<i>Rate parameters</i>				<i>Rate parameters</i>			
Basic parameter rate	9.88	1.16	***	Basic rate parameter	3.89	0.46	***
Agreeableness on rate	0.23	0.09	**	Extraversion on rate	0.18	0.09	*
<i>Five Factor Model</i>				<i>Five Factor model</i>			
Extraversion ego	-0.06	0.04		Extraversion ego	0.12	0.11	
Extraversion sq. ego	-0.10	0.05	*	Extraversion sq. ego	0.02	0.09	
Extraversion alter	0.08	0.04	*	Extraversion alter	0.16	0.12	
Extraversion sq. alter	-0.04	0.04		Extraversion sq. alter	-0.22	0.11	*
Extraversion ego * alter	0.09	0.04	*	Extraversion ego * alter	0.05	0.08	
Neuroticism ego	-0.06	0.05		Neuroticism ego	-0.12	0.11	
Neuroticism sq. ego	0.06	0.05		Neuroticism sq. ego	0.13	0.11	
Neuroticism alter	0.11	0.05	*	Neuroticism alter	0.07	0.11	
Neuroticism sq. alter	0.03	0.05		Neuroticism sq. alter	0.00	0.11	
Neuroticism ego * alter	-0.09	0.05	†	Neuroticism ego * alter	-0.08	0.10	
Agreeableness ego	0.15	0.08	†	Agreeableness ego	-0.07	0.18	
Agreeableness sq. ego	-0.04	0.08		Agreeableness sq. ego	0.07	0.12	
Agreeableness alter	0.14	0.07	*	Agreeableness alter	-0.06	0.18	
Agreeableness sq. alter	-0.07	0.06		Agreeableness sq. alter	0.05	0.12	
Agreeableness ego * alter	0.04	0.10		Agreeableness ego * alter	0.15	0.16	
Coscientiousness ego	0.02	0.05		Coscientiousness ego	-0.07	0.12	
Coscientiousness sq. ego	-0.01	0.05		Coscientiousness sq. ego	-0.05	0.11	
Coscientiousness alter	-0.02	0.05		Coscientiousness alter	0.03	0.11	
Coscientiousness sq. alter	-0.02	0.04		Coscientiousness sq. alter	-0.04	0.12	
Coscientiousness ego * alter	0.02	0.05		Coscientiousness ego * alter	-0.11	0.11	
Openness ego	-0.11	0.08		Openness ego	-0.38	0.17	*
Openness sq. ego	0.02	0.06		Openness sq. ego	0.16	0.14	
Openness alter	-0.14	0.07	*	Openness alter	0.09	0.15	
Openness squared alter	-0.02	0.06		Openness squared alter	0.27	0.12	*
Openness ego * alter	-0.09	0.10		Openness ego * alter	-0.16	0.14	
<i>Structural parameters</i>				<i>Structural parameters</i>			
Outdegree (density)	-2.56	0.32	***	Outdegree (density)	-6.05	1.08	***
Reciprocity	1.86	0.15	***	Reciprocity	1.05	0.30	***

Getting Along: How Five Factor personality traits contribute to friendship and conflict network dynamics.

Transitive recipr. triplets	-0.05	0.06					
GWESP I -> K -> J (69)	-0.21	0.41					
GWESP I <- K <- J	-0.76	0.33	**				
GWESP I <- K -> J	2.20	0.70	**				
Indegree - popularity sqrt	0.40	0.13	***	Indegree - popularity sqrt	0.14	0.15	
Outdegree - popularity sqrt	-0.73	0.15	***	Outdegree - popularity sqrt	0.82	0.28	**
Outdegree - activity sqrt	-0.04	0.07		Outdegree - activity sqrt	0.20	0.23	
Outdegree - trunc (isolates)	2.24	1.43		Outdegree - trunc (isolates)	-0.56	0.78	
<i>Controls</i>				<i>Controls</i>			
Gender ego	0.13	0.09		Gender ego	0.32	0.23	
Gender alter	0.01	0.08		Gender alter	-0.25	0.19	
Same gender	-0.04	0.08		Same gender	0.34	0.17	*
Same Race	0.14	0.08	†	Same race	0.12	0.17	
Same Section	0.78	0.14	***	Same section	1.90	0.19	***
Band section leader ego	-0.20	0.15		Band section leader ego	-0.03	0.29	
Band section leader alter	0.10	0.14		Band section leader alter	0.41	0.30	
Same section leader	0.08	0.13		Same section leader	0.27	0.28	
<i>Cross-network effect</i>				<i>Cross-network effect</i>			
Transitive closure with conflict (an enemy of an enemy is my friend)	-0.32	0.30		Friend to agreement	0.67	0.15	***

Significance levels: † $p < 0.1$. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

3.1.2 Results of RSiena analysis

Our main goal was to examine how of Big Five personality traits were associated with friendship and conflict dynamics, taking the interplay between these two types or relationships into account. Results presented in Table 6 reveal that apart from conscientiousness, four traits of the Five Factor model significantly predicted friendship formation; intellect or openness also played a role in conflict network dynamics. We subsequently elaborate on the results, and add a visualization to ease understanding of the effects. To this end, we plot in Figure 1 the selection functions for friendship and conflict for those personality traits, which effects reached statistical significance in the model. To this end, we plotted for participants at various levels of a personality trait in question their preference to connect to other band members depending on their traits.

3.1.3 Effects on Friendship Dynamics

Big Five traits and friendship dynamics. Our analysis indicated that contrary to our reasoning in hypothesis 1a extraverts do not engage in sociability (parameter *extraversion ego*, est. = -0.06, *ns*). Surprisingly, we found a negative squared ego parameter for extraversion (est. = -0.10, $p < 0.05$) indicating *normative activity* (hypothesis 1b): individuals who scored in the middle range on extraversion befriended others more, whereas high and low extraverts were less likely to befriend others. Whereas band members *aspired* to befriend people who scored higher than themselves on extraversion (hypothesis 1c: *extraversion alter*

parameter, est. = 0.08, $p < 0.05$), friendship selection has been more likely among those who scored similarly on the level of extraversion (*extraversion ego*alter* est. = 0.09, $p < 0.05$) supporting personality-based *homophily* on extraversion (hypothesis 1d).

Contrary to our reasoning in hypothesis 2b, band members were more likely to befriend others with higher neuroticism (*neuroticism alter* est.=0.11, $p < 0.05$), supporting *aspiration* mechanism. We found no evidence that neurotic individuals would be more likely to withdraw from befriending others (hypothesis 2a, parameter *neuroticism ego*, est.=-0.06, *ns*). Surprisingly, we observed personality-based *heterophily* - tendency to develop friendships to dissimilar others - on neuroticism (*neuroticism ego*alter*, est.= -0.09, $p < 0.1$), suggesting that individuals with lower neuroticism prefer to select friends with higher neuroticism. Band members were also more likely to befriend individuals high in agreeableness (*agreeableness alter* est.=0.14, $p < 0.05$) supporting an *aspiration* mechanism (hypothesis 3a). Agreeable individuals befriended others faster (*agreeableness on rate* est.=0.23, $p < 0.01$); they also demonstrated signs of *sociability* in befriending others (*agreeableness ego* est.=0.15, $p < 0.1$). We found no evidence for homophily (*agreeableness ego*alter*, est.=0.04, *ns*). Conscientiousness was not related to friendship dynamics in our sample. Openness to experience was neither related to withdrawal (hypotheses 5a, *openness ego*, est.=-0.11, *ns*), nor homophily (hypotheses 5c, *openness ego*alter*, est.=-0.09, *ns*) in our sample. However, band members *avoided* individuals who scored high on openness as friends (hypothesis 5b, *openness alter* est.=-0.14, $p < 0.05$).

Effects of socio-demographic and organizational controls. There was no gender homophily in our sample: band members did not select

friends based on the same gender. Friendships were more likely between individuals in the same section (est. = 0.78, $p < 0.001$) and those who shared the same ethnic background (est. = 0.14, $p < 0.1$). While individuals holding leadership positions within the band were less likely to send friendship nominations (*band section leader ego*, est. = -0.20, *ns*), this tendency was not significant.

Structural influences on friendship dynamics. As expected, several structural network processes were associated with friendship dynamics. Participants tended to reciprocate friendships (*reciprocity parameter*; est. = 1.86, $p < 0.001$). We also assessed the range of processes in triadic closure (“friends of my friends are my friends”, Davis 1970) to test whether the presence of indirect ties improves the chances of forming a new relationship. Considering three geometrically weighted edgewise shared partners parameters (GWESP), we found that the presence of indirect ties improved the chances of forming a new relationship (GWESP *BB*, est. = -0.76, $p < 0.01$, GWESP *BF*, est. = 2.20, $p < 0.01$; GWESP *FF*, est. = -0.21, *ns*). In particular, taking a weighted range of available opportunities, if person B considers you and person C as a friend, you would be more inclined to establish friendship to C (GWESP *BF*, est. = 2.20, $p < 0.01$). A negative geometrically weighted edgewise shared partners parameter (GWESP *BB*, est. = -0.76, $p < 0.01$) indicated that weighted three cycles were not likely to form. The *negative transitive reciprocated triplets* parameter (est. = -0.05, *ns*) indicated that friendships within transitive groups were less frequently reciprocated than friendships not embedded into groups (Block, 2015), but this parameter did not reach statistical significance in our sample. We found evidence for Matthew effect: popularity in friendship networks reinforced itself

(*indegree popularity*, est. = 0.40, $p < 0.01$). In other words, individuals who had many friends received even more friendship nominations over time. Our results did not provide evidence that people active in nominating many friends continue nominating many friends (*outdegree activity square root* parameter, est. = -0.04, *ns*); however, active participants became less popular over time (*outdegree popularity square root* parameter, est.=-0.73, $p < 0.001$).

3.1.4 Effects on Conflict Dynamics

Big Five traits and conflict dynamics. Our analyses aimed to determine how Big Five personality traits were associated with conflict dynamics. Contrary to our reasoning in hypothesis 6a, extraverts did not engage in conflict more than introverts did (*extraversion ego* est.=0.12, *ns*), but they got into conflict faster (*extraversion rate* est.=0.18, $p < 0.05$). Surprisingly, we found evidence for the attachment conformity for extraversion: band members got into conflict less with those who scored on the extreme ends of extraversion (*extraversion squared alter* est.=-0.22, $p < 0.05$).

With increasing levels of openness to experience, band members withdrew from conflict (hypothesis 10a, *openness ego*, est. = -0.38, $p < 0.05$). However, band members were more likely to have conflict with those who scored either very high or very low on openness (*openness squared alter* est. = 0.27, $p < 0.05$), suggesting an attachment conformity for the mid-range of the trait (hypothesis 10c). We did not find evidence that band members got into conflict with open individuals more (hypothesis 10b, *openness alter* est. = 0.09, *ns*).

Surprisingly, we found that -- beyond extraversion and openness

to experience -- Big Five personality traits of conscientiousness, emotional stability, and agreeableness were not associated with conflict emergence, thus dismissing hypotheses 7a, 7b, 8, 9a, and 9b.

Structural influences on conflict dynamics. Our analysis indicated that conflict is usually mutual (*reciprocity parameter*; est. = 1.05, $p < 0.001$). Those who nominated many conflicted ties, also became ‘popular’ in conflict networks (*outdegree popularity* est. = 0.82, $p < 0.05$). Band members who reported many conflict incidents with others did not continue to experience conflict with others (*outdegree activity* est. = 0.51, *ns*) and Matthew effect (‘rich get richer’) did not hold in conflict network – there was no tendency of those receiving many conflict nominations to receive even more (*indegree popularity* est. = 0.14, *ns*).

Effects of controls. Band members experienced more conflict with others of the same gender (*gender homophily*, est.=0.34, $p < 0.05$). Conflict was also more likely within the same section (*same section*, est.=1.90, $p < 0.001$).

3.1.5 Cross-network effects

We also found that processes in conflict and friendship networks influenced each other. In particular, we found evidence for an interpersonal process that could be described as “the enemies of my friends are my enemies” (friend to agreement on conflict parameter,). We examined two cross-network transitivity effects. We did not find evidence for Heiders’ (1958, 2015) suggestion that an enemy of an enemy turned into a friend (specified as a *cross-network GWESP FF*, est.= -0.32, *ns*). However, we found evidence for the cross-network transitivity specified with a ‘friend to agreement’ parameter (est.=0.67, $p < 0.001$),

which in Heiders' words mean "my friends' enemy is my enemy". In other words, band members established conflicted ties to others with whom their friends previously had conflict.

3.1.6 Assessing goodness of fit

We assessed goodness of fit for statistical network models (Ripley et al. 2019). Results of the sienaGOF indicated that our model specification provided adequate fit to the data. Detailed information is available upon request.

3.2 Discussion

We explored how Five Factor personality traits were associated with friendship and conflict network dynamics in a medium-sized gender-balanced organization. We documented how personality traits were associated with a comprehensive array of interpersonal mechanisms contributing to network selection, including (a) sociability (tendency to initiate and maintain a relationship), (b) withdrawal (tendency to forgo the opportunities to create a relationship), (c) aspiration (preference to form a relationship to others with particular - e.g. higher -value), (d) avoidance (tendency to avoid others with a particular trait), (e) normative activity (tendency to form ties according to an existing group norm), (f) attachment conformity (tendency to form relationships within others who fall within the desirable range on particular trait), (g) homophily (attraction to those with similar value), and (h) heterophily (attraction to those with different value). We found that these personality-related mechanisms operated

together and shaped the processes through which friendship and conflict networks changed.

In friendship network selection, agreeable individuals were more active in befriending (sociability). We also observed avoidance tendencies for open individuals, normative activity for extraversion, aspiration tendencies for extraversion, agreeableness and neuroticism, homophily for extraversion, and heterophily for neuroticism. Agreeable individuals also bonded faster with their peers. On the conflict side, we found withdrawal and attachment conformity for openness to experience and attachment conformity for extraversion in others. Extraverted individuals also tended to get into conflict faster.

3.2.1 Theoretical implications

By focusing on network formation mechanisms, our study contributed to understanding how network ties form (Borgatti et al. 2009) and elaborated on how people “get along and get ahead” in organizational settings (McAdams 2015), advancing network perspective on organizations (Borgatti and Foster 2003, Casciaro et al. 2015, Kilduff and Tsai 2003). Our results shed light on micro-foundations of network formation (Taselli et al. 2015) by (1) identifying how personality contributes to dynamics of intra-organizational networks (Feiler and Kleinbaum 2015, Hampson 2012, Nestler et al. 2015, Sasovova et al. 2010, Tasselli et al. 2015), (2) elaborating on interplay between positive and negative networks, and (3) applying and extending the new methodological approach to understand how individual characteristics manifest in mechanisms that contribute to network evolution (Snijders and Lomi 2019).

How personality contributes to intra-organizational network dynamics. First, we trace the origins of social network emergence (Klein et al. 2004, Burt, Kilduff, and Tasselli 2013) by specifying the underlying *mechanisms* of how personality contributes to friendship and conflict selection in organizational settings. In doing so, we answer calls to identify how intra-organizational networks reflect the psychology of individual members of a group (Fang et al. 2015, Feiler and Kleinbaum 2015, Hampson 2012, Nestler et al. 2015, Sasovova et al. 2010, Tasselli et al. 2015). Taking the work by Snijders and Lomi (2019) as a starting point, we applied the model specification with quadratic effects to map interpersonal mechanisms that impact processes through which personality manifests in interpersonal relations (Hampson 2012): sociability, withdrawal, aspiration, avoidance, homophily, heterophily, normative activity, and attachment conformity. In doing so, we showed that personality traits were associated with distinct network patterns in group settings (Burt 2012, Tasselli et al. 2015).

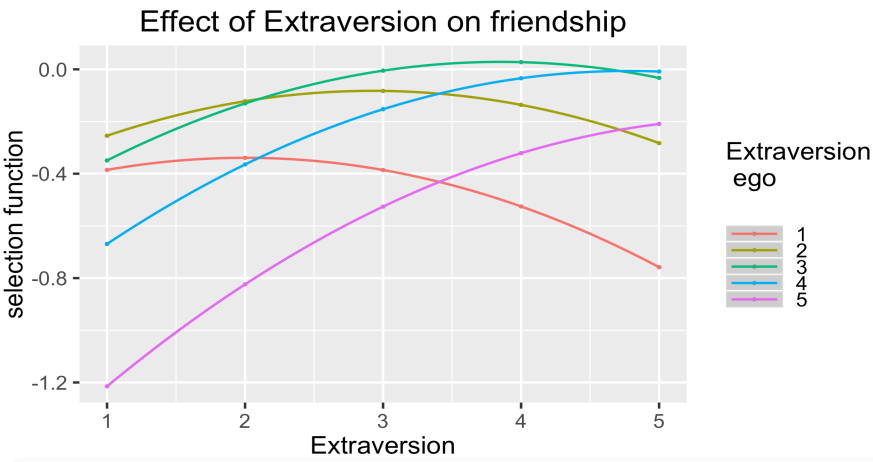
How Big Five personality traits contribute to friendship and conflict dynamics. Moreover, our results contribute to the literature on Big Five personality traits and provide a more nuanced understanding of how Big Five traits contribute to formation of friendship and conflict. In particular, our results confirmed that, over time, extraverts successfully attracted and held social attention (Ashton et al. 2002, Feiler and Kleinbaum 2015, McAdams 2015). However, we provided a more nuanced account on the role of extraversion as related to social network dynamics. Band members exhibited normative activity in befriending others: the tendency to form friendship was higher for individuals scoring in the middle range of extraversion, whereas introverts and high extraverts

tended to befriend others less (Figure 3). Whereas this pattern makes sense for introverted individuals who are less likely to send out friendship ties, for highly extraverted individuals, these findings are seemingly surprising. Figure 3 illustrates that this tendency at the higher end of extraversion might emerge due to a combination of several effects operating together: people prefer to befriend extraverted others (aspiration), which in combination with homophily preference leads to a scenario when extraverts reach saturation levels in terms of the number of friends that they can have. We speculate that these tendencies might be amplified by the Matthew effect (popular people are getting even more popular). Together, these tendencies - aspiration, homophily (preference for the similar levels of social interaction), and Matthew effect, - might explain why high extraverts contribute less to selection function. In other words, an extraversion-based homophily (Feiler and Kleinbaum 2015, Selfhout et al. 2010), aspiration to connect to extraverts and limitation on the carrying capacity in friendship might explain the emergence of normative activity.

Contrary to past research (Battistoni and Fronzetti Colladon 2014, Klein et al. 2004), we observed aspiration in befriending neurotic individuals. In other words, persistent patterns of negative emotions and emotional volatility did not scare away the band members in our sample and they remained as attractive friendship partners. Figure 4 reveals that aspiration tendencies were higher among emotionally stable individuals. This seemingly surprising pattern may emerge because band members may re-evaluate in a more positive light their initial negative view of emotionally volatile individuals and start viewing their contributions to the groupwork with a greater appreciation (Bendersky and Shah 2013). In

sum, our findings generate the new evidence underscoring positive consequences of neuroticism for social dynamics that is in contrast the view that neuroticism has an exclusively negative impact on relationships (Klein et al. 2004, Schulte et al. 2012, McAdams 2015).

Figure 3: Social selection function for extraversion on friendship.



The continuous curves represent participants' preferences to befriend others with certain levels of extraversion, all else held constant. The x-axis represents alters (receivers) level of extraversion, y-axis - contribution to objective function, the curves are plotted for different levels of extraversion on the sender (ego). For example, the purple curve represents that a participant with a score of 5 on extraversion would have a preference to befriend others with higher level of extraversion.

Figure 4: Social selection function for neuroticism on friendship.

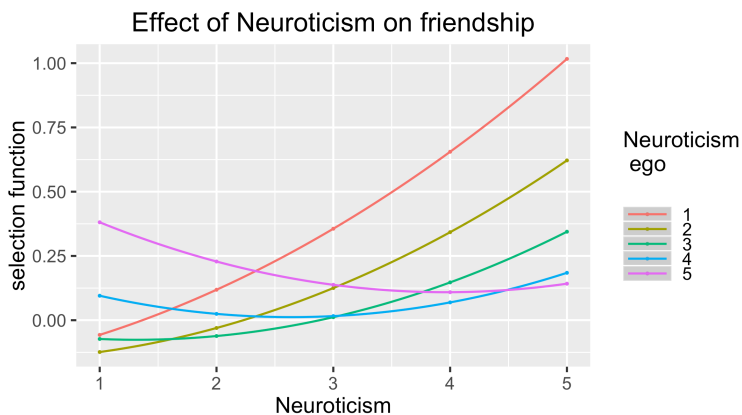


Figure 5: Social selection function for agreeableness on friendship.

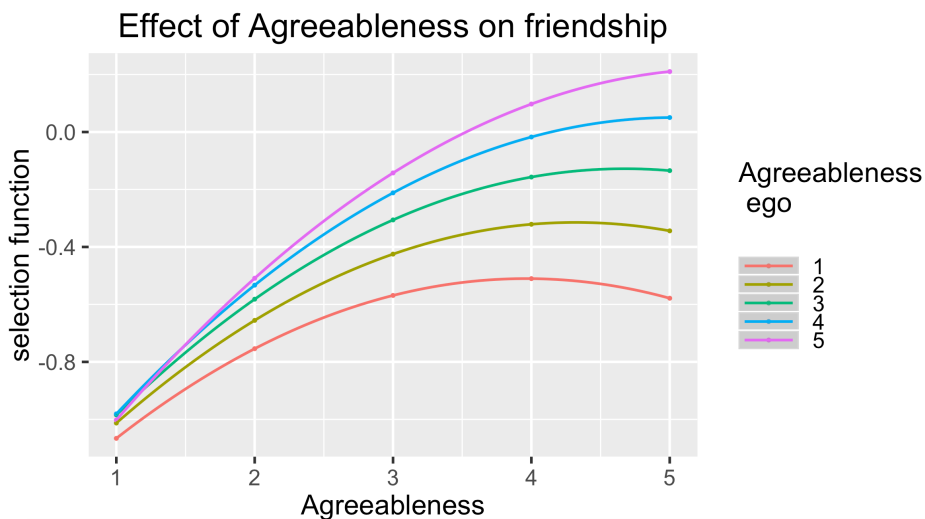


Figure 6: Social selection function for conscientiousness on friendship

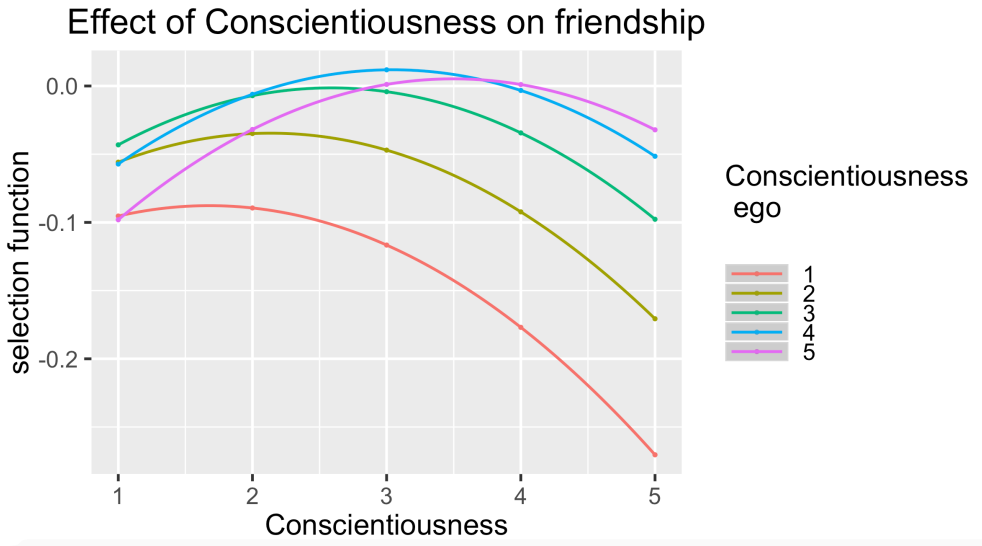


Figure 7: Social selection function for openness to experience on friendship

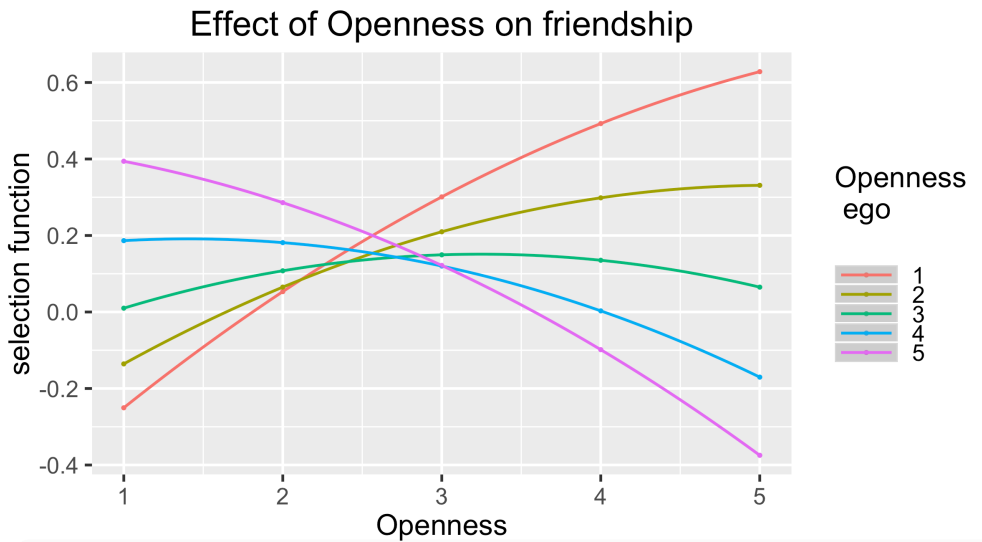
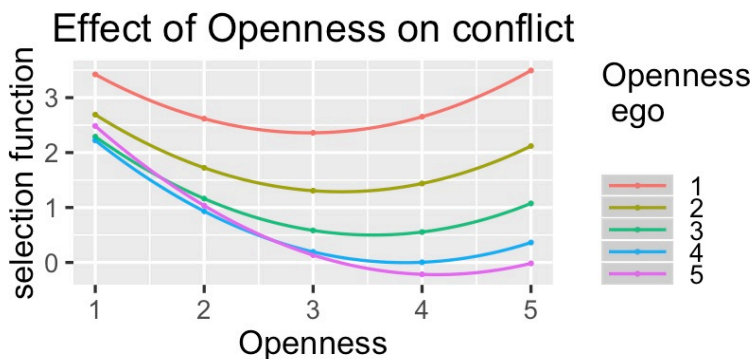


Figure 8: Social selection function for openness on conflict



We demonstrated how agreeable individuals accrued positive relationships. In our sample, agreeableness manifested itself as sociability and aspiration: agreeable individuals are more likely to select friends and to be selected by others (Figure 5). Moreover, we found that agreeable people befriend others quicker. Contrary to previous findings by Selfhout et al. (2010), we found no evidence for agreeableness-based homophily. Several explanations to the absence of effect are feasible. First, our specification of homophily with quadratic effects captures more nuanced estimates of the parameters. Second, if we compare mechanisms of agreeableness with mechanisms of extraversion, we could suggest that the combination of mechanisms does not lead to homophily on agreeableness: where the mechanism of normative activity (curvilinear ego effect) operates on extraversion, which indicates friendship saturation for extraverts, a sociability mechanism (linear ego effect) does not lead to selecting friends with certain level.

Our findings also clarified the previously documented mechanisms in which open individuals moved to the periphery of friendship and to the core of adversarial networks (Klein et al. 2004). We found that avoidance

was at play in friendship selection. Further examination of Figure 7 reveals that individuals who scored low on openness had a preference to connect to individuals who scored higher on openness. However, this tendency reversed for open individuals: they avoided others who scored higher on openness. While the combination of these effects might suggest heterophily, our statistical analysis suggests that avoidance tendencies dominated in this sample.

We also contributed to the scarce literature on how Big Five personality traits impact negative tie formation in groups (Labianca 2014). Our results echo Labianca et al. (1998) suggestion that with increasing opportunities for social interaction, more differences would be revealed providing fertile ground for conflict emergence (as Figure 8 illustrates, the odds of conflict are the highest for extraverts). We also found that band members exhibited attachment conformity for extraversion: they have gotten into conflict less with those who scored high and low on extraversion. Additionally, we found that extraversion affected the speed of conflict emergence.

Moreover, we found attachment conformity for others' openness in conflict: the conflict was more likely with others who 'deviated from the norm' and scored either low or high on openness. As Figure 8 illustrates, while those who scored low on openness were most likely to get into conflict, everyone was more likely to develop conflict more with highly conservative and traditional individuals and with very original and creative individuals. The context of our study might explain the attachment conformity for openness within the group: as marching band requires coordination among the members and 'dancing out of tune' might negatively impact performance and would not be greeted with

enthusiasm. While Klein et al. (2004) suggested that open individuals might annoy others with their non-conventional ideas, we found that open individuals withdrew from conflict. In our setting conflict was more likely for those who scored low on openness (Figure 8). Openness might impact network characteristics differently when new interpersonal experiences matter (Selden and Goodie 2018), e.g., in transitional periods for organizations, when openness could facilitate new social connections, or in other creative settings, which are more conducive to individual expression. Because of the well-established connection between openness and creativity (McCrae 1987, Feist 1998), future research might want to explore how openness contributes to interpersonal mechanisms across contexts in which the importance of creativity varies.

Contrary to our reasoning, we documented no evidence that other personality traits –agreeableness, neuroticism or conscientiousness – shape conflict dynamics in our sample.

Finally, personality traits contributed to the speed of relationship formation in groups: agreeable individuals befriended others and extraverts got into conflict faster. Thus, our findings not only specify *how* personality traits affect relationship dynamics, but also *how fast* these processes unfold, extending pioneering work by Sasovova and colleagues (2010).

Interplay between positive and negative networks. Second, our focus on co-evolution of friendship and conflict networks illustrated how different ties influence each other (Schulte et al. 2012, Selden and Goodie 2018, Snijders et al. 2013) and illuminated how networks enabled and constrained social behavior within organizations. Coevolution perspective explains how the social environment emerges from individual choices and

behavior; this co-created social setting subsequently provides opportunities and constrains for individuals' action (Tasselli et al. 2015). We observed that band members established conflict to the enemies of ones' friends, and did not befriend enemies of own enemies. In other words, embeddedness in one type of network (friendship) enabled and constrained action in another network (conflict). Thus, in our sample conflict spread through friendship. This process, in turn, contributes to subgroup formation and emergence of clustering in larger social groups.

Thus, this study illustrated *how* negative interactions spread in the system of personal relationships (Labianca 2014, Labianca and Brass 2006). Our results echo those of Doreian and Krackhardt (2001) that people were less likely to befriend an enemy of an enemy than to 'adopt' enemies of their friends. In other words, friends come with enemies attached. When we select certain friends, we are more likely to get into conflict with our friends' adversaries. This implies that clustering in our social settings occurs via friendship and not conflict route.

Negative ties exhibited different dynamics unlike the positive ones (Labianca 2014). We identified similarities and differences among interpersonal processes contributing to the dynamics of friendship and conflict networks. We found that sending a lot of ties makes you less - not more - popular: activity in friendship networks decreases your popularity, and activity in conflict networks boosts negative nominations. We were surprised to find reciprocity in conflict networks. Labianca and Brass (2006) previously argued that people tend to hide negative ties as they violate social norms and, therefore, reciprocity would be less prevalent in negative networks, such as conflict, than in positive networks such as friendship. Our explanation is that reciprocated conflict emerges over

time: while it might be easier to avoid fleeting negative interactions or feelings in the short run, it is harder to ignore more stable patterns of negative interactions. Thus, conflict might operate differently from other types of negative ties, such as negative feelings or judgments that are easier to hide. Future research is warranted to identify contingency factors that contribute to reciprocation of conflict.

3.2.2 Strengths, limitations and directions for future research

These revealing insights were facilitated by new generation of analytical tools and modeling: *RSiena* software enabled us to analyze the impact of individuals attributes on co-evolution of two networks (Snijders et al. 2010) by accounting for the impact of personality on network dynamics, interdependencies within longitudinal network data, and mutual influences between two distinct networks. Our analytical approach, longitudinal sample of a substantial size, and organizational setting constitute the major strengths of the study. Whereas we identify process-based theorizing, analytical approach and rigorous implementation as the papers' strengths, its findings are qualified by several limitations. Because not all marching band members provided consent and chose to participate in the study, we worked with the incomplete social network data. To counter this limitation, we used the standard missing data imputation procedure to minimize bias in parameter estimates (Huisman and Steglich 2008).

While our findings could generalize to similar organizations that rely on agile teams and self-organization - particularly in leisure and voluntary fields, - as in most field studies organizational context puts boundaries on result interpretation. Our results might be especially

valuable for organizations where social relationships are essential to deliver the superior creative performance in order to maintain competitive advantage and to contribute to a broader community. We recommend confirmatory studies across various organizational contexts: it could be that extraverted members self-selected themselves into a marching band, amplifying the effects of extraversion. Omitted variables might have influenced relationship formation in this sample, e.g., we do not capture the impact of romantic relationships on friendship or conflict tie selection.

Directions for future research. We were puzzled by the limited effects of social factors and personality on conflict network selection. Future research needs to distinguish between task and relationship conflict (Jehn and Mannix 2001), as personality might impact these two types of conflict differently. For instance, we hypothesize that conscientiousness might contribute to emergence of task conflict while having no impact on relationship conflict, and the lack of emotional stability might be more conducive to relationship conflict. Similarly, employees might be able to develop friendships with others they disagree in in terms of how things need to be done but might avoid others with whom they have personal conflict. Another direction for future research is to look into why personality traits trigger the network selection mechanisms, e.g., shed more light on why people connect to dissimilar others on the trait of neuroticism. Moreover, researchers might want to specify how certain personality traits - e.g., neuroticism—might affect how people perceive their relationships (Selden and Goodie 2018).

Whereas our study explores the underlying mechanisms of social relationships and thus refrains from making any predictions or recommendations, we note that understanding these mechanisms opens

the door for potential interventions. We note a few implications for people working in organizations. First, conflict is not localized to the conflicting parties but keeps on spreading through their friends. Thus, it is advisable that efforts in conflict mediation within organizations to take this into account. Second, one way to balance social relationships within organizations is to reach out to distressed individuals through existing positive (i.e., friendship) social ties. Third, previous research established that openness to experience fuels up idea generation and innovation within organizations (Kaufman et al. 2016, George and Zhou 2001). Unfortunately, our study indicates that social processes sometimes inhibit this potential source of innovation: people avoid –and even get into conflict with– individuals open to experience. To leverage the innovative potential within the organizations, organizations could explore interventions fostering inclusion of open individuals.

Social networks matter in organizations: they affect individual and group performance (Burt et al. 2013, Fang et al. 2013, Kilduff and Brass 2010), career progression (Brass et al. 2004) and innovation (Kilduff and Tsai 2003). The emerging debate on the micro-foundations of social networks (Tasselli et al. 2015) quests for the origins and processes of social structures. Our study contributes to this debate by extending our understanding of how people do and do not get along and get ahead socially in organizational settings. We found that Big Five personality traits are associated with a range of mechanisms that contribute to network selection. We also studied the interdependencies between friendship and conflict networks and found that conflict spreads through friendship. By employing new methodology, this study opens up a new

chapter in understanding the processes of network selection and advances the dynamic paradigm in personality and social network research.

3.3 Conclusion

Application of the dynamic social network analysis methods allowed us to unravel personality contributions to the social processes unfolding in organizations. We found that Big Five personality traits contributed to friendship and conflict dynamics through a range of interpersonal mechanisms: sociability, withdrawal, aspiration, avoidance, normative activity, attachment conformity, homophily and heterophily. Big Five traits impacted friendship selection as follows: extraversion triggered aspiration, homophily and normative activity, agreeableness – aspiration, openness to experience – avoidance, neuroticism – aspiration and heterophily. Openness to experience manifested as withdrawal from conflict and attachment conformity. We found support for the “an enemy of my friend is my enemy”: conflict spread through friendship relationships. Taken together, these results help us understand how people get along in organizations – and how they don’t, –and offer insight into dynamics that affect individual and organizational outcomes.

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Getting Along: How Five Factor personality traits contribute to friendship and conflict network dynamics.

Executive Summary

How people get along and get ahead socially within the organizations? This dissertation studies the role of personality and interpersonal perceptions in social network dynamics. It presents two studies that advance our understanding on how friendship unfolds within the organizations. The first study looks into how proactive personality personality- individuals' inclination to shape their environment and foster change (Bateman & Crant, 1993) - contributes to the formation of perceptions of competence and friendship in teams. The second study looks into how Five Factor personality traits add to dynamics of friendship and conflict networks and looks into how friendship and conflict mutually influence each other.

Both studies aim at three key contributions to organization studies. First, they specify processes and mechanisms through which personality affects social network dynamics, thus responding to calls to study how individual actions contribute to formation of social structures (Tasselli et al., 2015). Second, both studies address how two types of networks mutually influence each other (perceptions of competence and friendship, Chapter 2; friendship and conflict, Chapter 3), advancing our understanding of how multiplex networks evolve. Finally, this dissertation aims to

distinguish structural influences from individual actions by applying stochastic actor-based modeling of social network dynamics. I elaborate on key insights below.

3.3.1 Study 1

The first study zooms in on social networks in the small systems – teams. It looks into how perceptions co-evolve with actual relationships, and how stable individual differences affect this process. The study focuses on how perceptions of competence and influence friendship formation. It suggests that friendship co-evolves with perceptions of competence: people prefer to build friendship relationships with competent others, and attach higher competence attributions to their own friends. It also explores the role of proactive personality in this process. We test whether proactive individuals appear as more competent to their team members. Six hundred fifty participants in 130 teams provided the data to test these hypotheses. Stochastic actor based modeling of network dynamics (RSIENA) reveals that perceptions of competence and friendship form a self-reinforcing loop: seeing others as competent fosters friendship, and being friends helps to establish and maintain a competent image of others. The results also help us understand how proactive people leverage on this process: they recognize actual competence better and appear competent to their team members. This study contributes to our understanding of how networks within the organizations evolve by elaborating on role of

personality and interpersonal perceptions. Results demonstrate that team members co-create their social network positions: proactive individuals convey a competent image that their teammates choose to follow upon in developing friendships.

3.3.2 Study 2

Study two explores how the Five Factor personality traits contribute to friendship and conflict dynamics in a marching band (193 participants, 53% female). The Five Factor traits consist of extraversion, agreeableness, neuroticism (also called emotional stability), conscientiousness and openness to experience. We suggest various interpersonal mechanisms through which personality is displayed: (a) activity / withdrawal, (b) aspiration / rejection, (c) homophily/ heterophily, and (d) conformity/normative activity. Additionally, we explore the interplay between friendship and conflict networks: do people come into conflict with those others whom their friends already have a conflict with (an enemy of a friend is an enemy) or do they build friendship relationships to enemies of their own enemies (an enemy of an enemy is a friend). Results suggest that personality contributes to friendship formation through a range of mechanisms: activity holds for agreeableness, withdrawal for openness, (b) aspiration for extraversion / rejection for openness, (c) homophily for extraversion/ heterophily for neuroticism and (d) normative activity for extraversion. The data revealed that open individuals withdraw from conflict. Conflict was

more likely with others who scored in a mid-range of extraversion, and more likely with those who scores at the extreme ends of the openness scale. These results suggest that conflict within groups spreads through friendship (“an enemy of my friend is my enemy’), which helps us to understand how groups divide. This study helps us to understand how individual characteristics such as personality contribute to how people get along –or not– within organizations.

Overall, this dissertation provides a more refined understanding of origins of social network dynamics and the role of personality in this process. In other words, it sheds light into how people get along and get ahead socially within the organizations.

Samenvatting

Hoe gaan mensen met elkaar om binnen organisaties? In dit proefschrift wordt onderzocht hoe persoonlijkheid en interpersoonlijke waarnemingen de dynamiek van sociale netwerken beïnvloeden. Hierin worden twee studies gepresenteerd die ons begrip over het ontstaan van vriendschap binnen organisaties vergroten. Het eerste onderzoek bestudeert hoe de persoonlijkheidskenmerk 'proactive persoonlijkheid' - het vermogen van een individu om zichzelf of haar / zijn omgeving te veranderen (Bateman & Crant, 1993) - bijdraagt aan de vorming van de perceptie van competentie en vriendschap binnen teams. Het tweede onderzoek bestudeert hoe de Five Factor persoonlijkheidskenmerken bijdragen aan de dynamiek van vriendschaps- en conflictnetwerken, alsmede hoe vriendschap en conflict elkaar beïnvloeden.

Beide studies leveren drie bijdragen aan het organisatietheorie. Ten eerste geven zij inzicht in de processen en mechanismen waarmee persoonlijkheid sociale interactie beïnvloedt, waarmee zij gevolg geven aan de vraag de bijdrage van individuele handelingen aan de vorming van sociale structuren te onderzoeken (Tasselli et al., 2015). Ten tweede belichten beide onderzoeken hoe twee soorten netwerken elkaar wederzijds beïnvloeden (perceptie van competentie en vriendschap, hoofdstuk 2; vriendschap en conflict, hoofdstuk 3), waarmee onze kennis over de ontwikkeling van

multiplexe netwerken wordt vergroot. Tot slot heeft deze dissertatie tot doel om verschillende structurele invloeden van individuele handelingen te onderscheiden door de toepassing van stochastische-actormodellen op sociale netwerken.

3.3.3 Onderzoek 1

Het eerste onderzoek richt zich op sociale netwerken in kleine systemen: teams. Hierin wordt bestudeerd hoe percepties zich gelijk met de eigenlijke relaties ontwikkelen, en hoe vaststaande individuele verschillen dit proces beïnvloeden. Het onderzoek gaat dieper in op hoe percepties van competentie de vorming van vriendschap beïnvloeden. Het stelt dat vriendschap zich tegelijkertijd ontwikkelt met de perceptie van competentie: mensen sluiten liever vriendschappen met competente mensen en hechten een groter competentiewaarde aan hun eigen vrienden. Tevens wordt de rol van het persoonlijkheidskenmerk 'proactive persoonlijkheid' onderzocht in dit proces. Wij onderzochten of individuele deelnemers, die hoog scoorden op proactiviteit, competenter overkomen dan hun teamgenoten. De gegevens voor de onderbouwing van deze theorieën werd verzameld onder 650 deelnemers in 130 teams. Stochastische-actormodellen van sociale netwerken (RSIENA) onthullen dat de waarnemingen van competentie en vriendschap een zichzelf versterkende cirkelbeweging vormen: door anderen als competent te beschouwen

wordt de vriendschap gevoed, en door bevriend te zijn kun je het beeld van de competentie van anderen bepalen en in stand houden. De resultaten vergroten ook ons inzicht in hoe proactieve mensen profiteren van dit proces: zij kunnen de competenties van hun teamgenoten beter erkennen en dragen een competent beeld van henzelf uit naar anderen. Dit onderzoek draagt bij aan ons begrip van de ontwikkeling van netwerken binnen organisaties door gedetailleerder in te gaan op de rol van de persoonlijkheid en interpersoonlijke waarnemingen. De resultaten laten zien dat teamgenoten hun posities in het sociale netwerk gezamenlijk creëren: proactieve individuen stralen een competentie uit die hun teamgenoten in ontluikende vriendschappen willen navolgen.

3.3.4 Onderzoek 2

Het tweede onderzoek bestudeert hoe de Five Factor persoonlijkheidskenmerken bijdragen aan de dynamiek van vriendschap en conflict binnen een fanfareorkest (193 deelnemers, waarvan 53% vrouwelijk). De Five Factor kenmerken bestaan uit: extraversie, service-gerichtheid, zorgvuldigheid, emotionele stabiliteit, en open staan voor nieuwe ervaringen. Wij stellen verschillende interpersoonlijke mechanismen voor waarmee een persoonlijkheid wordt gepresenteerd: (a) bedrijvigheid / terugtrekkende houding, (b) aspiratie / afwijzing, (c) homophilie (gelijkenissen) / heterophilie (verschillen), en (d) conformerende /normatieve activiteit. Daarnaast onderzoeken wij de relatie tussen

vriendschaps- en conflictnetwerken: raken mensen in conflict met anderen met wie hun vrienden al een conflict hebben ('een vijand van mijn vriend is mijn vijand') of bouwen zij een vriendschap op met vijanden van hun eigen vijanden ('een vijand van mijn vijand is mijn vriend')? De resultaten laten zien dat persoonlijkheid bijdraagt aan de vorming van vriendschap middels enkele mechanismen: service-gerichte mensen vertonen bedrijvigheid, open mensen vertonen een terugtrekkende houding, (b) mensen willen graag bij met extraverte vrienden zijn (aspiratie) / open mensen worden vaak afgewezen, (c) mensen met een gelijk niveau van extraversie (homophilie) of met een ongelijk niveau van emotionele stabiliteit (heterophilie) raken eerder bevriend en (d) extraversie is ook met normatieve activiteit verbonden. De gegevens toonden aan dat open individuen een conflict mijden, terwijl een conflict opzoeken aannemelijker was voor diegenen die in het middengebied scoorden voor extraversie, evenals voor diegenen die ofwel heel laag, ofwel heel hoog scoorden op openheid. Deze resultaten suggereren dat conflicten in groepen zich verspreiden via vriendschap ('een vijand van mijn vriend is mijn vijand') waardoor we meer inzicht krijgen in hoe groepen verdeeld kunnen raken. Het onderzoek helpt ons begrijpen hoe individuele kenmerken, zoals iemands persoonlijkheid, bijdragen aan hoe mensen met elkaar omgaan - of juist niet - binnen organisaties.

Samenvattend gaat dit proefschrift gedetailleerd in op de oorsprong van de dynamiek in sociale netwerken en de rol van een

persoonlijkheid in dat proces. Met andere woorden: het verschaft inzicht in hoe mensen met elkaar omgaan binnen organisaties.

Автореферат

Как люди ладят между собой и строят отношения в группах? В этой диссертации изучается роль индивидуальных личностных особенностей в динамике межличностных отношений (социальных сетей). В работе представлены два исследования, помогающих нам понять, как внутри организаций и групп формируются отношения между людьми. В первом исследовании рассматривается вопрос о том как проактивность (черта личности), под которой понимается устойчивое стремление влиять на окружающую ситуацию и способствовать изменениям (Bateman & Crant, 1993), влияет на формирование дружбы в командах. Во втором исследовании рассматривается влияние личностных черт "Большой Пятёрки" на динамику дружбы и развитие конфликтов.

Оба исследования вносят свой вклад в изучение того, как личностные особенности способствуют формированию отношений внутри групп. Во-первых, они определяют процессы, с помощью которых личностные особенности влияют на динамику социальных отношений. Во-вторых, в них рассматриваются взаимосвязи между различными типами отношений, что помогает лучше понять динамику социальных сетей. В первом исследовании рассматривается взаимосвязь между представлениями членов команды о компетентности друг друга и влияние этих представлений на возникновение дружбы между ними, во втором исследовании - взаимосвязь между дружбой и конфликтом.

Наконец, диссертация рассматривает роль личности в формировании связей. Стохастическое агентное моделирование динамики социальных сетей помогает нам более точно определить факторы и процессы, происходящие при формировании отношений, и разделить влияние социальных процессов от воздействия индивидуума на них.

3.3.5 Первое исследование

Первое исследование рассматривает формирование отношений в командах. В нём рассматривается, как проактивность и представления о компетентности других влияют на развитие дружбы в командах. Исследование рассматривает, как дружба развивается вместе с представлениями о компетентности: предпочитают люди строить дружеские отношения с компетентными людьми или приписывают они компетентность своим друзьям? Мы протестировали эти гипотезы на данных, полученных от 650 участников из 130 команд. Команды участвовали в соревновании по разработке и внедрению стратегии на виртуальных предприятиях в течение 10 недель. Результаты исследования выявили, что участники приписывали более высокую компетентность проактивным членам команды. Результаты, полученные с помощью стохастического агентного моделирования динамики социальных сетей показали, что дружба и представление о компетентности влияют друг на друга: участники дружили с теми, кого они считали компетентными, и приписывали компетентность своим друзьям. Анализ полученных данных также помог понять, как активные люди выигрывали в этом процессе: они лучше распознавали истинную компетентность других и создавали себе образ компетентного человека, на которой 'велись' другие участники. Проведенные исследования способствуют пониманию того, как проактивность и

представление о компетентности друг друга влияют на формирование отношений в командах.

3.3.6 Второе исследование

Второе исследование посвящено тому, как "Большая Пятёрка" личностных черт способствует развитию дружбы и конфликта в инструментальном ансамбле (193 участника). "Большая Пятёрка" личностных черт включает в себя экстраверсию (общительность), доброжелательность (дружелюбие), добросовестность (сознательность), невротизм (в некоторых исследованиях - эмоциональную стабильность), и открытость новому опыту (иногда называемую интеллектом). Мы рассматриваем различные механизмы межличностного общения, с помощью которых "Большая Пятёрка" проявляется в общении и влияет на формирование отношений. В частности, мы предлагаем следующие межличностные механизмы: (а) активность / избегание, (б) аспирация (влечение) /отторжение, (в) гомофилия /гетерофилия, и (г) соответствие / нормативная деятельность. Кроме того, исследованы взаимодействия между процессами, формирующими дружбу и конфликт. К примеру, мы изучаем вопрос, вступают ли люди в конфликт с теми, с кем у их друзей уже есть конфликт ("враг моего друга – мой враг"), или же они предпочитают строить дружеские отношения с врагами своих врагов ("враг моего врага – мой друг"). Результаты показывают, что "Большая Пятёрка" способствует формированию дружбы с помощью целого ряда механизмов. Доброжелательные люди проявляли большую активность в попытках подружиться. Несмотря на то, что люди демонстрировали стремление подружиться с экстравертами (общительными людьми), люди среднего уровня общительности дружили с другими больше (механизм нормативной деятельности). Конфликты также были

более вероятны между участниками среднего уровня общительности. Мы наблюдали, что участники нашего исследования в итоге дружили с теми, кто соответствовал им по уровню общительности (экстраверсии). С другой стороны, гетерофилия (предпочтение строить отношения с людьми, не похожими на себя) наблюдалась среди людей, не похожих друг на друга по уровню эмоциональной стабильности (невротизма). Участники инструментального ансамбля избегали дружить с теми, кто был открыт новым впечатлениям, несмотря на то, что участники с высоким уровнем открытости избегали конфликтов. Конфликты были менее вероятны среди участников со средним уровнем открытости. Также наши результаты показали, что конфликт распространялся через дружбу ("враг моего друга – мой враг"). Данные исследования помогают понять, как личностные особенности способствуют формированию отношений внутри организаций.

В целом, диссертация обеспечивает более точное понимание истоков динамики социальных сетей и роли черт личности в этом процессе. Другими словами, она вносит вклад в понимание того, как внутри групп формируются отношения между людьми.

Zusammenfassung

Wie arrangieren sich Menschen innerhalb von Organisationen? Diese Dissertation untersucht inwieweit Persönlichkeit und die Wahrnehmung von zwischenmenschlichen Beziehungen soziale Netzwerkdynamiken beeinflussen. In den zwei vorgestellten Studien wird erforscht, wie sich Freundschaften innerhalb von Organisationen entwickeln. In der ersten Studie wird untersucht, inwieweit Proaktive Persönlichkeit (proactive personality) zur Bildung von Freundschaften in Teams beiträgt. Proaktive Persönlichkeit ist die Neigung der Individuen, ihre Umgebung zu formen und Veränderungen zu fördern (Bateman & Crant, 1993). Die zweite Studie untersucht, inwieweit die Big Five (Fünf Faktoren Modell der Persönlichkeit) zur Dynamik von Freundschafts- und Konfliktnetzwerken beitragen. Beide Studien leisten einen Beitrag zur Organisationsforschung. Erstens spezifizieren sie die Prozesse die dafür sorgen, dass individuelle Charaktereigenschaften die Dynamik sozialer Netzwerke beeinflussen können. Die Studien untersuchen also wie individuelle Eigenschaften zur Bildung sozialer Strukturen beitragen. Zweitens geht es in beiden Studien darum, wie sich zwei Netzwerke gegenseitig beeinflussen (z.B. Freundschaft und Konflikt, Kapitel 3). Hierdurch können wir erfahren, wie sich Multiplex-Netzwerke entwickeln. Ein letztes Ziel dieser Dissertation ist es, um die strukturellen Einflüsse von den Persönlichkeitseinflüssen durch die Anwendung einer neuen analytischen Methode zu unterscheiden (stochastic actor-based

modeling of social network dynamics RSiena). Im Folgenden werde ich auf die wichtigsten Erkenntnisse eingehen.

3.3.7 Studie 1

Die erste Studie untersucht soziale Netzwerke in kleinen Systemen - Teams. Es wird geprüft, wie stabile individuelle Unterschiede (Persönlichkeitsmerkmale) zur Freundschaftsbildung beitragen und die Wahrnehmung der Kompetenz beeinflussen. Ich erforsche ob Freundschaften sich zusammen mit der Wahrnehmung der Kompetenz entwickeln und ob höhere Kompetenz den eigenen Freunden angerechnet wird. Zusätzlich teste ich ob Teammitglieder ihre proaktiven Kommilitonen als kompetent betrachten. 650 Teilnehmer in 130 Teams lieferten uns die Daten, um diese Hypothesen zu prüfen. Die Resultate unserer Analyse (RSiena) zeigen, dass die Wahrnehmung von Kompetenz und Freundschaft einen sich selbst verstärkenden Zyklus formen: Andere als kompetent zu sehen fördert die Freundschaft, und Freundschaften helfen, ein kompetentes Bild von anderen aufzubauen und zu erhalten. Die Ergebnisse helfen uns auch zu verstehen, inwieweit proaktive Menschen vom diesen Prozess profitieren: sie erkennen tatsächliche Kompetenzen besser und erscheinen ihren Teammitgliedern als kompetent. Studie 1 hilft uns also zu verstehen, wie sich Netzwerke innerhalb von Organisationen entwickeln, indem sie die Rolle der Persönlichkeit und der zwischenmenschlichen Wahrnehmung herausarbeitet. Die

Ergebnisse zeigen, dass Teammitglieder ihre sozialen Netzwerkpositionen gemeinsam gestalten: Proaktive Personen vermitteln ein kompetentes Image, das die Freundschaftsentwicklung befördert.

3.3.8 Studie 2

Die zweite Studie untersucht, wie die Big Five (Fünf Faktoren Modell der Persönlichkeit) zu einer Freundschafts- und Konfliktdynamik innerhalb einer Blaskapelle beitragen. Die Big Five bestehen aus Extraversion, Verträglichkeit (Kooperationsbereitschaft), Neurotizismus (auch emotionale Labilität genannt), Gewissenhaftigkeit und Offenheit für Erfahrungen. Wir schlagen eine Reihe von Prozessen und Mechanismen vor, die zur Netzwerkdynamik beitragen: (a) Geselligkeit / Entzug, (b) Aspiration / Abstoßung, (c) Homophilie / Heterophilie und (d) Bindungskonformität / normative Aktivität. Außerdem untersuchen wir das Zusammenspiel von Freundschafts- und Konfliktnetzwerken und erforschen die folgende Frage: Kommen Leute in einen Konflikt mit anderen Menschen wenn die eigenen Freunde mit diesen Menschen ebenfalls einen Konflikt haben (ist also der Feind eines Freundes auch mein Feind)? Oder schließen sie Freundschaften mit anderen Menschen, obwohl diese mit den anderen eigenen Freunden einen Konflikt haben (kann also ein Feind eines Feindes mein Freund sein)? Die Ergebnisse dieser Studie zeigen, dass die Persönlichkeit zur Freundschaftsdynamik durch die

oben genannten Mechanismen beiträgt: (a) Verträglichkeit äussert sich durch Geselligkeit, Offenheit - durch Entzug (b) Extraversion ist mit der Aspiration verbunden (Leute möchten extravertierte Menschen befreunden) / Offenheit - mit Zurückweisung (offene Teammitglieder werden öfter zurückgewiesen), (c) Homophilie mit Extraversion (Leute mit ähnlichen Niveau von Extraversion befreunden einander)/ Heterophilie mit Neurotizismus (emotionale stabile Menschen befreunden labile Teammitglieder) und (d) normative Aktivität mit Extraversion (Leute mit mittleren Niveau der Extraversion befreunden anderen mehr). Offene Mitglieder vermeiden die Konflikte. Darüber hinaus, wird der Konflikt wahrscheinlicher, wenn anderen Mitglieder mittlere Niveau von Extraversion haben (eine Bindungskonformität).

Die Ergebnisse deuten darauf hin, dass sich Konflikte innerhalb von Gruppen durch Freundschaft ausbreiten ("ein Feind meines Freundes ist mein Feind"). Die Studie hilft uns also zu verstehen, wie die Persönlichkeitsmerkmale zur Beziehungsdynamik und Netzwerkevolution beitragen.

Insgesamt verbessert diese Dissertation unsere Kenntnisse darüber, wie sich die soziale Netzwerke entwickeln, und hilft uns zu verstehen, wie Menschen innerhalb von Organisationen miteinander auskommen.

Exposé général de la thèse

Comment les gens s'entendent-ils et construisent-ils leurs relations dans les groupes ? Dans cette thèse nous nous penchons sur le rôle des particularités individuelles d'une personnalité dans la dynamique des relations interpersonnelles (des réseaux sociaux). Cet ouvrage présente deux études qui contribuent à notre compréhension de la manière dont des relations interpersonnelles se forment à l'intérieur d'organisations et de groupes. La première étude examine comment la proactivité (un trait de personnalité) sous laquelle on sous-entend l'aspiration stable à influencer le milieu ambiant et faciliter les changements (Bateman & Crant, 1993), aide à créer l'amitié dans les équipes. La deuxième étude observe l'influence des « Cinq Grands » (Big Five) traits de caractère sur la dynamique de l'amitié et sur le développement de conflits.

Les deux études apportent leur contribution dans l'analyse de la manière dont les particularités individuelles d'une personne encouragent à former des relations au sein de groupes. Premièrement, elles définissent les processus à l'aide desquels les caractéristiques individuelles influencent la dynamique de relations sociales. Deuxièmement, elles décrivent des corrélations entre différents types de relations, ce qui aide à mieux comprendre la dynamique de réseaux sociaux. La première étude est consacrée à la corrélation entre la perception de la compétence de chacun des membres d'une équipe et à l'influence de cette perception sur la

naissance de l'amitié entre eux. La deuxième examine la corrélation entre l'amitié et le conflit. Enfin, cette thèse penche sur le rôle d'une personnalité dans la formation de liens. La modélisation stochastique de la dynamique des réseaux sociaux orientée sur l'acteur (stochastic actor-based modeling of social network dynamics RSiena) nous aide à définir avec plus de précision les facteurs et les processus concernant la formation de relations et séparer l'influence de processus sociaux sur un individu de celle d'un individu sur ces processus.

La première étude aborde la formation de relations dans les équipes. Elle observe comment la proactivité et la perception de la compétence des autres influence le développement de l'amitié dans les équipes. Cette étude examine comment l'amitié dépend de la perception et de l'interprétation de la compétence : si les gens préfèrent construire des relations amicales avec des gens compétents ou s'ils attribuent de la compétence à leurs amis. Nous avons testé ces hypothèses sur les données que nous avons reçues des 650 participants de 130 équipes. Les équipes ont participé pendant 10 semaines à la compétition de la mise au point et de la mise en oeuvre d'une stratégie dans des entreprises virtuelles. Les résultats de l'étude ont révélé que les participants avaient attribué une plus haute compétence aux membres de l'équipe proactifs. Les résultats reçus lors de la modélisation stochastique de la dynamique des réseaux sociaux orientée sur l'acteur (RSiena) ont montré que l'amitié et l'interprétation de la compétence avaient un influence

mutuelle : les participants se liaient d'amitié avec ceux qu'ils trouvaient compétents, et attribuaient de la compétence à leurs amis. L'analyse des données reçus a également aidé à comprendre comment des gens actifs tiraient leur profit de ce processus : ils reconnaissaient mieux la vraie compétence des autres et se créaient d'eux une image de personnes compétentes que les autres participants commençaient à croire. Les études que nous avons faites nous aident à comprendre comment la proactivité et la perception de la compétence de chacun influencent la formation de relations dans une équipe.

La deuxième étude analyse comment « Les Cinq Grands » (Big Five) traits de personnalité ont contribué au développement de l'amitié et de conflits dans un ensemble instrumental composé de 193 musiciens. Ces Cinq Grands Traits sont l'extraversion (la sociabilité), l'agréabilité (la convivialité), la conscienciosité (la bonne foi, la conscience), le neuroticisme (dans certaines études – la stabilité émotionnelle) et l'ouverture à une nouvelle expérience (que l'on appelle parfois l'intelligence). Nous nous penchons sur de différents mécanismes de la communication interpersonnelle qui révèlent Les Cinq Grands Traits (Big Five) dans la communication et influent sur la formation de relations. Nous proposons notamment les mécanismes interpersonnels suivants : (a) activité / retrait, (b) aspiration (attirance) / rejet, (c) homophilie / hétérophilie et (d) conformité / activité normative. De plus, nous explorons l'interaction entre les mécanismes formant l'amitié et le conflit.

Par exemple, nous examinons la question : les gens entrent-ils en conflit avec ceux dont les amis sont déjà en conflit (« un ennemi de mon ami est mon ennemi ») ou préfèrent-ils construire des relations d'amitié avec les ennemis de leurs propres ennemis? (« un ennemi de mon ennemi est mon ami »).

Les résultats suggèrent que les caractéristiques individuelles contribuent à la formation de l'amitié à travers une série de mécanismes. C'étaient les gens agréables qui étaient plus actifs dans leurs tentatives de se lier d'amitié avec les autres. En général, on manifeste l'aspiration à devenir amis avec des extravertis (des gens sociables). Malgré cela, les liens d'amitié se formaient le plus souvent chez les individus au niveau moyen de sociabilité (le mécanisme de l'activité normative). Les conflits étaient aussi plus probables entre les participants au niveau moyen de extraversion (sociabilité).

Nous avons donc observé que les participants de notre étude se liaient d'amitié avec ceux qui leur correspondaient par leur niveau de sociabilité (extraversion). D'autre part, on observait l'hétérophilie (la préférence de construire des relations avec les gens qui ne vous ressemblent pas) chez les individus qui se distinguaient par leur niveau de stabilité émotionnelle (neurotisme). Les musiciens de l'ensemble instrumental évitaient de se lier d'amitié avec ceux qui étaient ouverts aux nouvelles impressions, malgré le fait que les participants au niveau élevé d'ouverture évitaient les conflits. Les conflits étaient moins probables entre les participants au niveau

moyen d'ouverture. Nos résultats ont révélé aussi que les conflits se propageaient par l'amitié («un ennemi de mon ami est mon ennemi»), ce qui nous aide à comprendre comment des caractéristiques individuelles contribuent à la formation de relations au sein des groupes.

Globalement, cette thèse fournit une compréhension plus fine des origines de la dynamique des réseaux sociaux et du rôle de la personnalité dans ce processus. En d'autres termes, cela met en lumière la manière dont les gens s'entendent et progressent socialement au sein des organisations.

About the author



Evgenia Dolgova sees collaborative relationships as key to fulfilling careers that enable employees to realize their full creative potential within the organizations. To this end, her research focuses on social network dynamics in innovative contexts.

Evgenias' research investigates why people get along within the organizations – and why they don't – and how it matters. She applies dynamic social network analysis to study how organizational members collaborate to innovate. Zooming on how people form relationships, Evgenia explores the role of individuals' personality and interpersonal perceptions in organizational contexts where people innovate (e.g. marching bands, teams working out a strategy, companies reinventing their organizational structure). Zooming out, she looks on the interplay between relationships and individual and team performance. This stream of research advances the social network perspective on organizations by emphasizing how individuals and their relationships impact organizational performance. Evgenia is particularly excited about the new research venues that dynamic social network analysis opens up for organizational scholars.

Currently, Evgenia teaches and conducts research at the Department of Strategic Management and Entrepreneurship. Previously, at the Erasmus Center for Women and Organizations at Rotterdam School of Management, Erasmus University, Evgenia studied how to create fulfilling collaborative relationships within the organizations and evaluated measures that lead to increased female representation in leadership roles. She also completed a Post-Doc on social networks at VU Amsterdam, worked as an

Assistant Professor at Tilburg University, and received a Marie Curie Fellowship from the European Union to conduct research on management of emergent technologies at Leeds University. There, applying dynamic analysis of social networks and semantic network analysis, she studied how new technologies propagate through society, taking massive open online courses as an example. Before embarking on the PhD trajectory at the Rotterdam School of Management, Erasmus University, Evgenia completed a Masters degree in Psychology at the Ludwig-Maximilians-Universitaet in Munich and worked as an organizational change consultant.

Portfolio

PROFESSIONAL PUBLICATIONS

Schootstra, E.L., Deichmann, D. & Dolgova, E. 2017. Can 10 minutes of meditation make you more creative? *Harvard Business Review*. Available at <https://hbr.org/2017/08/can-10-minutes-of-meditation-make-you-more-creative>

Japanese: <http://www.dhbr.net/articles/-/5033>

Also reprinted in *Harvard Business Review OnPoint*

See video related to research on: <https://discovery.rsm.nl/articles/detail/323-how-ten-minutes-of-mindfulness-could-make-you-more-creative/>

Press coverage: BNR, nu.nl, Personeel beleid, HRZone, NRC

REFEREED JOURNAL ARTICLES UNDER REVIEW

Dolgova, E., Sasovova, Z. & Schippers, M. C. The co-evolution of perceptions of competence and friendship: The effect of proactive personality.

Dolgova, E., Kornienko, O. Getting along: The effect of Five Factor personality traits on emergence of friendship and conflict networks.

WORKING PAPERS

Aggarwal, I., Huo, J., Ates, N.Y., Dolgova, E. Team Cognitive Diversity and Transactive Memory Systems: The Mediating Role of Emergent Diversity.

Dolgova, E., Bevelander, D.L., & Page, M. Getting by with a little advice from my friends: How cognitive abilities affect advice seeking networks.

Dolgova, E., Heugens, P., Wolf, M. & Pandza, K. MOOC hopes and fears: How discourse and sentiment form around an emerging practice.

PROJECTS IN PROGRESS

Dolgova, E., Heugens, P., Steglich, C. On moving on: The evolution of European hiring networks among top economics faculties and business schools.

Breet, S., Dolgova, E., Glaser, L., Jansen, J.J.P. Co-evolution between advice seeking and performance. Conference paper.

REFEREED JOURNAL ARTICLES

Verdel, B., Dolgova, E. 2006. Propensity Weighting als Optimierungsmöglichkeit für repräsentative Studien. [Propensity weighting as optimization possibility for representative studies.] *Planung & Analyse*, 6: 69-71.

BOOK CHAPTERS

Schrenpf, B. & Dolgova, E. 2015. Nano-technology in Ireland – an analysis of patent co-classification network. In: Assimakopoulos, D., Pandza, K. & Oshri, I. *Managing of Emergent Technologies for Economic Impact*. Edward Elgar Series on Science, Technologies, Innovation and Entrepreneurship.

PEER-REVIEWED CONFERENCE PAPERS

Dolgova, E., Heugens, P., On Moving On: Dynamics of the Academic Hiring Networks Among European Business Schools. *European Conference on Social Networks (EUSN)*, Zurich, Switzerland (09/2019).

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- Dolgova, E., Sasovova, Z. & Schippers, M. On getting ahead. *Colloquium of the European Group of the Organization Studies (EGOS) Edinburgh, UK* (07/2019).
- Dolgova, E., Sasovova, Z. & Schippers. On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship. *International Conference on Computational Social Science (IC²S²), Amsterdam, the Netherlands* (07/2019).
- Dolgova, E., Bevelander, D.L., & Page, M. On Getting By: Effect of diversity in verbal abilities on dynamics of advice seeking. *Equality, Diversity, Inclusion Conference, Rotterdam, the Netherlands* (07/2019)
- Dolgova, E., Bevelander, D.L., & Page, M. Getting by with a little advice from my friends. *Advanced RSiena Users Meeting, Groningen, the Netherlands* (01/2019)
- Dolgova, E., Sasovova, Z. & Schippers, M. On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship. Invited presentation at *Tinbergen Institute Dutch Networks Economics Day, Amsterdam, the Netherlands* (10/2018)
- Dolgova, E., Sasovova, Z. & Schippers, M. On getting ahead: The role of proactive personality in the co-evolution of perceptions of competence and friendship. *Network Evolution Conference (INSEAD), Fontainebleau, France* (10/2018)
- Dolgova, E., Kornienko, O. How Five Factor personality traits affect friendship and conflict emergence. *Academy of Management Annual Meeting, Chicago, USA* (08/2018)
- Dolgova, E., Bevelander, D.L., & Page, M. Getting by with a little advice from my friends. *InGROUP Conference, Bethesda, MD* (07/2018)

- Dolgova, E., Kornienko, O. On getting ahead: How Five Factor personality traits contribute to friendship and conflict emergence. *Annual Meeting of the International Network for Social Network Analysis (INSNA / Sunbelt Conference)*, Utrecht, the Netherlands (06/2018)
- Dolgova, E., Bevelander, D.L., Page, M. & Stephenson, K. Looking across borders: Antecedents of advice seeking beyond the team. *North American Conference for Social Network Analysis (NASN)*, Washington, D.C. (07/2017)
- Aggarwal, I., Huo, J., Ates, N.Y., Dolgova, E. Team Cognitive Diversity and Transactive Memory Systems: The Mediating Role of Emergent Diversity, *InGROUP Conference*, St. Louis, MI (07/2017)
- Dolgova, E., Sasovova, Z. & Schippers, M. How friendship co-evolves with competence perceptions. *Advanced RSiena Users meeting (AdSUM)*, Norrköping, Sweden (02/2017)
- Dolgova, E., Heugens, P., Wolf, M. & Pandza, K. (2016). Hopes and Fears: Institutional logics and sentiment around MOOCs. *Annual Meeting of the International Network for Social Network Analysis (INSNA / Sunbelt Conference)*, Newport Beach, CA (04/2016)
- Dolgova, E., Heugens, P., Wolf, M. & Pandza, K. (2016). Hopes and Fears: Institutional logics and sentiment around MOOCs. *OMT Paper Development Workshop*, Edinburgh, UK (03/2016)
- Dolgova, E. & Schippers, M. (2015). Co-evolution of perceptions of competence and friendship in teams: the effect of self-monitoring personality. *Annual Meeting of the International Network for Social Network Analysis (INSNA / Sunbelt Conference)*, Brighton, UK (05/2015)
- Dolgova, E., Wolf, M. & Pandza, K. (2014). The emergence of the field: Exploratory discourse analysis of Massive Open Online Courses

(MOOCs). *Proceedings of the Academy of Management Annual Meeting, Philadelphia, USA (08/2014)*

Dolgova, E., Wolf, M. & Pandza, K. (2014). To MOOC or not to MOOC? Paper development workshop at *EGOS 32nd Colloquium, Rotterdam, the Netherlands. (07/2014)*

Dolgova, E. (2013). The emergence of the field: Exploratory discourse analysis of Massive Open Online Courses (MOOCs). *Management Research for European Innovation, Aalto University, Helsinki, Finland (12/2013)*

Dolgova, E. (2013). The effect of self-monitoring personality, perceptions of competence on friendship formation in teams. *Proceedings of the Academy of Management Annual Meeting, Lake Buena Vista, USA (08/2013)*

Alexiou, A., Schippers, M., Oshri, I. & Dolgova, E. (2013). Exploring the real potential of serious games: The role of game features and individual differences on user engagement and learning. *EGOS Colloquium, Montreal, Canada (07/2013)*

Dolgova, E. (2013). Exploratory Discourse Analysis of an Emergent Field - Massive Open Online Courses. *Annual Meeting of the International Network for Social Network Analysis (Sunbelt Conference) in Hamburg, Germany (05/2013)*

Dolgova, E. (2012). The case of Siemens TechnoWeb: Using online social network as a tool to foster organizational learning. *Open Innovation Bayer Industry Event, Cologne, Germany (12/2012)*

Dolgova, E., Ben-Menahem, S., Neerijnen, P. & van de Vrande (2012). The Role of Team Members' Proactive Personality and Advice-Seeking Behavior in the Emergence of Team Proactive Behavior. *Strategic Management Society Conference, Prague, Czech Republic (10/2012)*

- Dolgova, E., Ben-Menahem, S., Neerijnen, P. (2012). The Emergence of Team Proactiveness. *Workshop on Information in Networks (WIN 2012)*, NYU Stern, New York, USA (09/2012)
- Dolgova, E. (2012). Nurturing Proactive Teams. Invited presentation at C-TIE. Leeds University Business School (04/2012)
- Dolgova, E., Ben-Menahem, S., Neerijnen, P. & van de Vrande (2012). The Emergence of Team Proactiveness. *Annual Meeting of the International Network for Social Network Analysis (Sunbelt Conference)* in Redondo Beach, USA (03/2012)
- Dolgova, E., Schippers, M. (2012). Birds of a feather 2.0: Is there a personality-based homophily? *NYU Stern Medici Summer School 2012*, Florence, Italy (06/2012)
- Dolgova, E., Schippers, M. (2012). The effect of self-monitoring personality and expertise on relationship formation in groups. *European Academy of Management Annual Meeting (EURAM)*, Rotterdam, the Netherlands (06/2012)
- Dolgova, E. (2011). Birds of the feather 2.0: Is there a personality-based homophily? *8th International Conference on Applications of Social Network Analysis (ASNA 2011)*, Zurich, Switzerland (09/2011)
- Dolgova, E. (2011). Personality-trait based homophily. *International Seminar "Personal Networks: Methods and Applications"*, Barcelona, Spain (07/2012)
- Dolgova, E. (2011). Birds of the Feather Flock Together? *ERIM IdeaSpark Seminar with Martin Kilduff*, Rotterdam, the Netherlands (03/2011)
- Dolgova, E. (2011). Birds of the Feather Flock Together 2.0: Is There a Personality Based Homophily? *Annual Meeting of the International Network for Social Network Analysis (Sunbelt 2011)*, St. Pete Beach, FL, USA

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- Verwaal, E., Belgraver, H. & Dolgova, E. (2011). The effect of cultural distance between corporate partners on the R&D intensity and firm performance relationship. *The Academy of International Business Annual Meeting* in Nagoya, Japan (06/2011)
- Dolgova, E., Van Olffen, W., Van Den Bosch, F.A.J. & Volberda, H.W. (2010). Personality, social network position on individuals' involvement in innovation process. *Proceedings of Academy of Management Annual Meeting* in Montreal, Canada (08/2010)
- Dolgova, E., Van Olffen, W., Van Den Bosch, F.A.J. & Volberda, H.W. (2010). The Interaction between Personality, Social Network Position and Involvement in the Innovation Process. *Organization Science Winter Conference* in Steamboat Springs, USA (02/2010)
- Dolgova, E., Van Olffen, W., Van Den Bosch, F.A.J. & Volberda, H.W. (2010). The Interaction between Personality, Social Network Position and Involvement in the Innovation Process. *INGRoup Conference: Colorado Springs, USA* (07/2009)
- Dolgova, E., Van Olffen, W., Van Den Bosch, F.A.J. & Volberda, H.W. (2010). The Interaction between Personality, Social Network Position and Involvement in the Innovation Process. *9th EURAM Conference: Liverpool, UK* (05/2009)

AWARDS AND GRANTS

- ERIM Research Program, Five research assistants for Academic Hiring Networks Project, 2018-2019
- RSM Force for Positive Change Award 2017 (award recognizes innovations in advancing UN sustainable development goals and RSM mission: reducing inequality and promoting gender balance): for work at ECWO

European Commission (FP7 # REA2009/238382), Marie-Curie Fellowship
“Management of Emergent Technologies for Socio-Economic
Impact.” 2012-2014. EUR 130,000

ERIM Research Assistance Program (“Social Innovation”) 2011, EUR 2,000

TEACHING

I have taught a broad portfolio of substantive (Organizational Theory, Organizational Behavior, Innovation Management, Strategy) and methodological (e.g. Social Network Analysis) courses in a variety of contexts - from bachelor level to executive education.

Executive teaching and workshops:

- The power of networks (ECWO, RSM)
- Networking & Conflict Resolution (ECWO, RSM)
- In-company project supervision (Executive MBA, RSM)

Bachelor courses (ca. 200 students, Dutch and international programs):

- Social Network Analysis (VU Amsterdam)
- Strategy and Organization (Tilburg University)
- Financial and Project Management (Tilburg University)
- Introduction to Management (Leeds University)
- Strategic Business Plans (RSM).

At the Masters level, I taught:

- Organisational identity: managing strategic change and company image (RSM Strategy)
- Master Thesis Supervision (RSM Information Systems, RSM Business-Society Management, Tilburg University)
- Organizing Strategy and Entrepreneurship (Tilburg University)
- Strategic Management (Leeds University)

- Leadership (LMU) and Quality Management (LMU)

Professional development workshops:

- Longitudinal modeling of social network dynamics (Santa Fe Institute)
- Socio-semantic networks (Academy of Management Annual Meeting PDW)
- The use of high-performance computing in social sciences (Leeds University)

PROFESSIONAL SERVICE

Contribution to Responsible Research Summit Summit

President, Erasmus PhD Association Rotterdam (EPAR)

- Lead PhD association (1250 members), developed relationships with key stakeholders and advanced PhD interests at the university and national levels

Treasurer, Erasmus PhD Association Rotterdam (EPAR)

Reviewer for Human Relations, International Journal of Information Management, Academy of Management Annual Meeting, and InGROUP.

SKILLS

LANGUAGES

Russian: Native

English: Fluent (Cambridge English Proficiency)

Dutch: Fluent

German: Fluent

French: Moderate

NETWORK ANALYSIS

R / RSIENA: Advanced

Actor-based modeling of networks

VosViewer: Advanced

Bibliographic content mapping

ConText:	Intermediate	Analysis of socio-semantic networks
UCINET:	Intermediate	Social network analysis
*ORA:	Intermediate	Dynamic network analysis
Python	Basic	Web scraping
Visone:	Basic	Visualization of network dynamics
PNET:	Basic	Exponential random graph modeling
Gephi:	Basic	Social network analysis
NetLogo:	Basic	Agent-based modeling

PROFESSIONAL DEVELOPMENT

01/2019	Advanced RSIENA users meeting, University of Groningen (NL)
06/2018	Complex Systems Summer School, Santa Fe Institute (Santa Fe, NM, USA)
02/2017	Advanced RSIENA users meeting, Linköping University (Norrköping, Sweden)
08/2016	RSIENA Summer School, Higher School of Economics (Moscow, Russia)
02/2016:	Advanced RSIENA users meeting, ETH Zurich (Zurich, Switzerland)
01/2015:	Advanced RSIENA users meeting, Groningen University (Groningen, the Netherlands)
12/2014:	SpitCamp: how to integrate (salivary) biomarkers into scientific studies, Arizona State University (Tempe, AZ)
09/2013:	New developments in Longitudinal Network Data Analysis using RSIENA, University of Bologna (Bertinoro, Italy)
09/2012	Complexity in Science in Technology (agent-based modelling), Santa-Fe Institute and Stanford University (Stanford, CA)

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- 06/2012 Medici Summer School in Management Studies, New York University, HEC Paris and Universita di Bologna (Florence, Italy)
- 05/2012 The Science of Complexity Course (Agent-based modelling), Santa Fe Institute and George Mason University (Washington, DC)
- 03/2012 Advanced RSIENA users meeting, Arizona State University (Tempe, AZ)
- 03/2011 Analysing network dynamics with RSIENA, Oxford University (Oxford, UK)
- 06/2011 Dynamic network analysis and computational organizational theory, CASOS Center at Carnegie Mellon University (Pittsburgh, PA, USA)
- 07/2011 Analysis of longitudinal network data using RSIENA, University of Bologna (Bertinoro, Italy)
- 04/2011 Advanced RSIENA users meeting, Universität Konstanz (Konstanz, Germany)

The ERIM PhD Series

The ERIM PhD Series contains PhD dissertations in the field of Research in Management defended at Erasmus University Rotterdam and supervised by senior researchers affiliated to the Erasmus Research Institute of Management (ERIM). All dissertations in the ERIM PhD Series are available in full text through the ERIM Electronic Series Portal: <http://repub.eur.nl/pub>. ERIM is the joint research institute of the Rotterdam School of Management (RSM) and the Erasmus School of Economics (ESE) at the Erasmus University Rotterdam (EUR).

Dissertations in the last four years

Ahmadi, S., *A motivational perspective to decision-making and behavior in organizations*, Promotors: Prof. J.J.P. Jansen & Dr T.J.M. Mom, EPS-2019-477-S&E, <https://repub.eur.nl/pub/116727>

Akemu, O., *Corporate Responses to Social Issues: Essays in Social Entrepreneurship and Corporate Social Responsibility*, Promotors: Prof. G.M. Whiteman & Dr S.P. Kennedy, EPS-2017-392-ORG, <https://repub.eur.nl/pub/95768>

Albuquerque de Sousa, J.A., *International stock markets: Essays on the determinants and consequences of financial market development*, Promotors: Prof. M.A. van Dijk & Prof. P.A.G. van Bergeijk, EPS-2019-465-F&A, <https://repub.eur.nl/pub/115988>

Alexiou, A. *Management of Emerging Technologies and the Learning Organization: Lessons from the Cloud and Serious Games Technology*, Promotors: Prof. S.J. Magala, Prof. M.C. Schippers and Dr I. Oshri, EPS-2016-404-ORG, <http://repub.eur.nl/pub/93818>

Alserda, G.A.G., *Choices in Pension Management*, Promotors: Prof. S.G. van der Lecq & Dr O.W. Steenbeek, EPS-2017-432-F&A, <https://repub.eur.nl/pub/103496>

Arampatzi, E., *Subjective Well-Being in Times of Crises: Evidence on the Wider Impact of Economic Crises and Turmoil on Subjective Well-Being*, Promotors: Prof. H.R. Commandeur, Prof. F. van Oort & Dr. M.J. Burger, EPS-2018-459-S&E, <https://repub.eur.nl/pub/111830>

Avci, E., *Surveillance of Complex Auction Markets: a Market Policy Analytics Approach*,
Promotors: Prof. W. Ketter, Prof. H.W.G.M. van Heck &
Prof. D.W. Bunn, EPS-2018-426-LIS, <https://repub.eur.nl/pub/106286>

Balen, T.H. van, *Challenges of Early Stage Entrepreneurs: the Roles of Vision
Communication and Team Membership Change*,
Promotors: Prof. J.C.M. van den Ende & Dr M. Tarakci, EPS-2019-468-LIS,
<https://repub.eur.nl/pub/115654>

Bernoster, I., *Essays at the Intersection of Psychology, Biology, and Entrepreneurship*,
Promotors: Prof. A.R. Thurik, Prof. I.H.A. Franken &
Prof. P.J.F. Groenen, EPS-2018-463-S&E, <https://repub.eur.nl/pub/113907>

Beusichem, H.C. van, *Firms and Financial Markets: Empirical Studies on the Informational
Value of Dividends, Governance and Financial Reporting*,
Promotors: Prof. A. de Jong & Dr G. Westerhuis, EPS-2016-378-F&A,
<http://repub.eur.nl/pub/93079>

Bouman, P., *Passengers, Crowding and Complexity: Models for Passenger Oriented Public
Transport*, Prof. L.G. Kroon, Prof. A. Schöbel & Prof. P.H.M. Vervest, EPS-2017-420-LIS,
<https://repub.eur.nl/pub/100767>

Brazys, J., *Aggregated Macroeconomic News and Price Discovery*,
Promotor: Prof. W.F.C. Verschoor, EPS-2015-351-F&A,
<http://repub.eur.nl/pub/78243>

Bunderen, L. van, *Tug-of-War: Why and when teams get embroiled in power struggles*,
Promotors: Prof. D.L. van Knippenberg & Dr. L. Greer,
EPS-2018-446-ORG, <https://repub.eur.nl/pub/105346>

Burg, G.J.J. van den, *Algorithms for Multiclass Classification and Regularized Regression*,
Promotors: Prof. P.J.F. Groenen & Dr. A. Alfons,
EPS-2018-442-MKT, <https://repub.eur.nl/pub/103929>

Chammas, G., *Portfolio concentration*, Promotor: Prof. J. Spronk,
EPS-2017-410-F&E, <https://repub.eur.nl/pub/94975>

Cranenburgh, K.C. van, *Money or Ethics: Multinational corporations and religious
organisations operating in an era of corporate responsibility*, Prof. L.C.P.M. Meijis, Prof.
R.J.M. van Tulder & Dr D. Arenas, EPS-2016-385-ORG,
<http://repub.eur.nl/pub/93104>

Consiglio, I., *Others: Essays on Interpersonal and Consumer Behavior*,
Promotor: Prof. S.M.J. van Osselaer, EPS-2016-366-MKT,
<http://repub.eur.nl/pub/79820>

Darnihamedani, P. *Individual Characteristics, Contextual Factors and Entrepreneurial Behavior*, Promotors: Prof. A.R. Thurik & S.J.A. Hessels, EPS-2016-360-S&E, <http://repub.eur.nl/pub/93280>

Dennerlein, T. *Empowering Leadership and Employees' Achievement Motivations: the Role of Self-Efficacy and Goal Orientations in the Empowering Leadership Process*, Promotors: Prof. D.L. van Knippenberg & Dr J. Dietz, EPS-2017-414-ORG, <https://repub.eur.nl/pub/98438>

Depecik, B.E., *Revitalizing brands and brand: Essays on Brand and Brand Portfolio Management Strategies*, Promotors: Prof. G.H. van Bruggen, Dr Y.M. van Everdingen & Dr M.B. Ataman, EPS-2016-406-MKT, <http://repub.eur.nl/pub/93507>

Duijzer, L.E., *Mathematical Optimization in Vaccine Allocation*, Promotors: Prof. R. Dekker & Dr W.L. van Jaarsveld, EPS-2017-430-LIS, <https://repub.eur.nl/pub/101487>

El Nayal, O.S.A.N., *Firms and the State: An Examination of Corporate Political Activity and the Business-Government Interface*, Promotor: Prof. J. van Oosterhout & Dr. M. van Essen, EPS-2018-469-S&E, <https://repub.eur.nl/pub/114683>

Erlemann, C., *Gender and Leadership Aspiration: The Impact of the Organizational Environment*, Promotor: Prof. D.L. van Knippenberg, EPS-2016-376-ORG, <http://repub.eur.nl/pub/79409>

Feng, Y., *The Effectiveness of Corporate Governance Mechanisms and Leadership Structure: Impacts on strategic change and firm performance*, Promotors: Prof. F.A.J. van den Bosch, Prof. H.W. Volberda & Dr J.S. Sidhu, EPS-2017-389-S&E, <https://repub.eur.nl/pub/98470>

Fisch, C.O., *Patents and trademarks: Motivations, antecedents, and value in industrialized and emerging markets*, Promotors: Prof. J.H. Block, Prof. H.P.G. Pennings & Prof. A.R. Thurik, EPS-2016-397-S&E, <http://repub.eur.nl/pub/94036>

Fliers, P.T., *Essays on Financing and Performance: The role of firms, banks and board*, Promotors: Prof. A. de Jong & Prof. P.G.J. Roosenboom, EPS-2016-388-F&A, <https://repub.eur.nl/pub/93019>

Frick, T.W., *The Implications of Advertising Personalization for Firms, Consumer, and Ad Platfroms*, Promotors: Prof. T. Li & Prof. H.W.G.M. van Heck, EPS-2018-452-LIS, <https://repub.eur.nl/pub/110314>

Fytraki, A.T., *Behavioral Effects in Consumer Evaluations of Recommendation Systems*, Promotors: Prof. B.G.C. Dellaert & Prof. T. Li, EPS-2018-427-MKT, <https://repub.eur.nl/pub/110457>

Gaast, J.P. van der, *Stochastic Models for Order Picking Systems*,
Promotors: Prof. M.B.M de Koster & Prof. I.J.B.F. Adan, EPS-2016-398-LIS,
<http://repub.eur.nl/pub/93222>

Ghazizadeh, P. *Empirical Studies on the Role of Financial Information in Asset and Capital Markets*, Promotors: Prof. A. de Jong & Prof. E. Peek,
EPS-2019-470-F&A, <https://repub.eur.nl/pub/114023>

Giurge, L., *A Test of Time; A temporal and dynamic approach to power and ethics*,
Promotors: Prof. M.H. van Dijke & Prof. D. De Cremer,
EPS-2017-412-ORG, <https://repub.eur.nl/pub/98451>

Gobena, L., *Towards Integrating Antecedents of Voluntary Tax Compliance*,
Promotors: Prof. M.H. van Dijke & Dr P. Verboon, EPS-2017-436-ORG,
<https://repub.eur.nl/pub/103276>

Groot, W.A., *Assessing Asset Pricing Anomalies*, Promotors: Prof. M.J.C.M. Verbeek &
Prof. J.H. van Binsbergen, EPS-2017-437-F&A, <https://repub.eur.nl/pub/103490>

Hanselaar, R.M., *Raising Capital: On pricing, liquidity and incentives*,
Promotors: Prof. M.A. van Dijk & Prof. P.G.J. Roosenboom, EPS-2018-429-F&A,
<https://repub.eur.nl/pub/113274>

Harms, J. A., *Essays on the Behavioral Economics of Social Preferences and Bounded Rationality*, Prof. H.R. Commandeur & Dr K.E.H. Maas,
EPS-2018-457-S&E, <https://repub.eur.nl/pub/108831>

Hendriks, G., *Multinational Enterprises and Limits to International Growth: Links between Domestic and Foreign Activities in a Firm's Portfolio*,
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