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PH.D. THESIS

Judit Pál

Status and Negative Ties:
A Longitudinal Network Study among Adolescents

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Introduction

All over the world, there is a substantial interest in understanding students’ everyday life in schools (Bradshaw, Keung, Rees, & Goswami, 2011; Currie et al., 2012). Essentially, the school represents a key location in the life of students. Additionally, school is not only an institution for academic activities, but also a place to learn how to achieve respect among their fellows, how to build relationships with their peers or how to deal with conflicts (Juvonen, 2006).

Understanding the “school world” is especially fundamental for students in secondary education, as they are between 14 and 18 years old, in their adolescence, an intermediate stage of physical and emotional human development (American Psychological Association, 2002). This is a period of major developmental changes and challenges when the youth acquire and consolidate the competencies, attitudes, values, and social capital necessary to make a successful transition into adulthood (American Psychological Association, 2002). They create a sense of involvement with other people and with communities, therefore being actively engaged with school and with other people have a significant effect on their social development (Willms, 2003). This is due to the increased time that students around the age of 15 spend not only in school but also with their peers. Hence, understanding the social dynamics of adolescence in secondary schools is essential.

Students establish their roles and relations to other fellows in the peer group, which is a powerful place of identity formation and identity consolidation throughout the adolescence. Since the revolutionary work by the famous American sociologist, James S. Coleman (1961), the school is considered the territory of learning how status, the hierarchical position of an individual evolves in a group. In schools, there is no formal status ranking among students. Though, when kids enter into a school, their major goal is to get a valuable position in their peer group (Lindenberg & Steg, 2007). Consequently, when they start their studies in secondary schools, which usually represent new institutions in students’ academic career, they immediately establish their informal rankings. This informal social ladder helps them to orientate among their peers, and develop social competencies and strategies on how to “survive” in a group. Obviously, the social hierarchy is hardly ever permanent: it is constantly transformed by events, rumors, and individuals’ academic or sport achievements. Moreover, acquiring a

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position in the peer structure depends on external aspects of a student’s social life as well, such as social family background, ethnicity, gender, or physical appearance.

In school, students develop interpersonal relationships with their peers. These relationships are highly important for their social development and socialization experiences (Ryan, 2000). Establishing positive and good quality relationships, such as friendship, present protective factors in adolescents’ life (Lippman et al., 2014). Friendship ties to peers provide a distinctive safe environment to acquire individual and group identity (McNelles & Connolly, 1999). Frequent interactions with friends may facilitate the sense of belonging; provide social support and promote higher levels of happiness, self-esteem, and school adjustment (Currie et al., 2012). Friends also provide a venue for communicating about shared interests and activities (Bateman & Murrie, 2003).

It seems negative relations are also as unavoidable parts of human relations as good relationships. It is only in the past years that researchers started to understand why, how and with what outcomes these negative relations occurred in the social life of adolescents (Card, 2010). The negative emotional feelings, such as disliking or bullying, are present as risk factors. Being bullied or disliked, and being a bully might have long-term negative consequences, such as low academic achievement, dropout of schools, distress, aggressive behavior and internalizing problems (Jansen et al., 2012; Olweus, 1994; Pepler et al., 2006).

How are disliking and bullying formed? This is a very important question that not only researchers but teachers and also policy makers aim to understand in order to build the most effective interventions programs. For instance, the successful KIVA program from Finland shows that empirical research must be done before schools introduce these programs. This pioneer policy program from an empirical aspect shows that disliking and bullying should be understood as group processes (Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996). It might happen that common friendship creates common enemies, while protective friendships could defend individuals from being bullied. Achieving high ranking in the social ladder is not independent from the relations an individual has, either. In the informal hierarchy, being friends with high status peers could raise the status of an individual, and vice-versa, being disliked by high status individuals could decrease the status of a peer (Faris & Ennett, 2012; Huitsing et al., 2012).

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In order to understand the formation of peer structure, researchers benefited from social network analysis, a method for investigating social structures using network and graph theories (Kadushin, 1994). Therefore, social network methods are used in this dissertation to comprehend how disliking ties are formed and thus might influence the well-being of adolescents. The main reason for analyzing this question is the fact that still little is known about the fundamental processes which govern the establishment of negative relations, both in adolescent and network research.

Consequently, this thesis has two important goals. The scientific objective is to measure and empirically analyze the interrelated dynamics of the negative relationships and the status positions of adolescents in secondary schools, using a Hungarian longitudinal dataset. On one hand, the thesis offers a new understanding of the constitutive factors of negative relations. On the other hand, it provides a novel way to understand the evolution of negative ties through analysing the interrelation of various perceived status measures among adolescents. The dissertation uses sociometric instruments and numerous advanced empirical methods to analyze the connection between negative ties and status.

The practical aim of the project is to offer more insights for policy makers, school psychologists and teachers. Conflicts arising among adolescents are a growing problem at schools in Hungary. The media recently reported on relational aggression in schools, cases where students bullied each other, or even their teachers. Therefore, there is an increasing interest in collecting and analyzing empirical data on bullying and negative relations in Hungary (Buda & Szirmai, 2010; Figula, Margitics, Pauwlik, & Szatmári, 2011). Nevertheless, there is still few data on the prevalence on disliking and bullying, which also reflects the specificities of the Hungarian secondary education system. The project fills this gap as well. As the thesis uses a longitudinal Hungarian data in order to understand the aforementioned scientific questions, the results might also reveal the specificities of the Hungarian public secondary education. The project involves data from general secondary schools, vocational secondary schools and vocational training schools. The findings on the high dropout rates, the segregation of students’ relations by their socio-economic background, ethnicity and gender also make important contributions to tackle the aforementioned problems. Summing up in one sentence, the PhD thesis examines how the negative, “dark side” of interpersonal relations and status positions interrelate among secondary school students in Hungary.

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CHAPTER 1 The Research Framework and the Study Design

Chapter summary

Social network analysts gather extensive information about the fundamental processes that govern the formation and dynamics of positive ties. They do not possess, however, the same amount of knowledge about how negative personal relations (such as disliking, gossiping, bullying) form and affect the performance, solidarity, and cohesion of groups. Since adolescence is the most important period of personal and group identity formation, observing negative relations in school context may contribute to a better understanding of school problems, such as segregation, social exclusion, and bullying.

The aim of this chapter is to introduce the research framework of the PhD thesis. This section gives an overview of the definition of negative ties, the role of assortative and dissortative mechanisms, structural network patterns, positive relations and status perceptions on the formation and the maintenance of negative relations. In what follows, the empirical data "Wired into Each Other" are introduced. This data are used in the subsequent chapters for testing the research questions of this thesis.

In the final part, we discuss the key methodology, such as descriptive network statistics, panel regression, exponential random graph models (ERGM) and stochastic actor based models (SABM).

Keywords: social network analysis, negative relations, school networks, descriptive network statistics, panel regression, ERGM, SABM

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1.1 Overview

1.1.1 The definition of negative ties

Relationships are formed among people, groups, and organizations, and have positive, neutral, and negative emotional and physical aspects, such as isolation and depression (Taylor, 1991). Actors in a network form global positive and negative judgments about their relationships (Newcomb, 1956; Taylor, 1967). Over time, these judgments lead individuals to form stable schemas about those with whom they connect (Fiske & Taylor, 2013). *"Negative ties by definition mean an enduring, recurring set of negative judgments, feelings, and behavioral intentions toward another person"* (Labianca & Brass, 2006, p. 597). The feeling of dislike and hate, and especially conflicts associated with these feelings are inherent in human behavior (Simmel, 1950). Negative ties could be understood as a representation of social or group conflict (Turner, 1975). Social conflict occurs when two or more actors oppose each other in social interaction to attain goals and prevent the other from attaining them. Traditionally, the conflict theory describes how conflicts arise within the society. It sees conflicts as a usual and normal aspect of social life rather than an abnormal occurrence (Turner, 1975).

Negative relations have visible, *manifest* forms such as verbal, physical and relational aggression, but they could also be invisible, when they are *internal* to the sender such as in the case of disliking or hating others. The *physical* type of negative relations could be best described as fighting, hitting, or punching others (Arbona, Jackson, McCoy, & Blakely, 1999; Gest, Graham-Bermann, & Hartup, 2001; Mouttapa, Valente, Gallaher, Rohrbach, & Unger, 2004). The *verbal* type represents mocking (Björkqvist, Lagerspetz, & Österman, 1992), while the *relational* form of negative ties often refers to bad gossiping (Ellwardt, Labianca, & Wittek, 2012) and exclusion. When aggression is often repeated and it relates to power, research uses the term bullying to describe the conflicted situations among individuals, especially among children and adolescents (Espelage, Green, & Wasserman, 2007; Huitsing & Veenstra, 2012; Olweus, 1994; Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukiainen, 1996; Veenstra, Lindenberg, Munniksma, & Dijkstra, 2010). Figure 1.1 shows the classification of various forms of negative ties.

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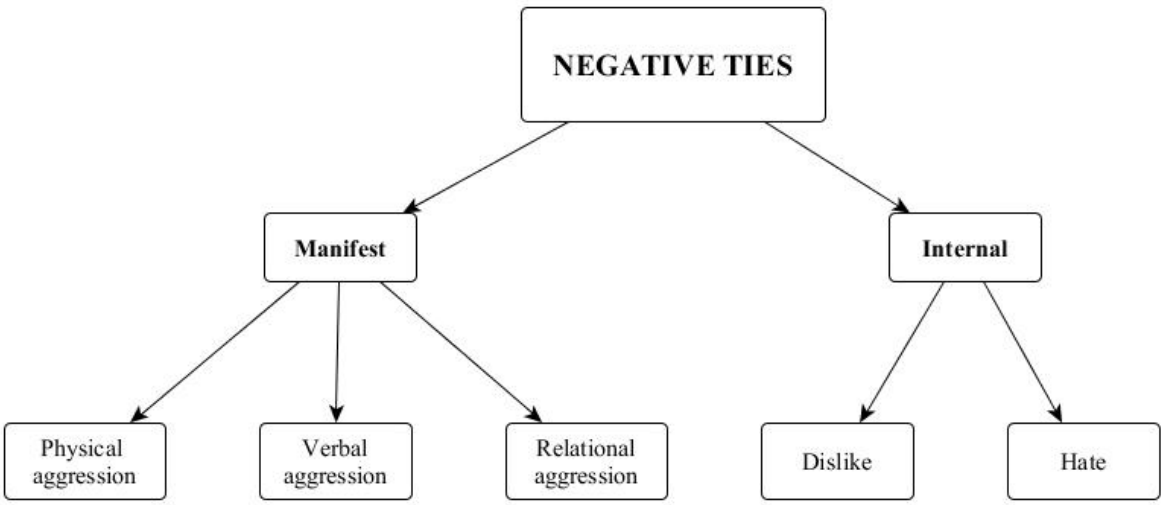
Figure 1.1: *Classification of negative ties*



Disliking as an internal form of negative relations is less likely to have social implications as long as it is not manifested (for instance, saying "I do not like you"), but its effect regarding the performance of organizations is significant (Labianca & Brass, 2006). Those who are disliked are less likely to perform well and to cooperate with their colleagues or their peers. Compared to positive or neutral relationships, the appearance of negative relationships is relatively rare: on average, about eight percent of reported relationships in total are negative (Brass & Labianca, 1999; Gersick, Dutton, & Bartunek, 2000). This might be explained due to revealing negative ties in surveys: they are more confidential than positive ones and the prevalence of negative ties is lower. Yet, the scarcity of negative ties makes them very powerful, regarding attitudes, behaviors, and outcomes: this is called *negative asymmetry* (Labianca & Brass, 2006). If there is only one negative tie within a community, it may be sufficient to prevent the goal of an institution, e.g. because it prevents effective communication and hatred.

Manifest forms describe the behavioral element of negative ties and include verbal (mocking, gossiping) and physical types (punching, fighting, hitting). It could be defined as *"a harmful action perpetrated outside of a victim's immediate purview such as ostracism or spreading rumors"* (Faris & Felmlee, 2011, p. 49). Within the boundaries of school classrooms, negative relations are unavoidable and therefore are sources of sour social capital (Moerbeek & Need, 2003; van der Gaag, Snijders, &

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Flap, 2008) as they cause embarrassment, decrease psychological well-being (Kalish, Forwood, & Robins, 2009), and might induce withdrawal and stifling movement towards goals (Casciaro & Lobo, 2008). It might largely decrease the performance and can mount up to conflicts between subgroups (Joshi, Labianca, & Caligiuri, 2002).

Aggression as an external form of negative relations is defined as behavior aimed at causing harm or pain - including verbal and physical aggression - from one person to another (Archer & Coyne, 2005; Crick & Grotpeter, 1995). An important aspect of aggression is the intention for repetition and competing for power that underlies the perpetrator's behavior, which is often referred as bullying in the literature.

1.1.2 Similarity and dissimilarity in establishing social ties

Establishing and maintaining negative and positive ties (such as liking, friendship, sharing information) happens in similar dimensions, albeit in different ways (Yap & Harrigan, 2015). Eventually, social network analysis has identified four mechanisms that designate the establishment of positive and negative relationships. While the description of two phenomena (homophily and heterophily) on positive tie formation is well recognized, less is known about the two opposite mechanisms (heterophobia and homophobia), which may describe how negative relations are established.

The phenomena of *homophily* ("love of the same"), also called assortative mixing mechanism (Rivera, Soderstrom, & Uzzi, 2010), describes how similar people establish mainly positive relationships with each other (Kandel, 1978). To be liked is a long process that forms on a mutual basis (Heider, 1958), therefore *homophily* suggests that individuals are more likely to bond to similar others (Feld & Carter, 1998; McPherson, Smith-Lovin, & Cook, 2001).

The first formulation of homophily by Lazarsfeld and Merton (1954) distinguishes between *status* and *value homophily*. Status homophily suggests that individuals with similar *social status* characteristics are more likely to connect with each other than by chance (Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001). These characteristics are recognized as ascribed features such as race, ethnicity, sex, age, and as picked or acquired characteristics like religion or education. *Value homophily* suggests that people tend to associate with individuals who share similar thoughts about certain issues, like religion and politics regardless of differences in their social status (Lazarsfeld & Merton, 1954; McPherson, Smith-Lovin, & Cook, 2001).

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The review by McPherson, Smith-Lovin and Cook (2001) suggests that geographical closeness, family connections, organizational settings, occupational roles and cognitive processes have a major influence in creating homophile ties. Those who are physically close to each other, e.g. live in the same town, are more likely to be connected than those who live on a different continent (McPherson, Smith-Lovin, & Cook, 2001). If people often meet, they will have a higher chance to get connected (Blau, 1977). Although the spread of information communication technologies diminishes the importance of geographical closeness and face-to-face relations, they still have a crucial role in forming ties (Cummings, Butler, & Kraut, 2002). McPherson, Smith-Lovin and Cook (2001) also suggest that family connections represent strong links among individuals. Moreover, kinship ties often result in strong relationships among individuals who live geographically far from each other (Feld, 1981). School, work and other voluntary communities provide the greatest support for creating friendship ties, especially because the majority of people spend most of their time in these communities (McPherson & Smith-Lovin, 1987). *Structural equivalence* may also matter because connections between people occupying equivalent roles will induce homophily in the network system (DiMaggio & Powell, 1983). Cognitive processes describe that people who have the same demographic characteristics are more likely to start a conversation with each other, therefore they are more likely to form strong and friendly relationships (Feld & Carter, 1998; McPherson, Smith-Lovin, & Cook, 2001). Consequently, people are more likely to make friends with those who are similar to them in various ways (Moody, 2001). The phenomenon of *heterophily* ("love of the different") describes the tendency of individuals to connect in diverse groups; it is the opposite of homophily (Bourdieu, 1984; Rogers & Bhowmik, 1970).

This phenomenon is mainly described in organizational research, showing that the resulting diversity of ideas promote an innovative and productive environment, making organizations and teams more successful and effective (Anderson & Alpert, 1974; Rogers, 2010; Rogers & Bhowmik, 1970). The theory of weak ties by Granovetter (1983) and the work of Simmel (1950) are corresponding in the sense that Simmel's term *the stranger* (the member of a group who participates in activities, but remains distant) and Granovetter's weak tie (describing the advantage of having many weak connections, e.g. when seeking jobs) can both bridge homophile networks, turning them into one larger heterophile network (Granovetter, 1983; Rogers, 1999; Simmel, 1950).

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The phenomenon of *heterophobia* ("hate the different") describes the tendency of individuals to dislike each other (Flache & Mäs, 2008). This phenomenon is also known as dissortative mixing mechanism in network theory (Newman, 2003), and basically represents the mirror image of homophily. This mechanism describes how social segregation, culturally homogeneous discrimination may occur. People tend to hate those who are different mainly in ascribed characteristics, such as ethnicity and race (Clark, 1991). Recent research also suggests that increasing the level of homogeneity increases cultural polarization (Flache & Macy, 2006).

The phenomena of *homophobia* ("hate the similar") describes that people tend to dislike those how are similar to them.[1] Homophobia often occurs when there is perceived or non-perceived competition between individuals.

After understanding similarity and dissimilarity in establishing negative ties, we present how the dynamics of establishing positive and negative relations may differ. Positive ties form slowly (í]), exist and then, from time to time, are reassessed by the involved parties (Schachter, 1959). Although they are relatively stable, over time they may end (Zeggelink, 1993). Mutuality and the constant interactions between the actors support the formation of positive relations within communities (Doreian & Stokman, 1997). Maintaining positive relations is supported due to the time spent together; friends become more similar in their behavior, opinions and values (Newcomb, 1956). No matter how costly the establishment and maintenance of friendship ties or other types of positive ties is, it requires energy from the actors (Blau, 1977). An essential aspect of establishing ties is that there is a higher probability for two persons becoming friends if they often see each other (Blau, 1977). Other rules may be authoritative in the establishment of negative ties.

Creating negative relations does not necessarily need closeness or longer time spent together; and those who live too far from each other will not necessarily become enemies. Yet, negative ties are established in a much shorter period of time (Wiseman & Duck, 1995) than positive ones. They are more rarely reassessed, therefore they remain relatively stable. While in the case of positive relations, more complex events and characteristics are required for them to be established and maintained, in the case of negative ties only one characteristic or event is enough to trigger the unilateral or mutual antipathy (Labianca & Brass, 2006).

[1] Logically, this mechanism should exist, but there is no research that uses this term. Instead, homophily is used, as the mechanism describes a similar pattern, but with negative relations.

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1.1.3 Structural network patterns in establishing social ties

Establishing and maintaining negative and positive ties are also influenced by existing structural network patterns and mechanisms (Rivera et al., 2010).

Reciprocity describes whether one directional tie becomes mutual. It mainly occurs in dyads, which represent a subgraph or subgroup between two nodes and their links (Snijders, 2011). While empirical evidence implies that positive links are more likely to become reciprocal, it also suggests that the probability of a positive tie becoming mutual is higher as forming a new tie (Hallinan, 1979; Hallinan & Williams, 1989). However, one reason why relationships are usually short-lived and become dissolved is if they are not reciprocated (Gould, 2002). Recent empirical research suggests that mutuality could also occur in the case of negative relations (Huitsing & Veenstra, 2012; Roda, 2014). While research shows that a tie often becomes reciprocated, less is known about why ties become reciprocated or dissolved (Rivera et al., 2010). It could be explained either by homophily or by the presence of highly important individuals within the network, who receive many nominations, but only reciprocate relations which they find important for them (Rivera et al., 2010).

The *repetition of ties* is an important aspect to form and maintain relationships. (Rivera et al., 2010). Research about the dynamics of networks showed that ties which exist at one time point are likely to exist at another time point both in negative and positive social networks (Snijders, van de Bunt, & Steglich, 2010).

Clustering describes the extent to which a network is dense and connected. Research on triads and triad censuses has a long tradition in social network theory and research, and it describes how social networks become clustered over time (Davis, 1970, 1977; Davis & Leinhardt, 1967; Faust, 2006; Friedkin, 2006; Holland & Leinhardt, 1977; Johnsen, 1989). A triad is a "*micro structure which consists of configurations and properties of small subgraphs of nodes and arcs, most notably dyads and triads*" (Faust, 2006, p. 187). A triad is a subgraph between three nodes and the links between them. In a directed graph there are three classes of dyads based on their relationships (Wasserman & Faust, 1994). *"Ties can be mutual (M), asymmetric (A), ignoring the direction of the arc, and null (N)"* (Faust, 2006, p. 187). According to Holland and Leinhardt (1970), who first proposed the so called MAN notation for triads, sixteen different types of nodes exist, based on the number of mutual (M), asymmetric (A), and null (N) dyads in each triad, along with a further indication of the direction of the tie (Faust, 2006). Figure 1.2 summarizes the existing MAN notations.

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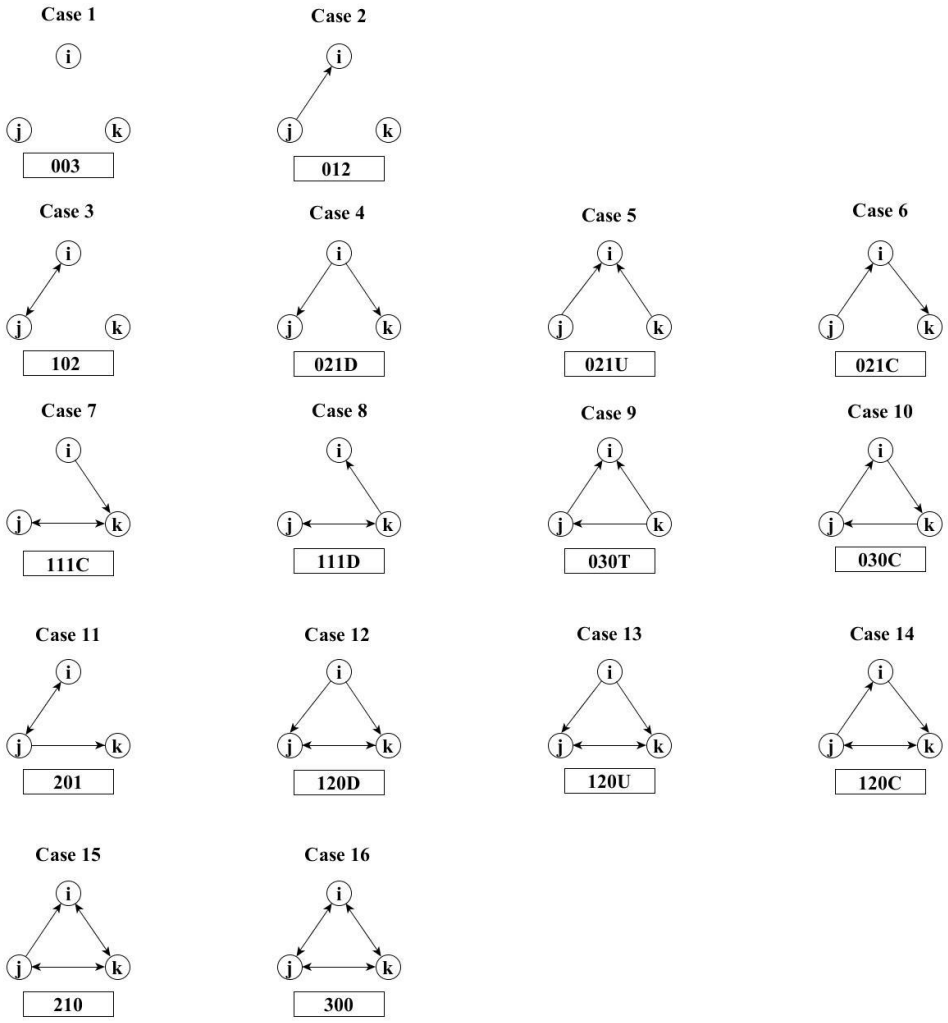
Figure 1.2: *Triads of MAN Notation*

(Faust, 2006, p. 187)



The major theory in social network analysis that deals with the organization and dynamics of social relations is the *structural balance theory* (Cartwright & Harary, 1956; Heider, 1946; Szántó, 2006; Wang & Thorngate, 2003; Szántó, 2006), which asserts the transitive closure of emotional and signed relations (Heider, 1958). In general, a triad is balanced if by multiplying the signs of the three relations (positive, negative and neutral); it gives a positive result (Cartwright & Harary, 1956; Harary, Norman, & Cartwright, 1965). Most typical for friendship ties, a transitive triplet with only positive relations is a balanced triad. There is no doubt that there is a strong tendency towards transitivity in human relations, which means that if two people have a common friend, their chance to connect is orders of magnitude higher than without their shared positive connection (Kossinets & Watts, 2006; Rapoport, 1953).

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Balancing takes place as individuals try to form their relations to achieve balanced triads, which could either be done by turning negative ties to positive, positive ties to negative, or by breaking ties (Hummon & Doreian, 2003; Zajonc, 1960). Individual balancing does not necessarily bring the network immediately into a balanced state. Balancing decisions and choices as parallel processes might be in conflict with each other (Hummon & Doreian, 2003). Simply by considering a negative dyadic element of a triad, one party might have the intention to turn the sour relationship into a happy one; meanwhile the other one might have the intention to delete the relation. To have further complications, the third actor might have an intention to change the sign of one of her relations. One could have many examples for such practical complications in the management of friendship relations from personal history. As Simmel (1950) discussed extensively, the triad is an arena of much more sophisticated strategic interactions than it is possible in the dyad. Actors might play mediation and gossip, or impose sanctions on others in order to have balanced relations. Balancing processes in a way provide resources to attain power and influence. Global balancing is an emergent result of dyadic and triadic balancing mechanisms (Khanafiah & Situngkir, 2004; Park, 2004). Balancing is of general occurrence, as it was shown in recent social simulations (Hummon & Doreian, 2003; Szántó, 2006). Although structural balance theory would predict the dissolution of triads with only negative relations, this prediction fails in observed networks (Davis, 1967). Moreover, further theoretical complications arise in the case of overlapping triads, in particular, if some of them are balanced and others are not: even from a single actor's perspective, it is not clear if the change of a given relation is beneficial or not. In result, previous empirical studies failed to confirm the general predictions of the structural balance theory, because structural balance is not a general, and more importantly, not the only mechanism that governs the dynamics of negative relations. Furthermore, balancing processes form between different groups, and explain that it is possible to have three or more hostile ties: this is the case of competitive groups (Davis, 1970; Davis & Leinhardt, 1967).

Degree centrality measures of networks describe how links could make some actors powerful and some not (Everett & Borgatti, 1999). They catch a glimpse of the preferential attachment processes by saying that those who have many ties are more likely to attract even more (Abbasi, Hossain, & Leydesdorff, 2012). As the distribution of ties is mainly scale free (Barabási & Albert, 1999), it is more likely that there are

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very few actors who have many, but there are lots who have few ties in a network. The *preferential attachment* mechanism could be useful in positive networks, where more links make actors more popular or powerful (Abbasi, Hossain, & Leydesdorff, 2012; Newman, 2001). However, in a negative network, those who have many negative ties are more likely to be the target of gossip or bullying for instance, or to become "black ships" by attracting many negative nominations. Nevertheless, *negative social capital*, (when social capital produces negative outcomes, such as exclusion from a group) can be useful for those actors who have high degree centrality in both networks. This may be described as the mechanism of "the Paul Street Boys" derived from the very popular novel by the Hungarian novelist Ferenc Molnár (Molnár, 1962). Briefly, the novel tells the story of the members of the youth group "The Paul Street Boys", who spend their free time after school at an empty yard in the heart of Budapest. When the "Redshirts", the rival gang of "The Paul Street Boys", led by Feri Áts, attempt to take over the ground, "The Paul Street Boys" are forced to defend themselves in military fashion. The two leaders (Feri Áts and János Boka) are popular and well respected in their own groups, but may attract negative emotional feelings mainly from the members of the out groups. Yet, the members of each gang have their formal and informal status positions, which determine whether they are liked or disliked by their group members.

1.1.4 Negative and positive relationships in adolescents' social development

Understanding tie formation among adolescents represents a crucial part of developmental psychology and sociology. Adolescence represents an intermediate stage of physical and emotional human development, which generally occurs between age 13 and 18. It is the period of exploration, learning, making choices, identity consolidation, and relationship building. Developing these competencies, self-awareness and connections with others lay the foundation of later development (American Psychological Association, 2002). Adolescence is a dynamic period that is improved when the youth can fulfil their individual and social goals, and, at the same time, achieve a sense of belonging among their peers (American Psychological Association, 2002).

Yet, adolescents are largely surrounded by risky, and, at the same time, by protective factors. These factors appear in three domains: individual, contextual and relationship (Lippman, Moore & McIntosh, 2011; Lippman et al., 2014).

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The *individual domain* suggests that there are biologically determined factors that affect the young person's health and well-being. These biological characteristics determine how the youth are social in nature, comprising the young persons' view of self - attitudes and beliefs, their sense of future and their ability to interact socially with others (Lippman et al., 2011). Research shows that some types of personality traits, such as being uncontrolled, indicates impulsivity, danger seeking and aggression (Caspi & Silva, 1995). The *context* domain describes a combination of measures that not only represents indicators, but also contributes to the development and well-being of children. These factors describe how embeddedness in school and in peers' subcultures, the larger community properties (such as poverty, violence), and social roles determine their development and well-being (Lippman et al., 2011; Lippman et al., 2014). For instance, gender role expectations about how to behave could be detrimental to how adolescents create and develop their relationship with their environment (Wolfe, Crooks, Chiodo, & Jaffe, 2009).

The *relationship domain* represents a more complex issue as interactions are not located merely at the individual level. The youth are active participants in establishing relationships, and the quality and type of relationships are viewed as extremely important indicators of their well-being (Armsden & Greenberg, 1987). Supportive and unsupportive connections to family, peers, teachers, and the larger community were recently recognized as necessary indicators in child development (Lippman et al., 2011). If adolescents are supported by a caring *family*, they are more likely to develop in healthy ways and less likely to engage in problem behaviors. For instance, students living in families of conflicts, instability and lack of supervision are more likely to be aggressive and to be engaged in criminal behavior (Willis, 1977). Young people who feel connected to *school* are less likely to be involved in problem behaviors and more likely to achieve well (Katja, Päivi, Marja-Terttu, & Pekka, 2002). Good quality relationships and the opportunity to meet supportive peers increase the likelihood of adolescents' well-being (Cotterell, 1992). Young people who feel a sense of belonging to a *community* that offers support and opportunity are bound to grow in healthy ways. This support can be provided through caring adults, community organizations, faith communities, other community institutions, and opportunities for authentic involvement (Lippman et al., 2011). Among the relationship factors, ties to peers are crucial because during this period the group effect is very intensive in the formation of individual and group identity (McNelles & Connolly, 1999). Several studies recorded the "high school

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world", its structure, and the development of caring relationships (Clement & Harding, 1978; Coleman & Johnstone, 1963; Quillian & Campbell, 2003). Those who have supportive friends with good grades and high school performance are more likely to perform well in school, and less likely to engage in conflicted situations (Vandell & Hembree, 1994; Wentzel & Caldwell, 1997).

Yet, *risk factors* such as bullying with peers and fierce conflicts, which are also widely reported in the media (Aronson, 2001), highlight that those who are disliked by others or have many conflicted ties are more likely to be depressed, anxious and have low performance in schools. Studies recognized the interrelation between positive ties and negative links among networks (Huitsing et al., 2012; Salmivalli, Huttunen, & Lagerspetz, 1997; Salmivalli et al., 1996). These emphasize that negative relations are not independent of the peer context, and peer influence has a decisive role in behavior. Peer influence describes the effect of peers on attitudes and behaviors. It can be direct and indirect, indicating an individual's own perception about the peer group's attitudes and behaviors. For instance, dislike is often a one-directed tie, as in several cases, there one person who receives many nominations from his or her peers, which do not become mutual (Sutton, Smith, & Swettenham, 1999). These nominations are often induced by pressure from the group.

1.1.5 Status and negative ties

Competition for resources, especially for status, is often the cause of conflict. Status has various definitions in the literature, but could be best described as a position in a social system that one individual holds in a group, such as a child in family, a student, a parent or a professional (Linton, 1936). This explains the location of the individual within a group, and it reflects his or her place in the social network of obligations, privileges, duties, and rights (Linton, 1936). Consequently, an individual may have more than one position in his or her life: husband, child, soccer fan, cello player in the orchestra; as the position of an individual in the social system possessed is the result of the basis of the given status system (Linton, 1936).

Status may be divided into two types: ascribed status and achieved or earned status. *Ascribed status* is assigned to an individual on the basis of the position in society; such a status may be given by birth or by placement (Foladare, 1969). For example, in an educational setting, a student may enjoy a particular status because of being born in a rich, influential family. *Achieved status* describes status or the position

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that a person has given by his own personal achievements (Foladare, 1969). This status is given by the ability, capacity and the efforts of the individuals. For example, a person who is able to exhibit his ability in sports, education or professional life is seen as having higher and better status.[2]

Status also describes a superior-inferior relationship, in other words dominance and subordination (Gould, 2002). Status describes a constantly changing position of an individual, which is also the basis of hierarchical differentiation (Gould, 2002). A *status hierarchy* is an order of positions between individuals or groups based on the aggregate of respect or admiration accorded by others (Magee & Galinsky, 2008; Parsons, 1961).

Position in the status hierarchy often induces negative relations, and is often described by the competitive and dominance theory. These theories outline that relationships are not only embedded in the larger peer structure, but also influenced by competitive motives.

The *competitive theory* explains that one of the results of conflict between people with competing interests and resources is the creation of a social structure (Wright Mills, 1956). Social structure refers to the norms in a community that heavily influence peoples' everyday behavior. In relation to the competitive theory, the *social dominance theory* of intergroup relations describes the maintenance and stability of group-based social hierarchies (Sidanius, Pratto, Van Laar, & Levin, 2004).

From a developmental perspective, gaining *status* represents the central goal for adolescents as the goal-oriented approach describes (Lindenberg & Steg, 2007; Pellegrini & Long, 2002). The more admired students feel better in the peer structure, which is often associated with occupying a high position in the peer structure. This could explain why negative and positive relations occur by status motives (Craig & Pepler, 1998; Faris & Felmlee, 2011, 2014; Rodkin & Berger, 2008). The study of competition for status originates in the study of Coleman (1961), in which status competition was demonstrated to be a major underlying force of structuring the adolescent society (Coleman, 1961).

In the larger society, *status characteristics* such as gender, race, and age help us categorize other people (Berger & Fisek, 2006). However, status positions are also defined by the norms of a given community, which explains why status characteristics can be reinforced by community-based dimensions as well (Wagner and Berger, 2002;

[2] In the dissertation, we will concentrate on achieved, rather than ascribed status.

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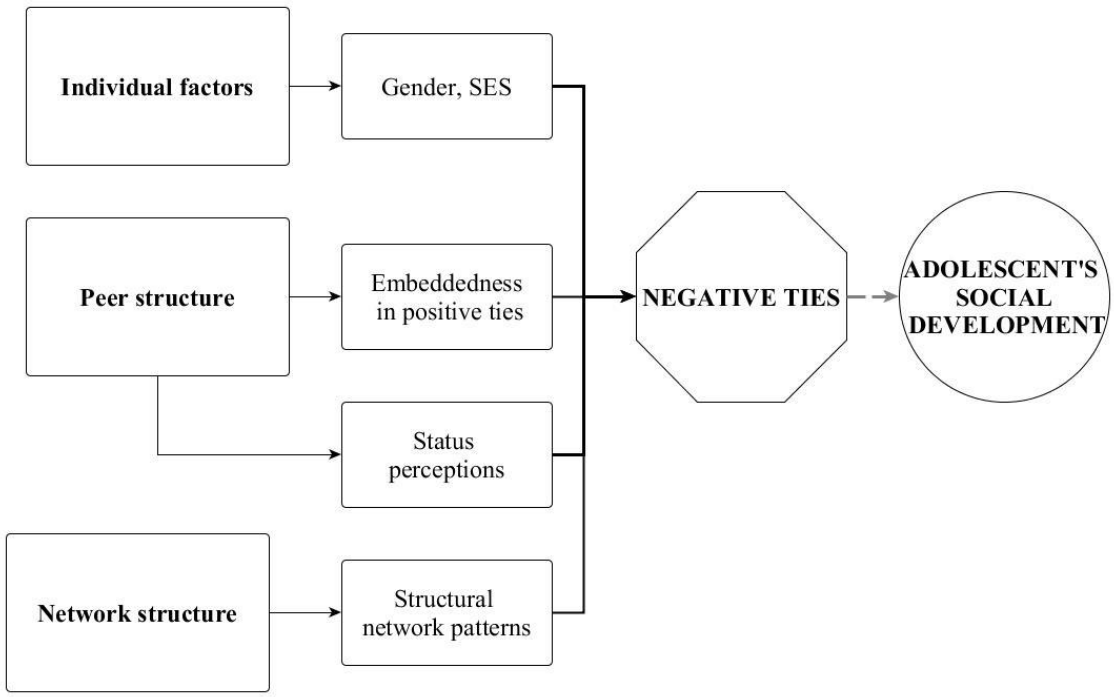
Amoroso et al., 2010). More precisely, status positions could be examined at an individual as well as at a group level (Lynn Hawkins, Pepler, & Craig, 2001).

1.1.6 Visual summary of the research framework

Figure 1.3 gives a brief overview of why it is necessary to study negative relations among adolescents. The key points include four effects that may all contribute to the formation and establishment of negative ties. The first one is the assortative and dissortative mechanisms through the influence of individual factors. The second one is the existing network patterns while the third is the role of status perceptions. Finally, it also incorporates how the peer structure through the interrelation with positive ties contribute to the formation of negative ties.

Figure 1.3 also illustrates how the research done in this dissertation puts forward a better understanding of negative tie formation.

Figure 1.3: *Visualization of the research framework*



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1.2 Research questions

The aim of this thesis is to examine the presence, the formation and the evolution of negative relations. More specifically, we have three main research questions. We analyze the role of individual factors, the embeddedness in positive relations, the effect of dyadic status perceptions, and also the role of existing network patterns in creating and dissolving network ties. These research questions are organized as follows.

Individual factors

Question 1 - Assortative and dissortative mechanisms in establishing negative ties

How do individual factors (gender, ethnicity, status positions) induce the formation of different forms of negative relations among adolescents?

Peer structure

Question 2 – Embeddedness in positive networks

How do positive relations contribute to negative tie formation?

Question 3 –Status perceptions

How do status perceptions contribute to negative tie formation?

Network structure

Question 4 – Structural network patterns

How does the structure of negative networks influence negative ties?

To understand these questions, we conducted three studies using the most up-to-date methodological tools in social network and adolescent research. The first study is a cross-sectional analysis to understand manifest negative tie formation, such as bullying and victimization tie formation. The second and the third study use longitudinal analysis to understand disliking, the latent form of negative ties. We believe that a new way of status conceptualization (such as taking perceived admiration mechanisms into account) helps to understand more clearly what motivates negative ties to create. We consider that the results of our work could make a valuable contribution to the very little existing research on negative relations.

In Chapter 2, we present the cross-sectional analysis. First, we analyze how status positions based on peer admiration and peer acceptance influence the formation of bullying and victimization. Second, we examine how the self-proclaimed bullying and victimization networks differ from each other. Third, we test the role of existing

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network patterns and network independent attributes, such as socio-economic status and gender, to explain the creation of bullying and victimization ties.

In Chapter 3, we focus on understanding who is nominated negatively and who gives negative nominations. First, we examine how positions of the four types of status measures affect the indegree centrality for negative relations, therefore being rejected and the outdegree centrality for negative relations, therefore being hostile Second, we elaborate on how results for negative indegree and outdegree centrality differ from what we observe in the positive networks. Third, we conclude that the status positions of individuals, created as perceived by other peers, do have a greater effect on rejection and hostility.

In Chapter 4, we concentrate on understanding the evolution of internal forms of negative relations. First, we analyze to what extent disliking relations depend on how adolescents perceive the relative informal status of their peers. Second, we also elaborate on how positive relations are interrelated with negative relations. Third, we test the role of existing network patterns, gender and socio-economic status in explaining the formation of negative relations. Table 1.1 summarizes the examined issues in this thesis.

Table 1.1: *Summary of the examined factors*

		Focus: negative ties		
Question	Examined factor	Chapter 2	Chapter 3	Chapter 4
Q1	Individual factors	X	X	X
Q2	Interrelations with positive ties	-	-	X
Q3	Status perceptions	X	X	X
Q4	Structural network patterns	X	-	X

1.3 Data: describing the study "Wired into Each Other"

The proposed research questions are tested on the Hungarian longitudinal national network panel data "Wired into Each Other: Network Dynamics of Adolescents in the Light of Status Competition, School Performance, Exclusion and Integration" ("Wired into Each Other," 2010).[3] This panel data on networks and behavior provide an excellent empirical view on the social development of adolescents, their norms,

[3] The author as a member of the MTA TK "Lendület" Research Centre for Educational and Network Studies (RECENS) participated in writing the grant proposal, as well as the preparation of the study, collecting the data, the data cleaning and the data management process.

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relations, and behavior. The study was conducted between 2010 and 2014, and was funded by the Hungarian Scientific Research Fund (OTKA) (K/81336).[4] MTA TK "Lendület" Research Center for Educational and Network Studies (RECENS) and the Corvinus University of Budapest, Institute of Sociology and Social Policy gathered the data using a survey method. Overall 1,767 students participated in the study.[5] Wave 1 was collected in November 2010, wave 2 was conducted in April-May 2011, wave 3 in April 2012, while wave 4 in April 2013. Wave 4 of the data collection was not included in the empirical analysis of this PhD dissertation. The main reason was that the relational data between the individuals changed significantly, and were not appropriate for network analysis. Moreover, most classes with vocational training programs were dissolved; therefore we lost a significant amount of information about them. Therefore, it seemed reasonable not to include wave 4. "Wired into Each Other" is in line with distinguished international network studies that analyze relational ties among adolescents, such as the National Longitudinal Study of Adolescent to Adult Health Project from the United States, the KiVa - Anti Bullying program form Finland and the Netherlands, the TRacking Adolescents' Individual Lives Survey from the Netherlands, and the Children of Immigrants Longitudinal Survey in Four European Countries (the Netherlands, Germany, Sweden and the United Kingdom).[6]

Complete network data were collected from each class, representing the sample unit of our study. School classes are understood as small communities which become and remain closed groups during high school years in Hungary. As a result, 9th graders were chosen to be involved into the first wave of the data collection, because they were freshly brought together shortly before the data collection had started. Moreover, school classes can be described as closed communities or micro-networks where the actors spend a lot of time together and they form strong emotional ties with other members of the community.

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[4] Additional support has been provided by OTKA (K-112929), TÁMOP (4.2.2/B-10/1-2010-0023) and the "Lendület" program of the Hungarian Academy of Sciences (HAS). For more information about the project, please, go to the following website:
http://recens.tk.mta.hu/en/wired-into-each-other-otka-research-2010-2013 - Downloaded: 23/02/2015

[5] Besides having quantitative data, questionnaires with teachers and school principals, and observations were conducted as well, but they do not present part of this PhD research.

[6] For more information about these studies, please visit their webpages.

- http://www.trails.nl/en/ - last access: 23/02/2015
- http://www.cpc.unc.edu/projects/addhealth - last access: 23/02/2015
- http://www.KiVaprogram.net/ - last access: 23/02/2015
- http://www.cils4.eu/ - last access: 23/02/2015

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The questionnaire used for the data collection contained relational information between classmates and also background questions about the pupils' learning attitudes, information about their past school performance and their social-family background. The relational information was gathered by using sociometric methods (Mérei, 1971), which contributed significantly to the description of adolescent relationships ties (Coleman, 1961; Coleman, Johnstone, & Jonassohn, 1963). It has been recognized that not only social relations are influential in adolescent behavior and norms, but behavior also affects tie formation and network evolution (Snijders et al., 2010; Steglich, Snijders, & West, 2006). The panel data provides for an excellent opportunity to examine social influences and social selection mechanisms and to understand, for instance, the role of friendship or gender in negative tie formation (Veenstra et al., 2010).

Self-administered pencil-based surveys that included information about social background and educational attitudes were completed during regular classes with the help of trained interviewers. The data collection in each class took no more than 45 minutes. During all waves of data collection, passive permission was required from the parents to sign and return if they consent for their child to participate in the project. The respondents and their parents were informed about the nature and duration of the study. Passive consent forms from the parents are stored in locked cupboards at the MTA TK "Lendület" Research Center for Educational and Network Studies (RECENS). The form masters (the teachers who were responsible for the management of the class) were also asked to fill in a short questionnaire.

The students without permissions were not included in the analysis, and the students who were absent during the data collection were coded as missing. The students were assured that their answers would be kept confidential and used for research purposes only. Relational information was collected between classmates only. For gathering network items, the full roster method was used, so that all students in a class could indicate their relationships with all classmates.[7]

The sample in the first wave contains 9th grade students from 44 secondary school classes of 7 Hungarian secondary schools nationwide in the country. The aim of the sampling procedure was to cover the Hungarian secondary educational system by its diversity in types of education, geographical locations including ethnically diverse

[7] A detailed description of our data protocol, including data storage, protection, and destruction is available online at: http://recens.tk.mta.hu. - last access: 23/02/2015

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settlements and the school's general performance. As educational research highlights, there are huge differences among Hungarian high-schools in the performance of their students, mainly explained by geographical positions, institutional settings, and also by the sociological background of their students (Kertesi & Kézdi, 2010). In short, socio-economic status correlates with the type of school selected. For example, a 15-year-old pupil who studies in a vocational training school is less likely to perform well and to study further in tertiary education than his/her similar age counterpart who follows the general grammar school training track. Moreover, it is more likely that the same student comes from a disadvantaged family and will drop out of school before finishing his/her studies. It was essential to include classes with different institutional programs and settlement types in proportion to their prevalence nationwide. The sample contains information about ethnicity as well, but this is not used in this thesis. More precisely, five of seven schools are located in ethnically heterogeneous neighborhoods based on the Hungarian Official decennial censuses 2001. The final sample was prepared from the administrative dataset of the Education Office, KIR.

The final population covers each type of institutional settings of 9th grade students located in differently sized settlements. Schools in the sample are located in Budapest, the capital of Hungary, in one county capital in Eastern Hungary, and two towns with maximum 13,000 habitants, also in Eastern Hungary. From a network perspective, we could expect different dynamics of the relations between classmates as the contexts might differ. In addition, as studies in a general grammar school could start in grade 5, grade 7, and grade 9, we chose students starting their secondary studies in grade 9. The sample contains one class where students started their secondary studies in the 5th grade, and one in the 8th grade. In the final sample, 15 classes are from general grammar schools (preparing students for the secondary school final examination), 14 classes are from vocational secondary schools (preparing students for the secondary school final examination with pre-vocational elements), and 15 classes are from vocational training programs (the program contains general subject courses with vocational guidance, preparing students for entering into a program that requires 10 years of general education altogether). Students in 12 classes were studying in the capital, Budapest, 17 classes were found in cities with maximum 13,000 inhabitants, and 15 classes located in a county capital with 55,000 inhabitants. Table 1.2 summarizes the characteristics of classes.

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Table 1.2: *Description of the sample*

School	Type of settlement	General grammar school	Vocational secondary school	Vocational training school	Total
School 1	County Capital – 55,000 inhabitants	5	0	0	5
School 2	County Capital – 55,000 inhabitants	0	5	5	10
School 3	Town 1: 13,000 inhabitants	3	1	3	7
School 4	Town 2: 13,000 inhabitants	3	1	0	4
School 5	Town 2: 13,000 inhabitants	0	3	3	6
School 6	Capital	4	0	0	4
School 7	Capital	0	4	4	8
Total		15	14	15	44

Note: In School 3, students started their secondary studies in grade 7 as one out of the three general grammar school classes. In School 4, students started their secondary studies in grade 5 as one out of the three general grammar school classes.

In total, 1,622 students participated in the first three waves of the study. The number of participants decreased by 20% from wave 1 to wave 3. The survey response rate was above 80% in all three waves, and increased from wave 1 to wave 3, from 86% to 88.5%. In each wave, there were students who joined the sample. While in the first and in the second wave, the number of joiners only represents about 3% of all participants, in wave 3, 12.6% of the sample consists of new students. This may explain why there are more changes between schools from one year to the next than within one academic year. Remarkably, we find the same pattern when we look at students who left the sample. While only 6.3% of the participants left the sample between wave 1 and wave 2, the number of leavers is five times higher, 27.5%, from wave 2 to wave 3. This large increase can be explained by the shift between two academic years. On one hand, some students changed schools to continue their studies in another institution. On the other hand, some students simply dropped out of school without finishing their studies. This especially happens in vocational training schools, and reflects the weakness of Hungarian secondary education (Liskó, 2008). The number of private students (those who are officially members of a class, but follow an individual track without studying together with the other classmates) was quite low in both waves.

There were 44 classes in wave 1, while in wave 3, four classes disappeared or were merged with other classes. There was also some internal "moving" within the

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sample. It is important to underline that the gender composition of the sample is distort and does not represent the rate of males and females in the secondary educational system, as it is more gender-balanced (KSH, 2012). In the target population 50% of students are males. In the sample, in each wave, the number of males is about 40%, which reflects sampling features only. This might slightly influence the results, but we have no knowledge whether this happens systematically or randomly. Table 1.3 summarizes the general descriptive statistics of the sample.

Table 1.3: *General descriptive statistics of the sample, by survey response and non-response; joiners and leavers*

	Wave 1		Wave 2		Wave 3	
	Count	%	Count	%	Count	%
Total	1,425	100.0	1,378	100.0	1,154	100.0
Survey-non response	200	14.0	231	16.8	139	12.0
Completed	1,225	86.0	1,147	83.2	1,015	88.0
New student - joined the sample	32	1.8	43	2.9	150	12.6
Left the sample since the previous wave	-	-	90	6.3	379	27.5
Students changed classes within the sample	1	0.1	27	1.5	65	5.5
Private students	14	0.8	27	1.5	16	0.9
Number of classes	44	-	43	-	41	-
Total- male	554	100.0	551	100.0	448	100.0
Survey non-response male	86	15.5	101	18.3	55	12.3
Completed male	468	84.5	450	81.7	393	87.7
Total- female	871	100.0	827	100.0	622	100.0
Survey non-response female	114	13.1	130	15.7	84	11.9
Completed female	757	86.9	697	84.3	706	88.1

Figure 1.4 and Figure 1.5 describe the distribution of the survey response and non-response rate by the two main dimensions of the sampling procedure, by school type and type of settlement respectively.[8] Figure 1.6 shows the percentage of survey response and non-response rate by schools.

The survey non-response rate is the lowest in the general grammar schools, and the highest in the schools with the vocational training program. The number of completed questionnaires decreased through the three waves, but this may be explained

[8] For more information about the survey response and non-response rate, by school type, type of settlement, schools and classes, please, consult Table A.1.1 and Table A.1.2 in the Appendix.

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by the decreasing number of survey participants and by the number of missing students. The number of responses is over 90% in the general grammar schools, 80% in the vocational secondary schools, and between 70-80% in the schools with the vocational training programs. Generally, in these classes, it is more likely that pupils do not attend schools and drop out before finishing their studies. In the two empirical papers where network analysis is used, we had to drop those classes where the survey non-response rate was high. In the regression paper, we disregarded those who left the sample, because they had missing values on the dependent and the independent variables.

Figure 1.5 shows the distribution of survey responses by school type. Interestingly, the distribution by type of settlements does not show a similar pattern. It seems that the geographical location does not affect who respond or do not respond to the questionnaire. Figure 1.6 shows the percentage of completed and non-completed surveys by schools throughout the three waves. In all schools the rate of survey responses was over 70%, and in School 1, School 4, and School 6, it was above 90% in all waves. These are the grammar schools. Moreover, the response rate in wave 2 was lower than in wave 3. It could be explained by the fact that the lowest performing students or those who did not attend school left the sample between the 9th and 10th grade.

Figure 1.4: *Number of survey responses, by school type*

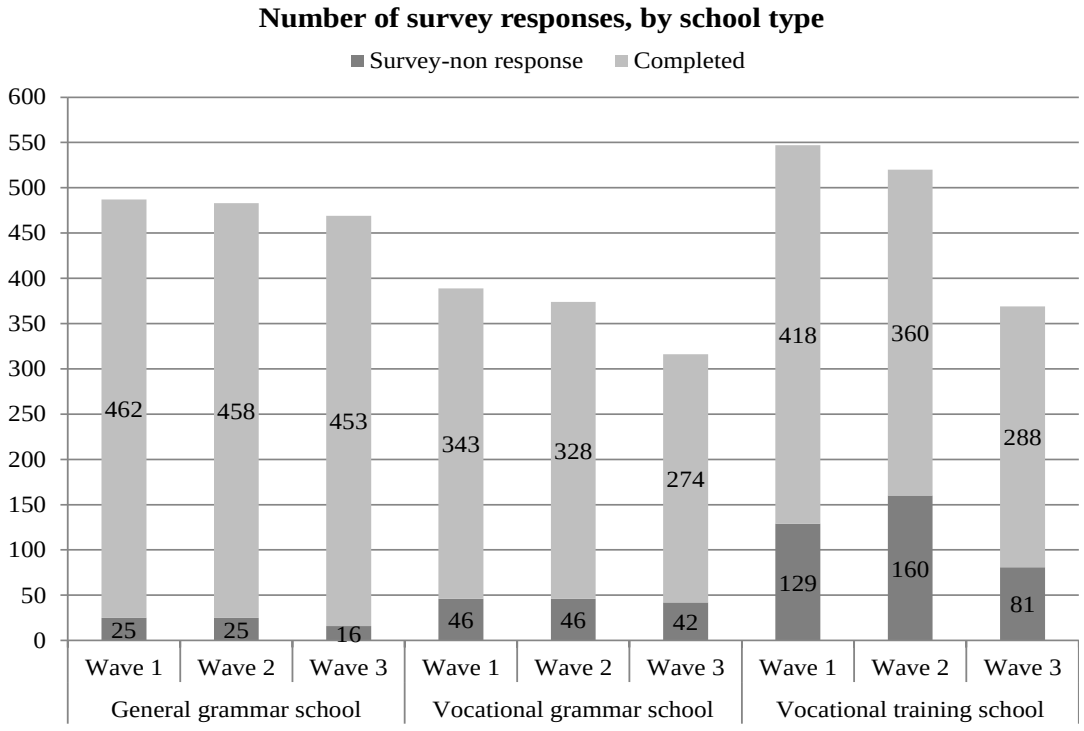

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Figure 1.5: *Number of survey responses, by type of settlement*

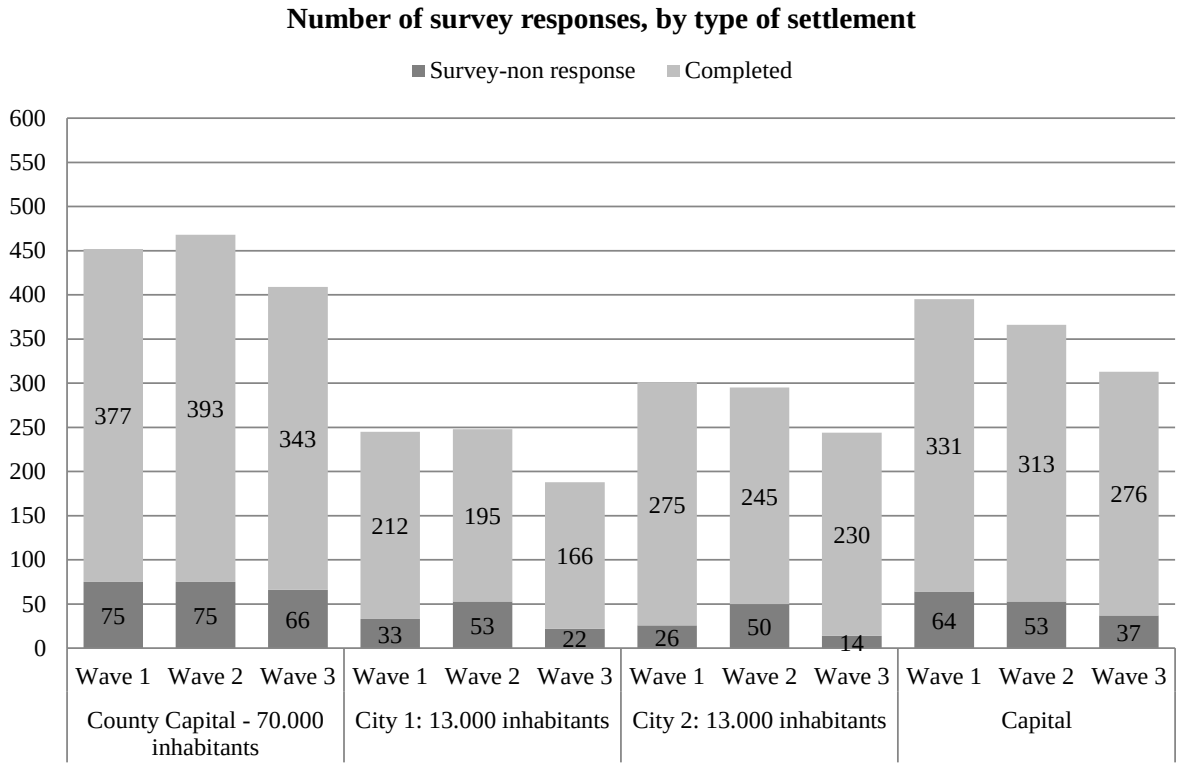
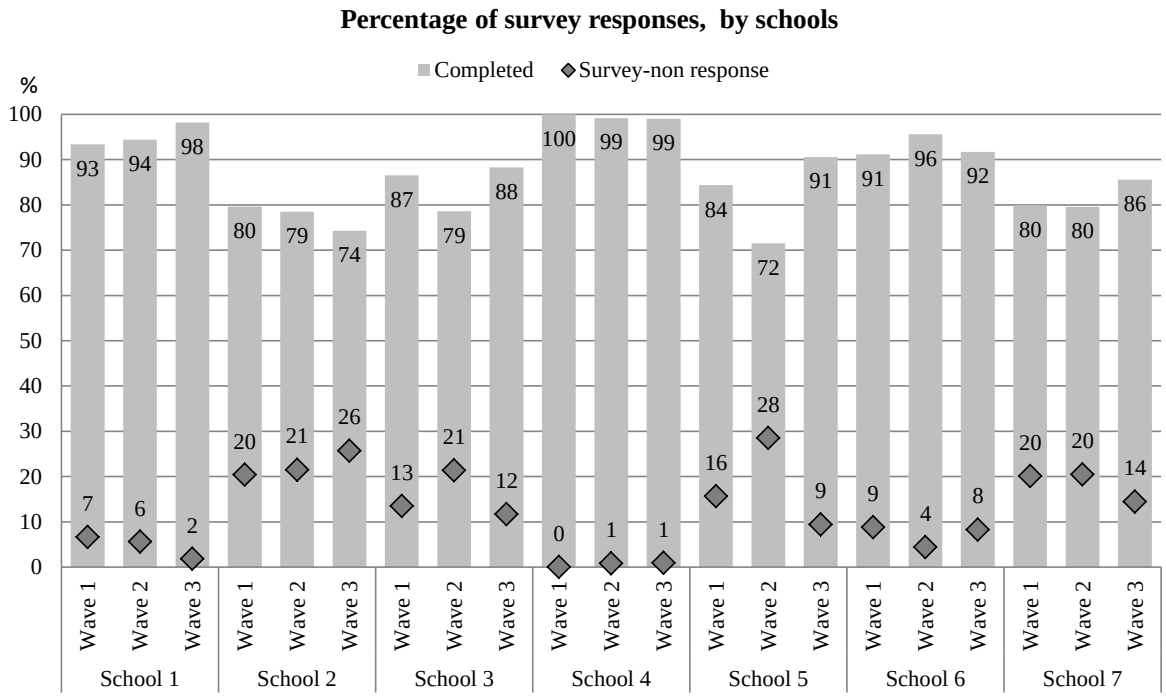


Figure 1.6: *Percentage of survey responses, by schools*



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1.4 Methods

The research questions in the upcoming chapters are analysed by using regression models, descriptive and analytical empirical network methods, such as exponential random graph models (ERGMs, also referred to in the literature as p*), and stochastic-actor based models (SABMs). The unit of the analysis compromises individuals and school class networks.

Panel regression allows for analyzing how, over time, no changing attributes influence certain specificities of the observed individuals or institutions. The panel approach is possible because each student was surveyed repeatedly over multiple (three) years in our data. Panel regression analysis allows us to control for time-invariant, potentially omitted factors – both observed and unobserved ones. Therefore, we use between and within variation in the differences between students, and the time-series or within-subject information reflected in the changes within subjects over time. This is achieved by including individual level (in our case, student level) fixed effects in the regressions. This allows for a more rigorous test of our hypotheses on the relationship between status positions in negative and positive peer regard (McManus, 2011).

The descriptive network methods consist of descriptions about the micro, mezzo and macro levels of the networks. The micro level identifies the role of actors in a network by calculating their centrality measures such as betweenness, closeness, eigenvector centrality (Kadushin, 2004; Wasserman & Faust, 1994). The mezzo level consists of the representation of dyads and triads, and other higher order configurations, such as cliques and n-cliques. The macro level suggests the descriptions of network level density value, which refers to the proportion of existing ties in a network (Prell, 2011).

The interrelation of networks is described by calculating overlapping indices, such as the Jaccard index, simple matching coefficient, overlapping index, and the quadratic assignment procedure (QAP) correlations. The simple matching coefficient (SMC) can be interpreted as the number of 1s and 0s shared by the nominations in the same positions, divided by the total length of all possible nominations. The overlapping coefficient can be interpreted as the number of 1s shared by the nominations in the same positions, divided by the total of the shared nominations in one of the networks. The Jaccard coefficient can be interpreted as the number of 1s shared by the nominations in the same positions, divided by the total length of all possible nominations. The idea of

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the QAP is to identify the value of the measure of association when there really is not any systematic connection between the two or more analyzed relations (Krackhardt, 1988). The QAP correlation is the Pearson correlation among matrices (Prell, 2011). The QAP analyzes whether the presence of a tie in one cell in matrix 1 corresponds to the presence of a tie in the same cell in matrix 2 (Prell, 2011).

To test the research questions about the structural parameters, the ERGMs (Robins, Pattison, Kalish, & Lusher, 2007) and the SABMs are used (Snijders, van de Bunt, & Steglich, 2010; Steglich, Snijders, & West, 2006). The intention behind developing ERGMs was to develop a statistical model for presuming the underlying structural nature of networks (Prell, 2011); ERGMs are mainly used for cross-sectional analysis, and could be interpreted as logistic regression models. Thus, whereas the QAP controls for network structure, p* attempts to explain it, and it examines lower level network configurations (Prell, 2011). A network configuration refers to a small set of nodes with a subset of ties amongst the nodes. The parameter estimates that ERGMs generate can roughly be interpreted as the parameters in logistic regression analysis (Lusher, Koskinen, & Robins, 2012). Standard statistical methods (e.g. logistic regression) assume independence among actors and ties; therefore, they cannot model network dependencies (Robins et al., 2007; Lusher et al., 2012). The network configurations are based on non-directed graphs and directed graphs as well. The ERGM framework explains which configuration explains global network properties better, such as density, centralization or transitive triads. The ERGMs take such dependencies into account, and use these network configurations to explain network structure, by probability distribution, dependency assumptions, and the estimation process (Robins et al., 2007; Lusher et al., 2012). ERGMs estimate by probability distribution that a given network configuration has a higher or lower chance to occur than in a random network (Robins et al., 2007). In this dissertation, the software package MPNet is used for estimating the ERGMs (Wang, Robbins, Koskinen, & Pattison, 2014).

The SABMs are developed to estimate changes in longitudinal network data (Snijders et al., 2010). SABMs assume that each actor in a network is evaluating their position in the current network according to the current network's characteristics, which are the specifications found in the model. More formally, when there is an opportunity for an actor to make a change, the probability of any given change is assumed to be proportional to the exponential transformation of the objective function (Snijders et al.,

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2010; Steglich, Snijders, & West, 2006). These changes can be assumed to be the results of endogenous processes although external factors are also included (Prell, 2011). *Social influence* shows how actors who share a social tie influence each other's behavior. *Social selection* describes that those who share a similar sort of behavior form ties (Prell, 2011; Snijders et al., 2010). As social influence and social selection are seen as intertwined processes (Steglich, Snijders, & Pearson, 2010), making use of a set of models helps the analyst unravel which process occurred first for a given set of actors (Prell, 2011). SABMs are often estimated in the program SIENA (simulation investigation for empirical network analysis) (Ripley, Snijders, Boda, Vörös, & Preciado, 2014). The actor-based models in Siena assume that each actor in a network is evaluating her position in the current network according to the specifications found in the model. More formally when there is an opportunity for actor *k* to make a change, the probability of any given change is assumed to be proportional to the exponential transformation of the evaluation function (Ripley et al., 2014).

When we used ERGMs and SABMs throughout this thesis, first, we conducted the analysis class by class, more precisely network by network, and then we conducted a meta-analysis. In statistics a meta-analysis covers statistical methods for combining results from different studies. This happens in the hope of identifying patterns among study results (Snijders & Baerveldt, 2003). A meta-analysis uses a statistical approach to combine the results from multiple studies and results in an effort to increase power, and improve estimates of the size of the effect. Essentially, a meta-analysis produces a weighted average of the study results included. This approach has several advantages: a meta-analysis is done by identifying a common statistical measure that is shared between the studies, such as effect size or p-value, and by calculating a weighted average of that common measure (Snijders & Baerveldt, 2003). This weighting is usually related to the sample sizes of the individual studies, although it can also include other factors, such as study quality. Results can be generalized to a larger population; the accuracy of estimates can be improved as more data is used. This, in turn, may increase the statistical power of different estimates. The variation of results across the studies can be analyzed, and hypothesis testing can be applied on summary estimates (Snijders & Baerveldt, 2003). The meta-analysis of several small studies does not predict the results of a single large study, and this is the weakness of the method. However, a meta-analysis seems a perfect way to increase the power of the separate analyses in our study. For the analysis, we programmed scripts in R, using various

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network methods and packages related to social statistics, such as RSiena, Stata, and SPSS. Table 1.4 summarizes the proposed methods.

Table 1.4: *Summary of methods in the thesis*

Methods	Chapter 2	Chapter 3	Chapter 4
Descriptive network analysis	X	X	X
Panel regression	-	X	-
Stochastic Actor Based Models (SABM)	-	-	X
Exponential Random Graph Models (ERGM)	X	-	-

1.5 Concluding remarks

This chapter gives an overview of the dissertation's research framework. In what follows, we summarize the social mechanisms that contribute to positive and negative tie formation. Next, we show why understanding the process of creating negative ties is important in the field of research on adolescence. Then, we elaborate on the main research questions derived from the proposed research framework. We also present the Hungarian empirical data which were purposely collected to test our questions,. We also provide an outline of the various methods that were used later in this dissertation. As a final point, we discuss the main conclusions of this chapter.

The analysis of positive social relations represents an important tool for studying a wide range of social phenomena. Extensive information is available about the mechanisms that establish positive ties (Ibarra, 1992; Kandel, 1978), but less is known about the processes that contribute to the creation of negative ties (Clement & Harding, 1978; Quillian & Campbell, 2003). While the dynamics of positive networks and their effect on social and behavioral dynamics have been studied extensively (Hallinan, 1979; Lazarsfeld & Merton, 1954; Mercken, Snijders, Steglich, & de Vries, 2009; Steglich et al., 2006), less is known about the governing processes that establish negative ties, and what the role of negative relations in the foundation of these social phenomenon is (Huitsing, Snijders, van Duijn, & Veenstra, 2014; Labianca & Brass, 2006; Roda, 2014). It is mainly because of measuring visible and invisible forms of negative ties (such as hitting or gossiping, and disliking or hate, respectively) are relatively difficult (Labianca, 2012).

We presented that negative ties could be defined as those judgments, feelings and intentions that one person has towards another person, and proposed its

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classification by showing that negative ties have manifest and internal forms (such as gossiping and fighting, and disliking and hate, respectively) (Labianca et al., 2006). While we offered an outline of how similar values and beliefs, geographical proximity, membership of the same community, and family ties could increase the probability of establishing positive ties, we still do not know whether similar or different mechanisms are responsible for negative ties (McPherson et al., 2001). Existing structural network patterns could also explain that if one actor nominates another as a friend (Rivera et al., 2010), it is more likely that this tie will be reciprocated over time (Steglich et al., 2006). It also shows that those who receive many positive nominations are more likely to become popular.

Positive and negative relations emerge by external and network-related factors. The external factors are mainly described as characteristics of individuals and groups, like race, ethnicity, gender, age, and social status. Positive relations are principally created by homophile mechanisms: those who share similar social characteristics, or share similar beliefs and values are more likely to be positively connected (Kenis & Knoke, 2002; McPherson et al., 2001). For example, let us assume two students who live in Budapest, both are 15 years old and like listening to rock music. As they live in the same city, they are of the same age, and share the same taste of music, they are more likely to become friends. While there are hundreds of articles that prove the existence of the power of similarity in creating positive relations, less is known about whether different (heterophobia) (Takács, Maes, & Flache, 2015) or similar (homophobia) characteristics may influence the establishment of negative ties. These assortative mechanisms highlight the importance of actor attributes in becoming central in a network or in forming a network tie (Rivera et al., 2010). For instance, those who have been working in the same organization for some time are more likely to become *bridge actors* that connect different divisions through their informal networks.

Recent research suggests examining the network nature of establishing a tie between two individuals or two organizations (Rivera et al., 2010). Embeddedness in social networks is gradually seen as an origin of human achievement, social stratification, and actor behavior (Rivera et al., 2010). Structural network patterns such as tendency for reciprocity or triadic configurations emphasize why existing relationships matter in creating a tie in a consecutive time point (Hallinan, 1979; Hallinan & Williams, 1989; Snijders, 2011). Actor-related network positions could also explain (such as betweenness, closeness) why those who are bridges or popular in a

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network are more likely to attract more nominations (Ibarra & Andrews, 1993; Kadushin, 2004). Even though negative ties do appear in the network literature, mostly on a theoretical level, for example in the analysis of triadic closures (Cartwright & Harary, 1956; Heider, 1958), the framework of defining them is not yet clarified; neither have empirical studies been made in large numbers, (Labianca, 2012).

Negative relations are the main target of the research on adolescence, which is a particularly important period of social development. Especially, because it has long-lasting consequences for later life (Coleman, 1961). Adolescents' well-being are mainly determined by the individual properties, the environment where they live, and their relationships with their families, teachers, and peers (Lippman et al., 2011). Studies that successfully measured negative relations found that negative interactions have a disproportionally greater effect on satisfaction, mood, and stress than positive relations; a phenomenon which has been described as a *negative asymmetry* (Labianca, Brass, & Gray, 1998; Moerbeek & Need, 2003). Those who are the receiver or sender of negative relations are more likely to be isolated and neglected by their peers (Faris & Felmlee, 2014b).

The latter research also emphasizes that negative relations are mainly driven by status mechanisms. Status is defined by individuals' personal attributes or the perception of their peers. In line with research on adolescence status, in this thesis, we define status by the perceptions of peers, describing social visibility in a community. Competing for status and being dominant represent a crucial factor in establishing and maintaining relationships (Coleman, 1961). This is especially crucial among adolescents, where status represents a major goal for being seen in a community (Lindenberg & Steg, 2007). Therefore, establishing negative ties seems a major underlying force to achieve high status (Faris & Ennett, 2012; Rodkin & Berger, 2008).

Structural balance is the most prominent theory that explains the interrelation of positive and negative ties (Cartwright & Harary, 1956; Doreian & Stokman, 1997; Heider, 1946, 1958). The theory describes that if we observe the smallest subgroups, the triad configurations in a network, we could expect that the relations between three actors either become balanced or not. It explains that it is more likely that the friend of my friend becomes my friend, or the enemy of my friend becomes my enemy as well than the other way around. It also describes that those common enemies could create friendship, and friendship could create common enemies as well.

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Based on this theoretical overview, we analyze how negative relations evolve over time, how perceived status positions induce the formation of different forms of negative relation, and how positive relations interrelate with negative networks. Based on these supported aforementioned mechanisms, the question is whether we can observe the reversed patterns, more precisely whether we could empirically show that there are actors who attract many negative nominations and become "the black ships" of a group. Research also shows that individuals are more likely to give positive nominations, as the negative consequence for building social capital is sometimes higher than sending negative nominations (Brass & Labianca, 1999). Thus, we expect to observe a different activity rate in giving negative nominations than giving positive ones.

We use the data of the Hungarian panel study "Wired into Each other". We show that our sample non-representative, sample consists of 44 classes form 7 schools in 4 settlements. The data reflect the anomalies in the Hungarian educational system, such as the high dropout rates among pupils in vocational training programs. We receive a number of answers enough to test our hypotheses. Then, the network methods (QAP, ERGMs, SABMs) and meta-analysis (as the merged analysis of small datasets) that are used to test our questions are presented. In what follows, we present the three empirical studies on the evolution of negative ties.

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CHAPTER 2 Identifying the Role of Status Positions in Bullying and Victimization Networks[9]

Chapter summary

Peer perceived status positions have a profound impact on who the bully and the victim is. This study examines how peer admiration and peer acceptance influence the formation of self-proclaimed bullying and victimization relations. Moreover, the study also detects how bullying mechanisms could differ when we measure it either from the bully's or the victim's perspective. This question is examined on a cross-sectional sample using a meta-analysis of separate Exponential Random Graph Models (ERGMs).

The results suggest a marked association between large variation between peer admiration and peer acceptance. In both networks, there are students who were "black sheep" as they received a considerable amount of nominations, or "active" as they sent large numbers of nominations. As hypothesized, students become victims when they are mainly unaccepted or disrespected by their peers. Pupils are more likely to bully those who are dissimilar in the admiration and in the acceptance status hierarchy. No evidence is found that a high level of admiration leads to becoming a bully. Results also demonstrate gender similarity in bullying and victimization processes, while socio-economic status does not affect who the bully or the victim is. Finally, estimations seem more robust in the bullying than in the victimization networks. The chapter manages to show that admiration has an impact on bullying relations.

Keywords: bullying, victimization, peer reported status perceptions, adolescents, ERGMs, meta-analysis

[9] Chapter 2 is largely based on the working paper 'Pál, Judit & Kisfalusi, Dorottya (2015): Identifying status positions: The role of peer admiration and peer acceptance in adolescents' bullying networks'. The co-author allowed me to use this study as part of my PhD dissertation.

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2.1 Introduction

In the past decades, bullying among youth became an important focus of research and policy-making in all developed countries (Saluja, 2004). Since bullying causes serious problems and challenges for children, their families and their schools (Drydakis, 2014; Giovazolias, Kourkoutas, Mitsopoulou, & Georgiadi, 2010), it should be thoroughly examined and significantly reduced by educational institutions and by parents (Rigby, 2007).

Following Olweus' (1993) terminology, bullying might be described when children are being exposed repeatedly and over time to negative social and emotional actions by one or more peers. Bullying describes a systematic abuse of power with three key elements: repetition, intention to harm, and unequal power between the bully and the victim (Woods & Wolke, 2004).

Children can be involved in bullying as the perpetrators (bullies), the targets of bullying (victims), or being a target and at the same time bullying others (bully/victim) (Olweus, 1994; Salmivalli et al., 1996). Finally, most children not involved in bullying could be either neutral, outsiders, or bystanders – such as the follower of the bully (who supports and reinforces bullying), or the defender of the victim (Salmivalli et al., 1996; Huitsing & Veenstra, 2012). The numerous roles in bullying may explain why harassment is not an independent phenomenon from contextual factors, and could be understood as a group process (Salmivalli et al., 1996).

Bullying has severe forms such as *physical*, *verbal* and *relational* (Olweus, 1993). *Physical* (hitting, punching, or kicking) and *verbal* (name-calling or mocking) describes the direct form of bullying (Smith & Sharp, 1994). These direct forms also include verbally abusing, beating, destroying others' belongings, or blackmailing them. In contrast, *relational bullying* refers to social exclusion of children such as ignoring, excluding them from games or parties, destroying peer acceptance, spreading gossip, or enclosing them to be humiliated (Woods & Wolke, 2004). With the wide-spread usage of ICT (information communication technologies) tools among adolescents, *cyber bullying* appeared as a new form of bullying. According to Wang, Iannotti and Luk (2010) cyber bullying can be defined as *"a form of aggression that occurs through personal computers (e.g. e-mail and instant*

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messaging) or mobile phones (e.g. text messaging)" (Wang, Iannotti, & Luk, 2010, pp 369).

A common practice to measure bullying is to describe the prevalence of a student's self-reported experiences by using survey methods. On one hand, there are researchers who argue that it is better to measure bullying and victimization without using the term bullying itself (Felix, Sharkey, Green, Furlong, & Tanigawa, 2011), and to designate their types instead. But in each case the respondent should be clear about what constitutes bullying, the diverse types and its prevalence (e.g. it occurs every 2-3 months) (Furlong, Sharkey, Felix, Tanigawa, & Greif-Green, 2010). On the other, there are researchers who argue that it is better to measure bullying by using the term itself, as the KiVa project describes: first, give a description about bullying, and then ask students about their experiences by using each types of bullying (KiVa, 2015).

Researchers use either peer, self-reports or self-proclaims to measure bullying. *Peer-reported* bullying is based on nominations or ratings assumed by group members or classmates, therefore participants nominate one or more classmates who seem suitable for the description of a certain bullying role or even type of bullying (Bouman et al., 2012; Sainio, Veenstra, Huitsing, & Salmivalli, 2010; Veenstra et al., 2005).

Self-reports are based on questions regarding the frequency of which a student bullied another or became a victim of bullying (Bouman et al., 2012). Moreover, social network questions could also help to identify how bullying ties develop between the bully and the victim; how the bullying and the victimization "map" of a community could be sketched; and also how it is embedded in the larger peer context.

Self-proclaims are based on questions to measure *dyadic* bullying. In this case, students receive a list that contain the names of all classmates and are asked to nominate them on bullying and victimization (Veenstra et al., 2007). The possibility they could make were unlimited and the questions are asked at the dyadic level (Veenstra et al., 2007).

Studies measuring the occurrence of bullying show that it ranges between approximately 10-25%, and differs considerably across countries (e.g. Analitis et al., 2009; Nansel, Craig, Overpeck, Saluja, & Ruan, 2004) A study from 2009 found that

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the prevalence of bullying is the highest in the Baltic countries, while the lowest in the Nordic countries, Ireland and Hungary (Craig et al., 2009).

Bullying is, however, not only a single action; it may have long-lasting mental, health and economic consequences both from the bully's and the victim's perspective. Most of the work on bullying and victimization shows that pupils who are engaged in harassment may experience physical, school, and mental health issues (Hugh-Jones & Smith, 1999; Rivers, 2000).

Being a bully in youth seems a strong predictor of anti-social behavior during adolescence and later in adulthood (Bender & Lösel, 2011). Students who bully are more likely to get into fights, and finally drop out of school (Loeber & Dishion, 1983; Stattin & Magnusson, 1989; Townsend, 2008). It is reported that they have more criminal convictions as adults and are more abusive towards their romantic partners, spouses, or children (Sourander, Jensen , Rönning, & et al, 2007).

Studies which successfully measured bullying showed that those who were ever bullied or became a bully-victim were more likely to skip or drop out of school, and had a lower academic achievement than peers (Konishi, Hymel, Zumbo, & Li, 2010; Townsend, 2008). Studies measuring the extreme behavior of school shooters showed that shooters had a history of being bullied in school (Leary, Kowalski, Smith, & Phillips, 2003).

Identifying risk factors of bullying can help prevent youth from becoming involved in bullying. Age, physical appearance, gender, ethnicity are the traditional risk factors that foster bullying, but there are some other factors, such as socio-economic status (SES), the role of which are less clear (Tippett & Wolke, 2014). For instance, research on school victimization shows higher rates of victimization among the youth who are physically less developed, unhappy with their appearance, or socially isolated (Faris & Felmlee, 2014).

Consequently, bullying and victimization are complex social phenomena that have long-lasting psychological, social, and economic consequences, and should be understood as a group process. Therefore, in the following section, we elaborate on the role of status positions, as one of the key indicators of describing group processes in bullying and victimization.

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2.2 Theories explaining bullying by status positions

Research on identifying risk factors also suggests that bullying could not be viewed as a single social action, but rather as social processes which are not independent from the larger peer context (Salmivalli et al., 1996). Accordingly, individuals tend to be aggressive with those they know and represent a potential threat to them.

Research also emphasizes that bullying is not independent of the peer context (Salmivalli et al., 1996), and most importantly inspired by status motives (Card & Hodges, 2006; Faris & Ennett, 2012; Lynn Hawkins et al., 2001; Sijtsema, Veenstra, Lindenberg, & Salmivalli, 2009). This is mainly explained with the help of the *goal-oriented approach* and the *dominance theory*. From a developmental perspective, gaining status represents a central goal for adolescents (Lindenberg & Steg, 2007; Pellegrini & Long, 2002). The more admired they are, the better they feel in the peer structure, which is often associated with occupying a high position in the peer structure. In closed groups, such as school classes, those who have high status are more likely to make decisions for the group, whereas having low status is associated with adjusting to opinions of other group members, and not participating in decision-making (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006; Berger, Rosenholtz, & Zelditch, 1980). Therefore, competition for status is a major force that structures the adolescent community (Coleman, 1961; Coleman et al., 1963).

Status cues provide the basis for the important early development of status hierarchies (Driskell, Olmstead, & Salas, 1993; Vinciarelli, Pantic, Bourlard, & Pentland, 2008). Efficient status signals stabilize the structure of adolescent relations and help to avoid open conflicts (Vinciarelli et al., 2008). When these signals are inefficient or when the status order is not accepted, dyadic conflict might occur (Pál, Csaba & Takács, 2011). Status competition could explain how otherwise peaceful peers turn into aggressors. From this perspective, bullying is a strategic tool and thus instrumental in status attainment (Hawley, Little, & Card, 2007; Kreager, 2007a, 2007b; Pellegrini & Long, 2002; Rodkin & Berger, 2008).

As *the dominance theory* describes, bullying is used as an instrumental tool for moving higher in the social ledger, particularly during the transition from elementary to high school, when patterns of the social hierarchy are established (Espelage, Holt, & Henkel, 2003; Espelage & Swearer, 2003; Paul, Espelage, & Green Jr., 2007). Previous studies found that bullies were strongly motivated by

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status, and bullying increased popularity (Sijtsema et al., 2009; Veenstra et al., 2007).

In adolescent communities, status could be defined in various ways. *Social visibility* describes it as the position a peer occupies in a group based on the perception of other group members (Clifford, 1963). Those who have high social visibility are often perceived as popular, admired, or dominant in the community (Cuddy, Fiske, & Glick, 2008; Fiske, Cuddy, & Glick, 2007). In adolescent research, social visibility is often measured by asking students who they consider popular or unpopular in their class or school. *Social visibility* is often labeled by the term *perceived popularity* or *consensual popularity*. This reflects that this type of popularity does not measure personal preferences, but the shared view of who is socially dominant or central (Bruyn & Cillessen, 2006). The latter research suggests that, comparing with social preference, the emotional nature of social visibility should be captured as well (Sweetman, Spears, Livingstone, & Manstead, 2013), by using sociometric measures (e.g. asking "who do you admire?"). This method helps to understand how admiration is created between two individuals. We refer to this type of status later in this study as *peer admiration*.

Social preference describes the peer perception of either liking or disliking other students in the community (Newcomb & Bukowski, 1983). The pioneering work by Coie, Dodge and Coppotelli (1982) pointed out that, based on the difference of liking and disliking peer perceptions, students could be put into five categories, thereby describing their position in the status hierarchy. Therefore, they can be either "rejected" (disliked by many), "neglected" (neither liked or disliked), "popular" (liked by many), "controversial" (liked by some and disliked by some others) or "average" (average on all four dimensions) (Coie, Dodge, & Coppotelli, 1982). We refer to this measure in the chapter as *peer acceptance*. Consequently, the association between these terms might differ in understanding status motives in bullying.

Perceived popularity, the most well-known measure of social visibility and admiration, is often described as a main factor in becoming the perpetrator of bullying (Bruyn, Cillessen, & Wissink, 2009; Cillessen & Mayeux, 2004; Cillessen & Rose, 2005; Bruyn & Cillessen, 2006). Studies successfully measuring the association between bullying and perceived popularity showed positive, but curvilinear connections (Bruyn et al., 2010). This explains that those who are low or

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high in the social ladder are more likely to bully than the others. A study by Faris and Felmlee (2011) pointed out the same pattern as well: the higher a student's perceived popularity is, the more likely it is that he/she will bully others. These students are called "popular bullies", because the higher they climb the school social ladder, the greater the risk is that they will be bullied. Once they reach the top of the status hierarchy, peers stop harassing them (Faris & Felmlee, 2011). Faris and Felmlee (2014) in another study also found that the more adolescents were concerned about their own popularity, the more aggressive they were. Unexpectedly, that is pointless for them, because hostile and aggressive behavior did not help to increase their status (Faris & Felmlee, 2014). Overall, Faris and Felmlee (2014) conclude that what matters is not whether status attainment works by being aggressive, but whether adolescents believe they can raise their own status by being aggressive.

Peer acceptance has mainly a negative association with bullying (Newcomb, Bukowski, & Pattee, 1993), but there are some studies which show the opposite. Those who are well-liked by their peers are less likely to bully others (Salmivalli, Kaukiainen, & Lagerspetz, 2000). Research examining the relationship between bullying and peer acceptance also shows that those who have many friends are less likely to become perpetrators of bullying, unless one of their friends is among the bullies (Bollmer, Milich, Harris, & Maras, 2005). Parkhurst and Hopmeyer (1998) found that adolescents who were indicated as popular by their peers, but not accepted, were more aggressive than adolescents who were both popular and accepted. Thus, acceptance moderated the positive effect of popularity on aggression (Parkhurst & Hopmeyer, 1998).

Peer acceptance also represents a protective factor against bullying. Bullies tend to target peers who lack social support. This is mainly because they are easy targets for the bully to show his or her own power (Bruyn et al., 2010). Those who have friends are less likely to be bullied than those who are isolated or alone, indicating that friendship is a protective factor (Bollmer et al., 2005). Furthermore, previous studies found evidence that friendship and bullying are not independent from each other. Bullies who are nominated by the same victims tend to like each other such as victims who are nominated by the same bullies (Huitsing et al., 2012). Moreover, victims with the same bullies and bullies with the same victims tend to defend each other over time (Huitsing, Snijders, van Duijn, & Veenstra, 2014). Not

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the number of friends, but the fact of having friends matters in bullying. For instance, friends can help simply by being there and letting the victim know they care (Bollmer et al., 2005). It could also happen that those who have many friends are more likely to become victims, as they are seen as peers who could be easily defended by others (Pellegrini, Bartini, & Brooks, 1999). This could be driven by "evilness": peers turn out to be aggressive towards those who could be seen as being accepted by the others. Friends could bully their peers as "frenemies": bullies pretend that they are the friends of the victims, but they bully them by, for instance, constantly spreading bad gossip behind their back (Coyne, Linder, Nelson, & Gentile, 2012).

In line with research on status perceptions in bullying processes, we analyze the effect of different forms of status measures in the process of becoming a bully or a victim. In this study, we define high status adolescents as being admired or accepted by peers. Additionally, the chapter analyzes two further issues. The first is that we test how admiration, captured as a sociometric term, affects bullying and victimization processes. The second is that we analyze these processes from a social network perspective.

We have three research questions 1.) How does peer admiration or peer acceptance influence who the aggressor and the victim is? 2.) Based on status motivation, are high or low status peers more likely to become aggressors and victims? 3.) In terms of the strength of outcomes, is there any difference between self-proclaimed bullying and victimization? In addition to these three questions, there are two supplementary contributions of the chapter. The first is that we examine bullying relations as social networks. The second is that we also control for the effect of gender and socio-economic status on the tie formation between the bully and the victim.

Similarly to the work of Bruyn and his colleagues (2010), we hypothesize that, like perceived popularity, peer admiration positively predicts who becomes the bully (H1a). This is mainly explained by the *dominance* mechanism. Those who are admired will bully more often in order to reinforce their dominance in the peer structure. We suggest that peer acceptance predicts (H2a) bullying negatively. This is explained mainly by the a*cceptance* mechanism. Those who are accepted by many do not risk their position when they bully others. We also hypothesize that peer admiration (H2b), and acceptance (H2b), negatively predict someone becoming a

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victim. Unaccepted and powerless peers are more likely to become victims, parallel with previous research.

The network nature of our data allows for the analysis of *status competition* and the *disdain mechanism*. Therefore, we also hypothesize that either *homophily* (being similar) or *heterophobia* (being different) in status positions predicts bullying. We suggest that, when status competition occurs, students who have an equal position in the status hierarchy are more likely to bully peers of the same status (H3a). However, we also suggest the opposite: when dominance occurs, students having different positions in the status hierarchy are more likely to bully each other (H3b). Table 2.1 summarizes the proposed hypotheses, in conjunction with the expected mechanism.

Table 2.1: *The proposed hypotheses*

Bully - victim / Type of status	Peer admiration	Peer acceptance
Bully	(H1a+) "admiration": Admired peers are more likely to be a bully.	(H2a-) "acceptance": Accepted peers are less likely to be a bully.
Victim	(H1b-) "disrespect": Admired peers are less likely to be a victim.	(H2b-) "unacceptance": Accepted peers are less likely to be a victim.
Bully & victim relationship	(H3a-) "homophily": Bullying occurs among peers of the same status. (H3b+): "heterophobia": Bullying is more likely to occur between peers of different status.	

In line with these theoretical foundations, we propose to understand the role of peer admiration in youth bullying behavior by examining the role of peer acceptance as well. *Self-proclaimed bullying* describes bullying from the bully's perspective by reporting *who they bully*, while *self-proclaimed victimization* defines bullying from the victim's perspective by reporting who *bullies the victims* (Bouman et al., 2012). We also analyze how bullying differs when we measure the aggressive behavior from the aggressor's (referred to as self-proclaimed bullying) and the victim's (referred to as self-proclaimed victimization) perspective. *Self-proclaimed bullying* describes if an individual *i* reports that he or she bullies another individual *j*, we identify the mocking tie from the perspective of the bully, therefore from individual *i.* In contrast, *self-proclaimed victimization* describes if individual *j* reports that individuals mock him/her, we identify the mocking tie form the perspective of the

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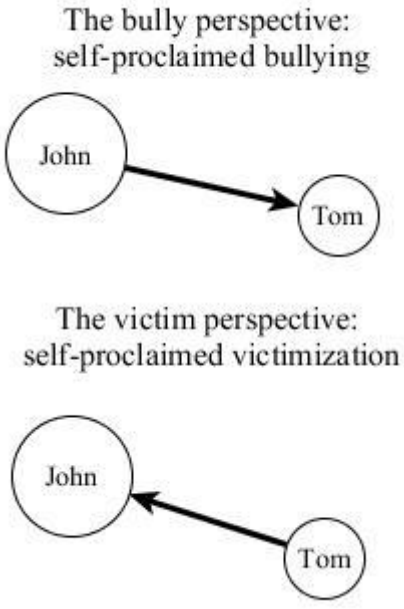
victim. The self-proclaimed victimization measures "who do you bully?" To our knowledge, there are few studies which tried to analyze this question from the bully's and from the victim's perspective at the same time (Bouman et al., 2012; Coyne, Smith-Lee Chong, Seigne, & Randall, 2003).

In order to clarify the aforementioned mechanism, we propose the following illustrative example. Let us assume two male students John and Tom who attend the same class. John has higher status on both peer admiration and peer acceptance than the average of the class, while Tom has lower status on both scales. When John reports that he bullies Tom, John has a self-proclaimed bullying tie to Tom. Therefore, the self-proclaimed bullying describes when students report on whom they bully. In this case, the ego (John) has higher status than the average, while the alter (Tom) has lower status than the average, and the difference between the status of ego and alter will be positive. When Tom reports that he is bullied by John, Tom has a self-proclaimed victimization tie toward John. Hence, the self-proclaimed victimization describes when students report who bullies them. In this case, the ego (Tom) has lower status than the average, while the alter (John) has higher status than the average, and the difference between ego and alter status will be identified positive.

Figure 2.1: *Illustration of the analyzed mechanism*



Note: The size and the position of the nodes illustrate the status positions of John and Tom.

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Further contributions

As we managed to identify bullying and victimization both from the bully's and the victim's perspective, we hypothesize that the model output is stronger when the dependent variable is self-proclaimed bullying rather than victimization. The main reason for this is that it is likely that the respondent feels humiliated when they have to report about who harasses them.

As bullying relates to gender role expectations, especially during adolescence, we also examine how gender explains bullying and victimization. To be accepted by peers and to avoid victimization, a lot of youth choose the safest way and behave according to gender expectations (Wolfe, Crooks, Chiodo, & Jaffe, 2009). As Wolfe, Jaffe and Crooks (2008) point out in their book, *"by disparaging those who fail to meet up to such expectations, teens protect themselves from falling outside the perimeter and remain safely within the acceptable boundaries defined by the comments and behavior of their peers and culture."* (Wolfe, Jaffe, & Crooks, 2008, p. 73). Boys are usually more often bullies than girls, but they seem to be more stable than girls in victimization (Camodeca, Goossens, Meerum Terwogt, & Schuengel, 2002). Males, who are socially withdrawn, shy or impulsive in their behavior, have no or few friends. They are disliked by other peer, are emotionally deregulated and have few coping skills (to tolerate stress), and are reported to be more likely to become victims of bullying (Berger, 2007; Olweus, 1994; Shields, Ryan, & Cicchetti, 2001; Veenstra et al., 2005; Wolke & Skew, 2011). While verbal aggression occurs with similar prevalence between boys and girls, physical forms are more common among boys, while relational aggression is more common among girls (Baldry & Farrington, 1999; Crick & Grotpeter, 1995; Rivers & Smith, 1994). Males spread gossip less often than females do, while females are less physically violent to each other than males are (Rivers & Smith, 1994). Compared to girls, boys are usually more likely to harass their peers (Salmivalli et al., 1996; Veenstra et al., 2007), and this gender difference is especially pronounced if physical aggression is under investigation (Card, Stucky, Sawalani, & Little, 2008; Olweus, 1993).

Adolescents who experience violence or aggression at home, or are influenced by negative parental relationships are more likely to bully others (Wolke & Skew, 2011). It is mainly because their adult models use aggression as an instrument to achieve their goals (Bandura, 1973). Socioeconomic status (SES) is an aggregate concept to capture family background. It measures material and social

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resources, and can be examined across societal levels, such as individual, household, and neighborhood. A recent study by Tippett and Wolke (2014) reviews the literature, and identifies controversial results in finding positive relationship between low SES and victims or bully-victims at school. They claim that studies showing a significant relationship between SES and becoming a victim found that low-economic status predicts children having a higher risk of being involved in bullying, either as a bully, a victim, or a bully-victim (Jansen et al., 2012; Tippett & Wolke, 2014). Moreover, single parenthood, low educational levels of parents (especially that of the mother) were important independent risk indicators of becoming bullied or bully-victims (Jansen et al., 2012; Wolke, Woods, Stanford, & Schulz, 2001). Compared to victimization, few studies explored the link between SES and bullying, and they found weak association between SES and becoming a bully (Tippett & Wolke, 2014).

2.3 Methods

2.3.1 Sample and participants

A subsample of 29 classes out of 40 of the second wave of the network study "Wired into Each Other" were included in the analysis. Students were 9th graders in the second wave, only 8 months after freshly brought together at the end of primary education. The subsample consisted of 32 classes out of 44. The subsample was selected based on the criterion that the response rate reached 80%. Later three classrooms had to be excluded from the analysis due to the lack of bullying nominations and the high values of parameter estimates' standard errors.[10] The final sample contained 29 classes.

Table 2.3 contains the descriptive statistics of the participants. The subsample comprises 843 respondents. On average, students were 15.8 years old (*SD* = 0.6), and the average number of enrolled students per school class was 30.5 (*SD* =4.8). 67.4% of the students in the subsample were female.[11] The subsample consists of classes from the three school types available in the Hungarian educational system:

[10] This explains why the structure of bullying networks could not be modeled adequately with the parameters we used; see more details in the "Analysis" section.

[11] On the one hand, this could be explained by the fact that our subsample does not represent the relevant cohort population in Hungary, which is more or less equal (52% are female). On the other hand, half of the sample is studying in grammar schools where the number of females is even higher (58 %) (KSH, 2012).

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secondary grammar school (14 classes), vocational school (ten classes), and vocational training school (five classes). 12 classes were in the capital city, Budapest; eight classes were in towns with approximately 13,000 inhabitants. Nine out of 29 classes were located in a city with a population of 55,000 inhabitants. Most students' father's and mother's highest level of education was high school.[12]

Table 2.2: *Information on the participants*

Name	Mean	SD	Min.	Max.	Sum
Class size	30.5	4.8	17.0	37.0	883
Age	15.8	0.6	14.7	18.8	
SES	0.0	1.0	-2.2	1.6	
Father education	4.3		1.0	7.0	
Mother education	4.3		1.0	7.0	
Girls (%)	67.4	23.8	50.0	100.0	

Note: The descriptive statistics are provided for the sample.

2.3.2 Measures

We chose to test our hypotheses using the second wave of the study, having two principal reasons for doing so. On the one hand, wave 1 of the data collection took place a few weeks after the beginning of the academic year, therefore, not surprisingly, the prevalence of the self-proclaimed bullying and victimization networks were low. Moreover, it increased for wave 2. It might be so because students had more opportunity to create conflicts with their peers. On the other hand, wave 2 seemed a relevant choice to observe status mechanisms, as compared to wave 3 of the study as status positions had not been perfectly established yet.[13]

Dependent variables: self-proclaimed bullying and victimization networks

We measured the prevalence of bullying behavior from both the bullies' and the victims' perspectives, similarly to other studies (Faris & Felmlee, 2014; Tolsma, van Deurzen, Stark, & Veenstra, 2013; Veenstra et al., 2007). We captured various aspects of *self- reported bullying* and *victimization*, such as physical, verbal and relational aggression.

A relationship between two classmates was both self-proclaimed bullying and victimization if student *i* nominated student *j* at least once. Then the corresponding

[12] More details about the socio-economic status can be found in the "Measures" section.
[13] The Jaccard indices between the bullying networks were very low, the data thus not making it possible to test dynamically the proposed questions.

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entry (i,j) in the self-proclaimed bullying matrix was marked 1 (0 otherwise). Row *i* in a matrix includes all nominations of student *i*; a column *j* in the matrix includes all the relationship nominations by others regarding student *j*. Then, we imputed the missing relations in order to decrease the number of missing values. The numbers of missing entries was so low that it did not influence the result of the final estimation.[14] The dependent variable was the *self-proclaimed bullying* network in model A, while the *self-proclaimed victimization* network in model B.

We combined the different forms of bullying into one variable. Our aim was twofold. From a theoretical point of view, our aim was to examine the students' experience on bullying in general, rather than focus on the specific types of bullying. From a methodological point of view, sparse networks might lead to convergence problems while testing the proposed questions.[15]

Table 2.3 summarizes the main descriptive statistics of the self-proclaimed bullying and victimization networks. The results highlight the sparse nature of our data. This is not surprising but in line with international statistics about the prevalence of bullying behavior. This is mainly due to the fact that in the observed classes there are very few nominations in physical types of bullying networks both on average and in total. However, this value is higher in the relational and verbal networks; more specifically, gossip networks contain quite high numbers of indegree and outdegree nominations. Consequently, the combined bullying networks are based principally on gossiping and mocking networks.

[14] MPNet is not designed to handle missing values; therefore we decreased the number of missing values by imputing them, using waves 1 and 3. If the value from actor *i* toward actor *j* was equal in waves 1 and 3, we used this average value of these nominations as the imputed value. For instance, if *i* gossips about *j* in wave 1and in wave 3, and *i* was missing in wave 2, the average of these nominations is 1, therefore we coded this missing value as 1. If *i* gossips about *j* in wave 1, but does not gossip about the same person in wave 3, the average value of this nomination is 0.5. This explains that there is no agreement whether *i* in fact gossips about *j*. Consequently, if the value is equal or less than 0.5 we coded the missing value as 0. Finally, if we could not impute any values from the other waves, then we coded the missing values as 0.

[15] For more descriptive statistics about the different types of bullying networks involved in the analysis, please, consult Table A. 2.1 and Table A. 2.1 in the Appendix.

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Table 2.3: *Descriptive statistics of the main variables*

Bullying/ Victimization	Type of bullying	Question	Density	Mean	Sum	Indegree Max.	Outdegree Max.
Bullying	Physical	Who did you beat up?	0.8%	0.2	172	2.0	3.3
	Relational	About who do you tell bad things to others?	2.9%	0.9	777	4.6	6.8
	Relational	Who do you mock?	2.6%	0.7	616	3.9	6.5
	Verbal	Who do you deliberately humiliate?	1.1%	0.3	294	2.3	3.9
		Total	7.5%	2.1	1,859	12.7	20.5
Victimization	Physical	Who beat you up?	0.3%	0.1	65	1.2	2.2
	Relational	Who tells bad things about you to others?	2.1%	0.6	500	3.2	5.9
	Relational	Who humiliates you deliberately?	1.3%	0.4	326	2.4	4.3
	Verbal	Who mocks you?	1.8%	0.5	401	2.6	4.9
		Total	5.5%	1.5	1,292	9.4	17.3

Independent variables: peer admiration and peer acceptance as status measures

Peer admiration was calculated by subtracting the sum of indegree nominations of admiration based on status downward perception ("who do you look down on") from status upward perception ("who do you look up to"). Then, we standardized the values creating centered z-scores within classes. The minimum value was -3.71, while the maximum 3.56. Due to the design of the scale, status downward and status upward perception was not mutually exclusive, but the average correlation between them was -0.18, negative and rather low (*Median*=-0.2; *SD*=0.18).

Peer acceptance was calculated by using a five-point Likert-scale. Each student had to indicate their relationship with all classmates according to the following descriptions: "I hate him/her" (-2), "I dislike him/her" (-1), "He/she is neutral to me" (0), "I like him/her" (+1), or "He/she is a good friend" (+2). We merged the values -1 and -2 of the scale to create negative, and +1 and +2 values to

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create positive preference networks. Due to the design of the scale, negative and positive networks were mutually exclusive. Finally, we subtracted indegree nominations of negative relations from positive relations and z-standardized these values.[16] The range of z-score values is higher in the case of peer admiration than in the case of peer acceptance (*Min*=-3.71, *Max*=3.56 and *Min*=-3.24, *Max*=2.57, respectively). So far, there were students who were only "looked down on" or "looked up to", and also, there were no students who were both disliked or liked

Control variables: gender and SES

In addition, we tested the role of gender, as it plays a crucial role in the structure of bullying relations in classrooms. Female students were coded by 0, and male students by 1. Socio-economic background (SES) is an essential demographic covariate. Furthermore, SES is often associated with the endogenous status of pupils. For capturing SES, factor points were calculated from the mother's highest education level and the number of books families have at home, using categorical principal component analysis (CATPCA). We measured SES in this way, mainly because these variables could describe social resources which could have a significant effect on bullying. The goal was to decrease an original set of variables into a smaller set of uncorrelated components that represent most of the information found in the original variables.[17]

2.4 Analytical strategy

We analyzed the self-proclaimed bullying and victimization networks, using Exponential random graph models (ERGMs) (Lusher et al., 2012; Robins et al., 2007). In the ERGMs framework, bullying networks are modeled as a network among class members in which directed binary ties between two students *i* and *j* can either be existing (e.g. 1 = *i* bullies *j*) or non-existing (0 = *i* does not bully *j*). The

[16] For more descriptive statistics about the status-related social networks, please, consult Table A.2.4 in the Appendix.

[17] This approach is similar to principal component analysis, but it is written for variables of mixed measurement levels that may not be linearly related to each other (Manisera, van der Kooij, & Dusseldorp, 2010). Mother's highest education was measured on a scale with 7 categories: 1. less than 8 years of primary school, 2. primary school, 3. vocational school, 4. secondary technical school, 5. secondary grammar school, 6. college (BA), and 7. university (MA). The number of books that families have at home has 6 categories: 1. 0-10 books, 2. 11-25 books, 3. 26-100 books, 4. 101-200 books, 5. 201-500 books, and 6. more than 500 books. As the mother's education level and the number of books did not change significantly during the data collection, we calculated the average value out of the three waves. We imputed the missing values using average or observed values from waves 1 and 2.

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parameter estimates that ERGMs generate can be interpreted as parameters in logistic regression analysis (Lusher et al., 2012). Standard statistical methods (e.g. logistic regression) assume independence among actors and ties; therefore, they cannot model network dependencies. ERGMs explicitly model the dependence among ties by conditioning the likelihood of the presence of a tie on the presence or absence of other ties in the network (Lusher et al., 2012).

A positive parameter estimate for a specified variable in the model implies that positive or negative higher values on this variable make it more or less likely that student *j* bullies student *i*. ERGMs also allow us to estimate this likelihood as categorical (such as *i* and *j* gender), continuous individual attributes (such as *i* and *j* perceived status scores), structural variables (ties that surround *i*'s behavior to *j*) network configurations, and dyadic covariates (Grow, Takács, & Pál, 2015; Lusher et al., 2012). Structural variables allow us to control for the possibility that within a given class bullying might be statistically interdependent. In social networks, several fundamental mechanisms (e.g. reciprocity, transitivity, homophily) organize the formation of ties between actors (Grow et al., 2015). These processes establish local patterns of ties which are dyad-based, triad-based, and potentially higher-order level network configurations as well (Grow et al., 2015). These could be represented by the parameters of the model (Lusher et al., 2012). During a simulation process, the model estimates the effects of included parameters on the probability that a tie exists (Lusher et al., 2012).

For testing how peer admiration and peer acceptance shaped self-proclaimed bullying and victimization networks[18], we examined the following structural effects in both models: *arc* (density, the number of outgoing ties), *reciprocity* (the tendency that ties are reciprocated), *in-tie spread* (indegree-related popularity, the tendency that actors with a high number of incoming ties attract extra incoming ties); *out-tie spread* (out degree-related popularity, the tendency that actors with a high number of outgoing ties send extra outgoing ties). The high-order structural effects were *shared in-ties* (structural balance, the tendency that there are structurally equivalent actors who nominate the same actors) and *shared out-ties* (the tendency that actors with a

[18] The estimation procedure was similar to the one described by Huitsing et al. (2012), however we had to disregard the *isolate* (the tendency that actors do not participate in the bullying game), and the *sink* (the tendency to receive one incoming tie) parameter from the final models because they did not have a significant effect in the majority of the classes. Moreover, all models converged perfectly without including these parameters.

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high number of outgoing ties attract extra incoming nominations). As some bullies report to harass the same victims and some bullies are nominated as bullies by the same victims, these parameters seemed reasonable to include in our models (Card & Hodges, 2006; Huitsing et al., 2012, 2014; Huitsing & Veenstra, 2012). These tendencies are described perfectly by the *shared in-ties* and *shared out-ties* parameters in the models.

We included *continuous actor attributes* for testing the effect of our main independent variables. We tested whether those who have higher scores than average on the peer admiration and peer acceptance scales tend to bully their peers (*sender*), tend to be more frequently nominated than those low on the scale (*receiver*), and whether participants tend to nominate those who are on a similar level of the status scale (*dissimilarity effect*). To control for whether students with a better socio-economic background are more likely to send or receive nominations, or those who are similar in socio-economic background are more likely to nominate each other as a bully or victim, we also used a continuous actor effect. Table 2.4 contains the visual representation and conceptualization of the proposed network mechanisms. We used a binary attribute to control for gender effects. We tested whether girls are more likely to send and receive bullying ties. Same-gender nominations are more likely than cross-gender nominations in both networks.

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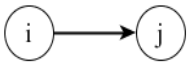
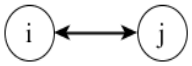
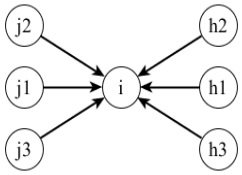
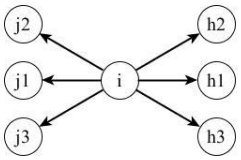
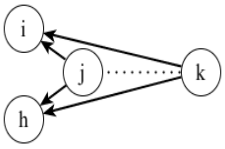
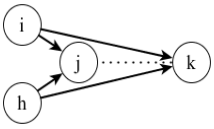
Table 2.4: *Network parameters in the ERG models*

Parameter	Equation	Figure	Conceptualization/
		Structural parameters	
Density (Arc)	$\sum_j x_{ij}$		The tendency that the network is sparser.
Reciprocity	$\sum_j x_{ij}\, x_{ji}$		The tendency that ties are reciprocated.
In-ties spread (AinS)	$\sum_{j,h} x_{ij}\, x_{ih} x_{jh}$		The tendency that actors with a high number of incoming ties attract extra incoming ties.
Out-ties spread (AoutS)	$\sum_{j,h} x_{ij}\, x_{jh} x_{hi}$		The tendency that actors with a high number of outgoing ties will give extra outgoing nominations.
Shared in-ties (A2P-D)	$\sum_{j,k,h;\,all\ different} x_{ij}\, w_{hj} x_{ik} x_{hk}$		The tendency that structurally equivalent actors nominate the same actors.
Shared out-ties (A2P-U)	$\sum_{j,k,h;\,all\ different} x_{ji}\, w_{jh} x_{ki} x_{kh}$		The tendency that structurally equivalent actors are nominated by the same actors.

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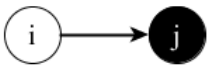
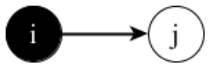
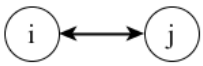
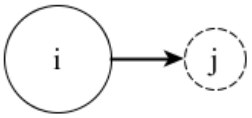
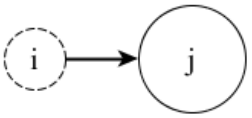
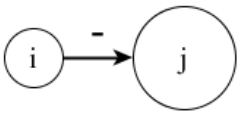
Parameter	Equation	Figure	Conceptualization/
		Binary actor attributes	
Sender	$v_{ij}x_{i+}$		The tendency e.g. that females nominate males.
Receiver	$\sum_j x_{ij}\,(v_{ij})$		The tendency e.g. that females are nominated.
Homophily	$\sum_j x_{ij}\,I\{v_i = v_j\}$		The tendency e.g. that females nominate females, and also holds for males.
		Continuous actor attributes	
Sender	$v_{ij}x_{i+}$		The tendency that actors' status score increases by 1 SD value from the mean by nominating other actors.
Receiver	$\sum_j x_{ij}\,(v_{ij})$		The tendency that actors' status score increases by 1 SD value from the mean by being nominated by other actors.
Homophily	$\sum_j x_{ij}\,I\{v_i \neq v_j\}$		The tendency that actors' status scores differ while nominating each other.

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To estimate our ERGM, we used the MPNet program (Wang et al., 2014). [19] MPNet estimates the parameters via Monte Carlo maximum likelihood methods (Snijders, 2002). The estimation procedure converges if the simulated networks are similar enough to the observed graph, which is expressed by the t-ratio. The model converges if the absolute value of the t-ratio is less than 0.1 for all parameters included in the model. The sample autocorrelation factor (SACF) of the statistics can be tolerated if its absolute value does not exceed 0.4 (Lusher at al., 2012).

First, we analyzed classes separately and made sure that the algorithm converged well. Second, the goodness of fit (GOF) of the models was assessed. Third, we conducted a meta-analysis of the results as described in Snijders and Baerveldt (2003).[20]

2.5 Results

2.5.1 Descriptive statistics

Table 2.5 presents the descriptive statistics of the self-proclaimed bullying and victimization networks, the possible associations between these two, and information about the gender and SES. The average number of self-proclaimed bullying nominations received in the observed wave is 1.7 (*SD*=1.98), which is slightly higher than the number of victimization nominations (*M*=1.09, *SD*=1.43). The rather high standard deviation in the case of both networks reflects that there might be few students who receive many bully and victim nominations. This indicates that there are not many students who participate in the bullying game. The reciprocity index shows the rate of mutual ties within the network. This is very low in both networks (*M*=0.12), indicating that there are very few mutual ties. The clustering coefficient is lower in the self-proclaimed victimization (*M*=0.13, *SD* =0.9) than in the self-proclaimed bullying network (*M*=0.17, *SD* =0.09). This suggests that in self-proclaimed victimization networks it is less common that actors form structures in which three students are all connected to each other. Indegree centralization indicates whether a network is rather centralized (value over 0.5) or decentralized (value lower than 0.5). The mean indegree

[19] The program is available at www.sna.unimelb.edu.au/PNet- last access: 12/12/2013

[20] The Goodness of Fit (GOF) test shows how the estimated model describes characteristics of the networks that were not modeled. The GOF of a configuration can be accepted if the difference between the observed mean value divided by the standard deviation (the GOF t-ratio) is not higher than 2 (Lusher et al., 2012). If t-ratios in the GOF test are higher than 2, we included other parameters to reach a better fit of the model. Those parameters which were non-significant in the majority of the classes were removed from the analysis to reach good convergence in all models, and also GOF statistics were satisfactory without including these parameters.

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centralization is slightly higher in the case of victimization networks (0.18 compared to 0.13), therefore both networks are rather decentralized.

The average value of four tie-level association measures describes different types of possible relations in the 29 peer and self-proclaimed bullying networks.[21] The simple matching coefficient (SMC) shows the ratio of matching (0 or 1 nomination) in the network. There is an observed simple matching of 0.94 (*SD*=0.02), indicating that if there is a 1 or a 0 nomination in the victimization networks, there is 94% chance that there will be a 1 or 0 in the corresponding cell of the self-proclaimed bullying networks. The overlap represents the ratio of overlapping ties to all ties in the first network. It is 0.43 (*SD*=0.17), describing that there is 43% of chance that existing ties are overlapping in the two types of bullying networks. The Jaccard coefficient describes the ratio of similar ties in two networks. The Jaccard index is 0.21 (*SD*=0.09), indicating that there is 21% chance that there will be 1 nominations between the peer- and self-proclaimed bullying networks. The QAP correlation describes the Pearson correlation measures on dyadic level. The QAP value is 0.31 (*SD*=0.13), describing that there is a low, but existing association between mutual dyads in the bullying networks. To sum up, the results show that there is an existing, but relatively low association between peer- and self-reported existing ties. Thus, the two networks could be interpreted separately; however it is important to note that the low density values of these networks may also be responsible for this difference.

[21] The simple matching coefficient (SMC) can be interpreted as the number of 1s and 0s shared by the nominations in the same positions, divided by the total length of all possible nominations.
The overlapping coefficient can be interpreted as the number of 1s shared by the nominations in the same positions, divided by the total amount of shared nominations in one of the networks.
The Jaccard coefficient can be interpreted as the number of 1s shared by the nominations in the same positions, divided by the total length of all possible nominations.
The idea of the "Quadratic Assignment Procedure" (QAP) is to identify the value of the measure of association when there is systematic and non-systematic connection between the two relations.

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Table 2.5: *Descriptive statistics of the main variables*

	Name	Mean	SD	Min.	Max.	Sum
Self-proclaimed bullying network						
	Indegree (SRB)	1.66	1.98	0.00	16.00	1,470
	Outdegree (SRB)	1.66	2.84	0.00	32.00	1,470
	Density (SRB)	0.06	0.03	0.02	0.12	
	Reciprocity (SRB)	0.13	0.09	0.00	0.31	
	Clustering (SRB)	0.17	0.09	0.03	0.38	
	Indegree centralization (SRB)	0.18	0.08	0.05	0.36	
Self-proclaimed victimization network						
	Indegree (PRB)	1.09	1.43	0.00	9.00	961
	Outdegree (PRB)	1.09	2.04	0.00	20.00	961
	Density (PRB)	0.04	0.03	0.01	0.15	
	Reciprocity (PRB)	0.12	0.10	0.00	0.29	
	Clustering (PRB)	0.13	0.09	0.00	0.29	
	Indegree centralization (PRB)	0.13	0.07	0.04	0.29	
Associations between self-proclaimed bullying and victimization networks						
	Simple Matching Coefficient (SMC)	0.94	0.02	0.87	0.99	
	Overlap	0.43	0.17	0.11	0.76	
	Jaccard	0.21	0.09	0.06	0.43	
	QAP correlation	0.31	0.13	0.06	0.56	
Actor attributes						
	Peer admiration	0.00	0.98	-3.71	3.56	
	Peer acceptance	0.00	0.98	-3.24	2.53	

Table 2.6 contains the values of Pearson correlations between standardized proposition values of indegree and outdegree of the dependent and independent variables. The results show that those who are bullies have possibly half of the chance to become a victim (r=0.5). This result indicates that the bullies and victims in our sample have relatively low peer admiration and peer acceptance values. The correlation values are negative and moderately strong between the indegree of the self-proclaimed bullying networks (being the victim) and peer admiration (r=-0.43) or peer acceptance (r=-0.47). In the victimization networks the result is described by the correlations of the outdegree nominations. The value is slightly negative and significant, indicating that those who are less accepted (r=-0.14) and less admired (r=-0.20) are seem to be bullies. For the bullies, these values are weakly negative. This may indicate that the bullies are less accepted (r=-0.21) and less admired (r=-0.11) than their victims. Moreover, the results also suggest that the bullies are more admired than accepted. As the result is

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significant, it may be explained by the fact that the number of nominations in the self-reported network is lower than in the victimization network. We also find that girls are more likely to send and receive bullying nominations in both networks. The result suggest that boys are more likely to admiered by their peers than girls. But the results may reflect that gossiping and mocking were the main indicators of creating the networks. Correlation results do not show evidence for the association between socio-economic status, indegree and outdegree nominations.

Table 2.6: *Pearson correlation values between the main variables*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Indegree victimization (Victim)	-							
(2) Indegree bullying (Bully)	0.50*	-						
(3) Outdegree victimization (Bully)	0.18*	0.27*	-					
(4) Outdegree bullying (Victim)	0.30*	0.16*	0.51*	-				
(5) Peer admiration	-0.43*	-0.21*	-0.20	-0.14*	-			
(6) Peer acceptance	-0.47*	-0.11*	-0.01	-0.20*	0.60*			
(7) SES	0.01*	0.03	0.00	0.03	0.00	-0.06	-	
(8) Gender female=1	0.07*	0.07*	0.04	0.00	-0.80*	0.00	0.02	-

Note: Correlations with * were significant at least with $p < 0.05$.

Figure 2.2 illustrates what we may predict for the effect of status positions, and the interrelation of self-proclaimed bullying and victimization networks. For this purpose, we visualized the bullying networks of *Class 1*. The two images are identical in the sense that the shapes and lines have exactly the same position in both illustrative figures. The shapes represent the students in the network, while the size of the shape describes the status position of the given student. The continuous status scales were transformed into a four category scale using 0.5 as the cut-off point to simplify the visualization process. Dark grey illustrates the girls, while light grey shows the boys in the class. The brown lines show self-proclaimed bullying, while grey depicts the

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victimization ties between actors. The black lines show when a tie between two actors is present in both networks.

The example *Class 1* illustrates that mainly the highest and low status children participate in bullying, and there are overlapping ties. However, there is one particular student, actor 18, who is the main target of bullying. This pupil has both low peer admiration and acceptance values. Interestingly, she is bullied by both high and low status same-gender classmates, indicating that status competition could exist between low status pupils as well.

It might be the case that actors 15 and 18 bully each other in order to secure a higher position in the social ledger. Interestingly, males with high, but not the highest, status positions are more likely to bully each other (such as actors 10, 20, and 19), while among females bullying is more likely to occur when their status position differs considerably. As in this class, the correlation between the bullying and victimization networks is under the median value; it is not surprising that status positions differ on the two scales.

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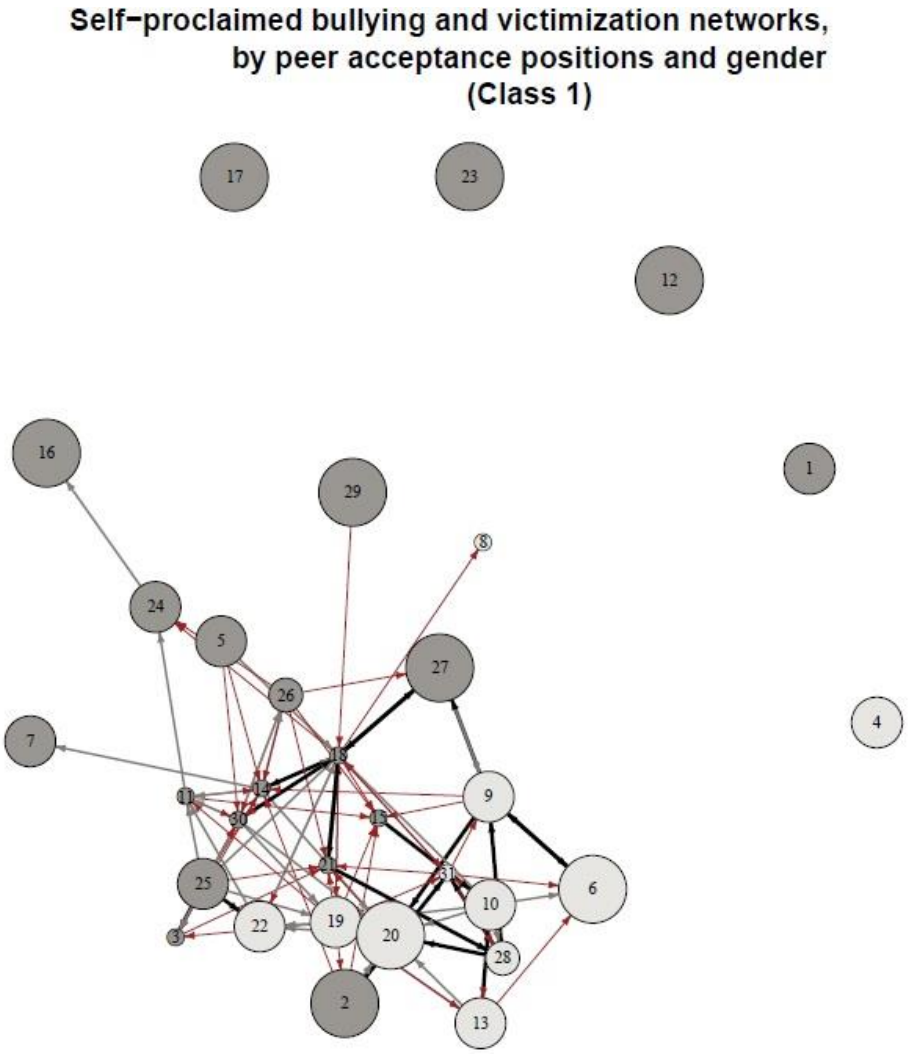
Figure 2.2: *Visual representation of the interrelation between self-proclaimed bullying and victimization networks, by status positions and gender*



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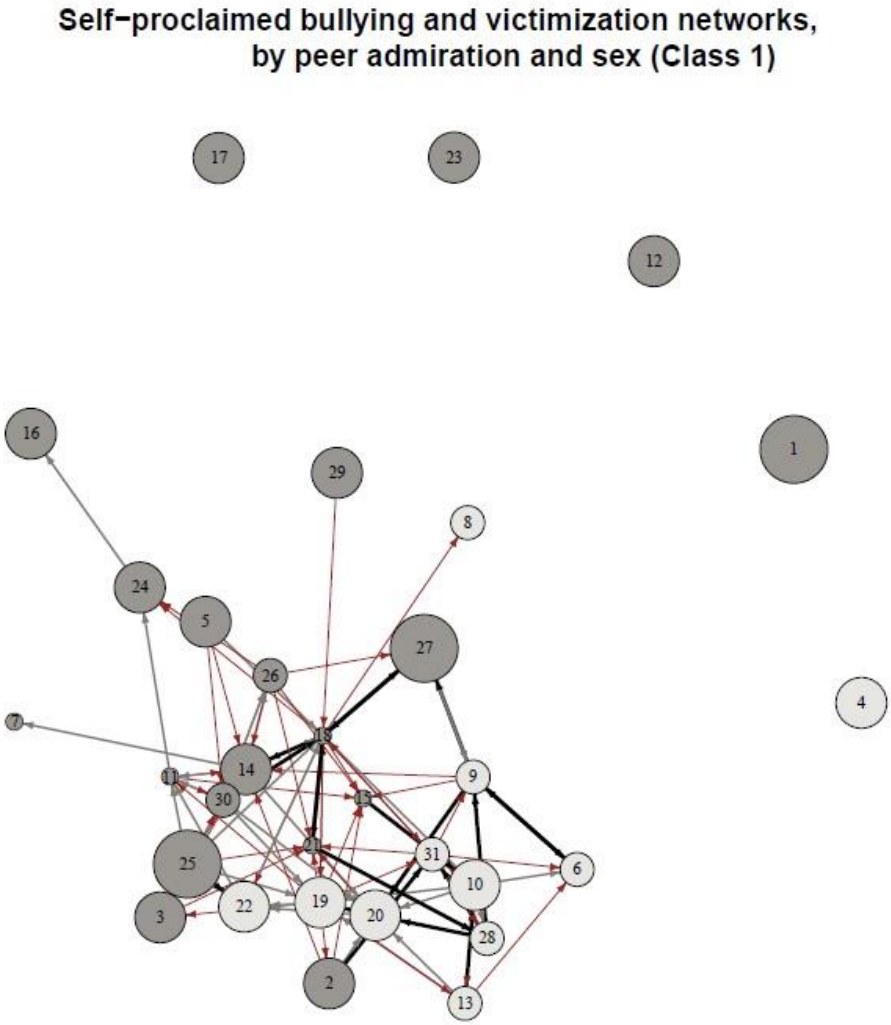

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2.5.2 ERGM results

The results of the estimated exponential random graph models (Lusher et al., 2012) are presented in Table 2.8a and Table 2.8b. Three models were estimated. Model 1 and model 2 include the effects of peer admiration and peer acceptance separately. Model 3 additionally includes the two sociometric status measures together. We used this two-step model construction to investigate how these two status measures affect the formation of bullying ties.

Each of the three models consists of two sub-parts. Table 2.8a contains all effects that are related to the bullying networks, while Table 2.8b presents the effects related to the victimization networks. The two processes are interdependent, and describe similar mechanisms, but they are the flip sides of each other. Each model is described by the effects included, the effect estimates and their standard errors. The reported estimates and standard errors are based on separately estimated models of the 29 school classes, which are combined in a meta-analysis (Snijders & Baerveldt, 2003). Significance levels are indicated as well. We further report the estimated standard deviation of estimates between school classes (σ), and whether the standard deviation significantly differs from zero. The final column in each model shows the number of school classes that were used in the meta-analysis (C).[22]

Bullying and victimization networks explained by endogenous effects

Self-proclaimed bullying and victimization networks can be explained partly by endogenous structural network effects. Endogenous bullying effects are shown in rows 1-6 in Table 2.8a, and victimization effects in rows 22-27 in Table 2.8b. The results in models 1, 2 and 3 differ slightly, but do not affect the results. In both networks we find that the number of ties maintained by an actor is limited (*negative density* effects), and that in classes (where it was necessary to include reciprocity), individuals tend to reciprocate nominations in both bullying (*est*. =1.96***) and victimization networks (*est*. =0.52***) (*reciprocity* effects).

The *in-tries spread* effect ("the black sheep" effect) is the tendency to be bullied by many / to become a bully. It is positive and significant with a similar value in both networks (0.5***). It shows that there are either bullies or victims who attract many

[22] More information on the estimation method, the meta-analysis and the effect interpretation can be found in the ERGM book and MPNet manual (Lusher et al., 2012; Wang et al., 2014).

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nominations from their peers. The *out-ties spread effect* ("the active") is the tendency that actors with a high number of outgoing ties attract extra incoming nominations. It is also positive and significant, but higher in the bullying (*est*. =1.2***) than in the victimization network (*est*. =1.07***), particularly in model 1 and model 3. This may reflect that students were more eager to report if they were bullied than if they bullied others. But, in Model 2, it is the other way around: the value is slightly higher, but almost the same both in the bullying (*est*. =1.18**) and in the victimization network (*est*. =1.16***). This result also indicates that in both networks there were students who were likely to bully more often than one of their peers, or be bullied by more than one of their classmates.

The *shared in-ties* and *shared out-ties* effects show the tendency that there are structurally similar actors for sending or receiving nominations by the same peers. The shared-in ties effect is positive in both networks, but the significance value is twice as high in the bullying network (*est*. =0.2***) than in the victimization networks (*est*. =0.1*). These results are consistent in the three models. This finding also supports that students are more likely to nominate the same peers as their bully rather than bullies name the same actors as their victims. It may suggest that there are more actors who bully the same peers. It is necessary to highlight once again that the density of the victimization network is lower than the density of the bullying network, which may influence the robustness of this finding. The *shared-out ties* effect is positive and significant in both the bullying and victimization networks, but the significance of the effect disappears, moreover, it becomes negative in the victimization network (*est*. =-0.03) in model 3. These negative findings are probably related to clustering tendencies in bullying networks.

Bullying and victimization networks explained by peer admiration

The effect of peer admiration status measures (effects 7-8 in the bullying network and 28-29 in the victimization network) are one of the two core effects in this chapter, and are directly related to hypothesis 1a and hypothesis 1b. The results can be found in model 1 and model 3.

Hypothesis 1a ("admiration") states that individuals who are perceived as having high peer admiration are more likely to be a bully. In the bullying network, this is described by the sender, while in the victimization network this is the receiver of the tie. We find no evidence for this admiration mechanism. The results show that in the

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bullying network it is negative and non-significant, while it is negative but significant in the victimization network (*est.* =-0.1***). The odds value for having high status while becoming a bully is 0.96. The result may indicate "that it is more likely that *"frustration"* happens: those who are less admired than the average are more likely to bully their peers (Pál, Stadtfeld, Grow, & Takács, 2015). They are angry, and would like to achieve higher status in the social hierarchy.

Hypothesis 1b ("disrespect") states that individuals with low peer admiration value are more likely to be a victim. We find a negative and strong effect for this hypothesis in the bullying network (*est*. =-0.58*** in model 1, and *est*. =-0.35*** in model 3). We also find evidence in the victimization network (*est*. =-0.1* in model 1) for the same mechanism, but the strength of the estimates differ in the two networks. Probably, those victims who are in the bottom of the admiration hierarchy are eager to name their bullies, which might explain the difference of the estimates. Moreover, the effect even disappears in model 3. This indicates that victims might not be uniformly disrespected, but bullies prefer to name students lower in the admiration hierarchy as their victims.

Bullying and victimization networks explained by peer acceptance

The effect of peer acceptance status measures (effects 10-11 in the bullying network, and 31-32 in the victimization network) describe other key effects in this study, relating to hypothesis 2a and hypothesis 2b. The results are presented in model 2 and model 3.

Hypothesis 2a ("acceptance") states that individuals who are perceived as being accepted are less likely to be a bully. Similarly to hypothesis 1a, in the bullying network, acceptance is described by the sender, while in the victimization network it is described by the receiver of the tie. We find no evidence for the acceptance mechanism neither in the bullying, nor in the victimization network.

Hypothesis 2b ("unacceptance") states that individuals who are perceived as being unaccepted are more likely to become a victim. In bullying networks, *unacceptance* is described as the receiver of the tie in the bullying network, while as the sender of the tie in the victimization network. We find evidence for this mechanism. In the bullying networks, the value for the alter of peer acceptance is negative (*est*. =-0.58***), even after controlling for peer admiration, the value remains negative and significant (*est*. =-0.41***). The odds of being more accepted than the average are 0.56.

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Being highly accepted as a victim is 44% less likely than becoming a victim as a highly accepted peer. We also found the similar direction in the victimization network, where this value is lower (*est*. =-0.17*), and the odds value is 0.86. The results are very similar to the peer admiration mechanisms.

Status homophily or heterophobia explained in the bullying and victimization networks

The effect of difference in status positions (effect 10 in the bullying network and effect 30 in the victimization network) are related to hypothesis 3a and hypothesis 3b. The results are presented in all models.

Hypothesis 3a ("homophily") states that individuals are more likely to bully those peers whose status positions are similar to their own in peer acceptance and peer-admired positions, while hypothesis 3b ("heterophobia in bullying") predicts the opposite. Based on the literature, we hypothesized the presence of this mechanism in the case of both status types. In the bullying network we found significant weak evidence for inequality in both status positions (*est*. =0.13* for peer admiration, and *est*. =0.09* for peer acceptance). When we included the two status measures in the same model, the significance of the peer admiration disappeared, but remained significant with peer acceptance. It may indicate that pure emotional feelings have a higher impact on bullying mechanisms than admiration. Students are more likely to bully those who are accepted differently. It might indicate that it is more probable that disdain or jealousy is expressed. High status students might be more likely to bully their unaccepted peers, while lower status adolescents are more likely to name their higher status peers as their bullies. But this mechanism is not independent from the competition mechanism either. Peers bully those who have different status from their own: if disdain is shown, it is mainly explained by the fact that higher status peers reinforce their status by bullying their weak mates. If jealousy happens, lower status students are more likely to bully those who have higher status in order to be seen as dominant, and to go up in the social ledger.

We found no evidence for any of these hypotheses in the victimization network, but the positive values may predict that the victims do not always name those who are different in their status positions. Table 2.7 summarizes the main findings.

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Table 2.7: *Summary of the main findings*

Bully - Victim / Type of status	Peer admiration	Peer acceptance
Bully	*(H1a-) "admiration": Admired peers are more likely to be a bully.*	(H2a-) "acceptance": Accepted peers are less likely to be a bully.
Victim	**(H1b-) "disrespect": Admired peers are less likely to be a victim.**	**(H2b-) "unacceptance": Accepted peers are less likely to be a victim.**
Bully & Victim relationship	(H3a-) "homophily": Bullying occurs among peers of the same status (H3b+): "heterophobia": Bullying is more likely to occur between peers of different status.	

Note: The bold parts indicate that the hypotheses were significantly supported. The italic part suggests that the hypothesis was significant, but the direction was the opposite as it was expected.

Bullying and victimization networks explained by gender and socio-economic status

We controlled for the effect of socio-economic status and gender on the formation of both bullying and victimization networks. We tested whether females and those who had higher SES are more likely to create and maintain bullying ties (*sender effect*), and tend to be more frequently nominated (*receiver effect*). We tested whether there was a higher probability of ties between same-gender students (*interaction*). We also controlled for whether participants of similar social background are more likely to bully those who come from a similar social background *(difference effect).*

We find strong evidence for the sender effect in the self-proclaimed bullying and victimization networks. This explains why females are more likely to bully or to be victims than males. The estimation values vary between -0.5* and -0.3**. We only find evidence for this receiver effect in Model 2 in the self-proclaimed bullying network (-0.4*), and in Model 1 in the self-proclaimed victimization network (*est*. =-0.2*). In the other two models, this effect is negative, but non-significant. This may explain why both bullies and victims are more likely to be females, but the results are not always significant. The gender distribution of the sample could also explain why this mechanism happens: there are more females in the sample than males, and not all classes are mixed.

We find strong support for gender homophily, as well. Except in model 1 of the self-reported networks, it seems that gender similarity leads to bullying. Females and males are more likely to bully each other.

We do not find strong support for the effects of socio-economic status on bullying and victimization. Though, the results show that those who have higher socio-economic

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status than the average in their class are more likely to be the bully or become the bully, but we find a significant effect for this only in model 2 (*est*. =0.18*).

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Table 2.8a: *Results for ERGM meta-analysis, self-proclaimed bullying (N=843)*

	Model 1						Model 2						Model 3					
	Est.		SE	σ	Sig.	C	Est.		SE	σ	Sig.	C	Est.		SE	σ	Sig.	C
Self-proclaimed bullying network																		
(1) Density	-5.02	***	0.18	0.53	34.86	29	-4.94	***	0.19	0.62	43.65	29	-4.87	***	0.19	0.54	35.8	29
(2) Reciprocity	1.96	***	0.37	0.00	0.53	3	2.01	***	0.36	0.00	0.50	4	1.61	***	0.29	0.00	1.9	5
(3) In-ties spread (AinS)	0.48	***	0.10	0.00	23.58	29	0.36	**	0.09	0.00	26.79	29	0.35	**	0.10	0.00	20.0	29
(4) Out-ties spread (AoutS)	1.07	***	0.08	0.00	27.46	29	1.18	***	0.08	0.00	26.18	29	1.08	***	0.08	0.07	36.2	29
(5) Shared in-ties (A2P-D)	0.11	*	0.04	0.17	56.02	28	0.11	*	0.05	0.21	52.26	27	0.10	*	0.05	0.20	47.8	27
(6) Shared out-ties (A2P-U)	0.05		0.03	0.00	58.45	28	0.07	*	0.03	0.00	47.07	27	-0.03		0.03	0.00	54.8	27
Independent variables																		
(7) Peer admiration: Sender (H1a)	-0.01		0.05	0.19	48.79	29							-0.02		0.04	0.12	39.0	29
(8) Peer admiration: Receiver (H1b)	-0.58	***	0.10	0.46	80.82	29							-0.35	**	0.11	0.48	56.5	29
(9) Peer admiration: Difference (H3)	0.13	*	0.05	0.15	54.29	29							0.08		0.05	0.13	43.6	29
(10) Peer acceptance: Sender (H2a)							0.03		0.09	0.42	47.27	29	0.03		0.08	0.36	43.8	29
(11) Peer acceptance: Receiver (H2b)							-0.59	***	0.07	0.26	43.31	29	-0.41	***	0.07	0.19	28.2	29
(12) Peer acceptance: Difference (H3a+3b)							0.09	*	0.03	0.00	61.20	29	0.08	*	0.04	0.00	36.9	29
Control variables																		
(13) Gender: Sender	-0.38		0.08	0.00	45.67	27	-0.50	***	0.08	0.00	45.28	27	-0.45	***	0.08	0.00	46.8	27
(14) Gender: Receiver	-0.19		0.21	0.91	36.34	27	-0.40	*	0.19	0.82	40.95	27	-0.34		0.24	1.05	36.8	27
(15) Gender: Interaction	1.50		0.16	0.00	44.52	27	1.74	***	0.16	0.00	43.51	27	1.78	***	0.16	0.00	39.7	27
(16) SES: Sender	0.01		0.08	0.39	50.72	29	0.02		0.07	0.31	51.10	29	0.02		0.08	0.38	51.7	28
(17) SES: Receiver	0.19		0.10	0.42	38.80	29	0.18	*	0.07	0.26	35.85	29	0.17		0.09	0.36	35.3	28
(18) SES: Difference	0.07		0.07	0.27	46.01	29	0.05		0.08	0.33	47.62	29	0.06		0.08	0.27	41.3	28

Note: * p < 0.05; ** p<0.01; ***p<0.001.

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Table 2.8b: *Results for ERGM meta-analysis, self-proclaimed victimization (N=843)*

	Model 1						Model 2						Model 3					
	Est.		SE	σ	Sig.	C	Est.		SE	σ	Sig.	C	Est.		SE	σ	Sig.	C
Self-proclaimed victimization network																		
(22) Density	-4.96	***	0.14	0.00	25.75	29	-4.83	***	0.14	0.00	31.99	29	-4.94	***	0.15	0.00	27.03	29
(23) Reciprocity	1.55	***	0.28	0.22	8.09	9	1.91	***	0.30	0.30	11.59	9	1.89	***	0.27	0.00	9.04	10
(24) In-ties spread (AinS)	0.51	***	0.11	0.00	17.31	29	0.55	***	0.10	0.00	20.00	27	0.45	***	0.11	0.00	17.93	26
(25) Out-ties spread (AoutS)	1.19	***	0.09	0.00	25.00	29	1.16	***	0.10	0.08	26.98	27	1.12	***	0.10	0.07	31.79	29
(26) Shared in-ties (A2P-D)	0.16	***	0.01	0.00	38.89	28	0.16	***	0.01	0.00	35.95	26	0.15	***	0.02	0.00	36.62	26
(27) Shared out-ties (A2P-U)	0.11	*	0.04	0.00	25.15	24	0.19	***	0.03	0.00	29.80	24	0.08		0.04	0.00	25.63	22
Independent variables																		
(28) Peer admiration: Sender (H1a)	-0.11	*	0.05	0.22	37.71	29							0.00		0.07	0.27	34.11	29
(29) Peer admiration: Receiver (H1b)	-0.24	*	0.09	0.41	65.50	29							-0.30	**	0.09	0.34	36.56	29
(30) Peer admiration: Difference (H3)	0.08		0.06	0.22	61.93	29							0.10		0.08	0.32	42.59	29
(31) Peer acceptance: Sender (H2a)							-0.17	*	0.06	0.25	46.40	29	-0.20	*	0.08	0.30	43.50	29
(32) Peer acceptance: Receiver (H2b)							-0.12		0.10	0.44	65.38	29	0.06		0.09	0.35	40.05	29
(33) Peer acceptance: Difference (H3a+3b)							0.02		0.05	0.11	58.16	29	-0.04		0.07	0.21	43.17	29
Control variables																		
(34) Gender: Sender	-0.30	**	0.09	0.00	34.92	27	-0.46	*	0.18	0.72	54.80	27	-0.32	**	0.10	0.00	41.04	27
(35) Gender: Receiver	-0.23	*	0.11	0.00	59.43	27	-0.37		0.22	0.88	63.62	27	-0.25		0.14	0.34	69.47	27
(36) Gender: Interaction	1.43	***	0.22	0.00	30.33	25	1.38	***	0.20	0.00	32.98	25	1.45	***	0.21	0.00	32.39	27
(37) SES: Sender	0.07		0.07	0.29	44.93	29	0.07		0.08	0.31	49.78	29	0.06		0.10	0.46	53.82	29
(38) SES: Receiver	0.13		0.08	0.27	31.15	29	0.10		0.07	0.18	34.59	29	0.10		0.08	0.26	32.44	29
(39) SES: Difference	-0.05		0.06	0.00	38.19	29	-0.05		0.06	0.00	39.78	29	-0.04		0.06	0.00	41.47	29

Note: p < 0.05; ** p<0.01; ***p<0.001.

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2.6 Discussion

The association between bullying and status motives represents an important field in adolescent research (Faris & Felmlee, 2014; Lynn et al., 2001; Veenstra, Lindenberg, Munniksma, & Dijkstra, 2010). Researchers have used social network methods in order to identify how status positions of the social ledger define the behavioral motivation of bullies and victims (Faris & Ennett, 2012). These findings are not only supported by experimental (Boulton, 2013), but also by empirical works, using a wide range of social science research methods from observation (Craig & Pepler, 1998) to cross sectional and longitudinal network analysis (Huitsing, van Duijn, et al., 2012; Huitsing et al., 2014).

The chapter contributes to this field of research. It introduces a novel way to understanding admiration in bullying processes. This is referred to as peer admiration (Becker & Luthar, 2007; Fiske et al., 2007), and measured by the difference between direct sociometric nominations of "who is looked up to" and "who is looked down on". The measure of peer admiration allows us to capture how admiration and disrespect towards peers occur on the dyadic level. Moreover, it allows us to test how peer admiration influences bullying, and also the extent to which it differs from the effect of peer acceptance.

The study also captures how bullying mechanisms could differ or overlap if we measure these social phenomena from the bully's or from the victim's perspective. To measure bullying, researchers often use peer- and self-reports in order to detect bullying mechanisms. Peer-reports are based on nominations of who is identified as the bully or the victim, while self-reports describe when a given individual considers himself or herself a bully or a victim (Bouman et al., 2012). In this chapter, we measured bullying, using self-proclaims. *Self-proclaims* are based on questions to measure *dyadic* bullying victimization (Veenstra et al., 2007). We referred to bullying when the students proclaimed who they bully, and we referred to victimization when the students reported who bully them.

This result has two theoretical implications. First, it seems that the victims are less eager to admit being part of the bullying game than the bullies. Second, the victims do not always know that they might be bullies at the same time. These results also highlight the importance to map bullying from the bully's and the victim's perspective as well.

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Our findings are inspiring, but mixed at the same time. Our results are stronger in the bullying than in the victimization network. It may suggest that individuals are more likely to report who they bully than who bully them. It also demonstrates that a lower score in both peer admiration and peer acceptance predicts the likelihood of becoming a victim. The results highlight that heterophobia in being admired and accepted are more likely to occur between bullies and victims. We also found that those who are less accepted are more likely to bully. However, these results could also imply that those who have a lower than average status in the social ledger is more likely to bully those who are even lower in this hierarchy. This is line with findings about using bullying as a strategic tool to achieve higher status (Faris & Felmlee, 2014).

The relatively low association between being a bully from the bully and the victim perspective describes at least two potentially interesting patterns. First, students are not eager themselves as a bully, or they bully in secret. Second, the victims are not eager to name their peers as bullies, because they may fear or do not want to be recognized as being bullied by these individuals. This could be the case e.g. in gossiping that occurs mainly "behind people's back". The findings show that both peer admiration and peer acceptance correlate negatively and significantly with the indegree and outdegree of self-proclaimed bullying and victimization.

In contrary to the results of studies conducted in Finland and the Netherlands, the prevalence of self-proclaimed bullying is higher than the prevalence of self-proclaimed victimization. While this finding need to be further tested, the result highlights that there might be cultural differences between countries that explain this difference (e.g. Hungarian students are less ashamed for reporting that they bully others, than for admitting that they are victims).

The chapter has its limitations. First, by combining different types of bullying measures, the robustness of this piece of research is limited. As these measures combine three types of bullying, the results may hide different kinds of possible explanations for the observed bullying processes. Second, even if individuals admit who they tell bad things about, it may occur that they do not know who gossip about them. This could explain why the self-proclaimed bullying networks are sparser. Third, even if we found strong evidence for females being more likely to bully, becoming victims, and bullying each other, it is important to underline that our data contained significantly more females than males. Fourth, we could not capture the material side of SES, which could also explain why lower or higher status children are more likely to be a bully or a

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victim. Those who are seen as having money are more likely to have high status, and tend not to be a victim. Our results are compared to the mean value of the SES, but this does not show evidence for the effect of social family background in bullying.

There are many possibilities for future research. On the one hand, it would be interesting to test our assumptions on a dataset from another country. On the other hand, it would be also interesting to show bullying processes embedded in dyadic status group processes. This could allow for comparing the dyadic nature of peer admiration and peer acceptance in the formation of bullying ties. Moreover, the multivariate method could also test how sociometric status measures are interrelated with bullying. As classes are embedded in a wider social context, multi-level network analysis could help better understand how bullying networks operate at the class or school level. A future study should also analyze the dynamic nature of bullying as Huitsing and his colleagues (2014) did. Further studies could also analyze the reverse causality, for example it is possible that an individual is accepted because this person does not bully their classmates. Or individuals are accepted because they bully others. This analysis might help identify how bullying a role in increasing someone's status plays. It might also be interesting to see that after controlling for gender and other possible control variables, certain variables such as personality traits and physical appearance would influence our results.

Besides the limitations, we believe that this chapter makes an important contribution to the understanding of the formation of bullying relations by analyzing the effect of peer admiration. We are certain that we managed to highlight that the network nature of measuring perceived status could give a broader interpretation of how bullying ties are formulated. Our results suggest that peer admiration and peer acceptance are important predictors of the emergence of bullying. At the same time, the chapter contributed to the understanding of bullying networks by modeling the evolution of self-proclaimed bullying and victimization networks.

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CHAPTER 3 The Effect of Perceived Status Positions on Rejection and Hostility

Understanding the association between perceived peer status positions and rejection processes represents an important question in adolescent research. This chapter examines how individuals' perceived status positions are associated with being rejected or becoming hostile in the classroom. Perceived status positions, rejection and hostility are all identified by social network measures.

We suggest that in a negative network, indegree centrality identifies who is rejected, while outdegree centrality detects who is hostile within a group. Four types of peer perceived status perceptions are defined, which are recognized either as a personal status attribution to an individual or as a personal status assessment of other peers' opinion about another individual. The *first-degree upward status position* describes who is respected, by accumulating nominations on the question "who do you look up on". The *second-degree upward status position* designates who is seen as disrespected by others when aggregating nominations on the question "who is looked up on by peers". The *first-degree downward status position* defines who is disrespected by aggregating nominations on the question "who do you look down on". The *second-degree downward status position* detects who is seen as disrespected by others when adding up the nominations on the question "who is looked down on by peers". Our results suggest that those who are highly respected, disrespected, or seen as respected by others are likely to be rejected and to become hostile. These results are supported by the analysis in the positive network as well.

The implication of the results is that individuals' own status attribution is not always consistent with the personal perception of the status order in a community. Consequently, this inconsistent connection between these two distinct forms of status perception might result in rejection and hostility.

Keywords: perceived status positions, rejection, degree centrality measures, adolescents, panel regression

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3.1 Introduction

Status describes the position of an individual within a group (Blader & Chen, 2012). Status creates order in the social system (Blau, 1977), which is a crucial component of social life. Status provides instruction and coordination for social actions, create rules within social communities (Blader & Chen, 2012). Certain social orders are more self-selecting and based on consensus, whereas others emerge through pressure, rules or even chance (Blader & Chen, 2012; Blau, 1977; Hanneman & Riddle, 2005).

Status can be understood as having prestige, respect, popularity and esteem that an individual or even a group has in the eyes of other individuals or groups (Blader & Chen, 2012; Magee & Galinsky, 2008). Status is often identified as an index of the social value that others attribute to an individual (Blader & Chen, 2012). It originates externally, and dynamically changes by the evaluation of other members' views on community actions and events (Fisek & Ofshe, 1970). Status also has a self-reinforcing nature: a prior status position generates expectations for further behavior and increases opportunities for individuals to influence their own group (Magee & Galinsky, 2008).

Status is an important aspect for adolescent social development as well. Those who are seen as important, influential or perceived as popular by the broader community are reported to have higher levels of social skills, fewer behavioral problems, trustworthiness (Allen, Porter, McFarland, Marsh, & McElhaney, 2005; Frentz, Gresham, & Elliott, 1991), and a well-established social place among peers (Coleman, 1961). The study by Allen and his colleagues (2005) shows two interesting patterns regarding the social development of adolescents who have high status, who are identified as popular. The first is that popularity among adolescents demonstrates higher levels of self-development, secure attachment and adaptive interactions with mothers and friends (Allen et al., 2005). The second is that popular adolescents are more likely to adopt behaviors that enjoy support in the peer group (e.g. low levels of delinquency), and renounce behaviors that are unlikely well-received by peers (e.g. hostility) (Allen et al., 2005). By contrast, having low status could cause severe problems such as bad mood, stress, low school achievement and high stress (Card, 2010; Betts & Stiller, 2014). Unpopular or unaccepted peers are at a greater risk to difficulties in later life points (Parker & Asher, 1987), and are likely to externalize problems and drop out from school (Laird, Jordan, Dodge, Pettit, & Bates, 2001).

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3.2 Theory explaining adolescents' status using social network methods

Studies that successfully measure adolescent status define who is popular, rejected or controversial, and often use social network measures to identify these individuals (Coie, et al., 1982). As a result, it might be important to understand how social network theory contributed to a number of important insights and conceptualizations about status (Hanneman & Riddle, 2005).

The first contribution is that the social network approach emphasizes that status is relational (Hanneman & Riddle, 2005). It may happen that an individual does not have formal status in the community, but have status as a consequence of personal relations (Hanneman & Riddle, 2005). Hence, high status individuals determined by their position within the network can dominate and influence others through their relationships (Borgatti & Everett, 1992; Kadushin, 2004). In social network terms, ego's status (the one being nominated; therefore receiving the nomination) depends on alter's view (the one nominating ego; therefore giving the nominations) (Hanneman & Riddle, 2005). The second contribution of the social network approach is that while status may be seen either as a micro (by describing relations between actors) or as a macro property (by describing the entire population), the macro and micro are closely connected (Hanneman & Riddle, 2005). As Hanneman and Riddle (2005) describe, if an actor has high status in a community where relations are dense, therefore getting more relations, it could raise his or her status, which happens when the network is positive. If an actor is embedded in a dense relational positive network, this person has more chances than others to have favorable structural positions, and may experience better deals in social exchanges, have greater influence than those in less favored positions (Borgatti & Everett, 1992; Hanneman & Riddle, 2005; Kadushin, 2004).

Among various methods, centrality degree measures identify who has high prestige and influence within a community through the categorization of network walks (such as Freeman centrality) or shortest paths (such as closeness centrality) (Kadushin, 2004; Hanneman & Riddle, 2005; Prell, 2011). Freeman centrality is a very effective measure of identifying whether an actor is possibly important and influential within a network (Kadushin, 2004; Prell, 2011). Freeman centrality could be understood in undirected and directed data. In directed data, we can distinguish between indegree and outdegree centrality. Indegree measure defines the connection to an individual from

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others (Clifton, Turkheimer, & Oltmanns, 2009). Whereas outdegree, which is the complement to indegree, describes the connection from an individual to others (Clifton et al., 2009). If negative networks represent the focus of the analysis, Freeman centrality seems the easiest and the most clearly interpretable way to describe who is important and influential in a community (Everett & Borgatti, 2014).

The interpretation of nominating and receiving nominations differs from each other in negative and positive networks. Having a high number of indegree nominations in a positive emotional network defines who is said to be important, prestigious or prominent, while giving a high number of outdegree nominations identifies who is influential in establishing ties (Borgatti & Everett, 1992; Hanneman & Riddle, 2005). In contrast, in a negative emotional network, having high indegree describes who is important, the "most rejected" while a high number of outdegree represents who is influential, the "most hostile" in the rejection process (Everett & Borgatti, 2014).

Freeman degree centrality is used often to identify adolescents' status. Network-based status measures have been understood in several ways in the adolescent literature, just as status itself has various conceptualizations (Hollingshead, 1975). *Peer admiration* describes who is perceived as respected (Coleman, 1961; Fiske, Cuddy, & Glick, 2007). Peer ratings on "who is admired" or "respected" often describes peer admiration (Becker & Luthar, 2007). This measure aggregates individual indegree nominations on personal beliefs about other peers' status. *Social visibility* describes social reputation and also defines who is influential in a group. For social visibility, researchers often ask students who they *perceive* as popular, unpopular or disrespected in the class (Bruyn & Cillessen, 2006; De Bruyn & Van Den Boom, 2005; Luthar & McMahon, 1996; Parkhurst & Hopmeyer, 1998; Prinstein & Cillessen, 2003). Peer admiration often refers to an individual's personal perception on the group members' belief about another individual's status. Hence, *peer admiration* and *social visibility* represent the perceived status measures as we will refer to these phenomena later in the chapter.

The negative and positive emotional networks, such as disliking and friendship, are examined in order to define to define who has high or low status in the community. It is often referred to in the literature as s*ociometric popularity* (Coie et al., 1982). Describing status by the negative or positive *emotions* feelings represents *social preference,* which describes various feelings that one person receives from another. By summing up the "disliking" or "hated" nominations (Coie, 1990) that an individual

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receives from the others, the *rejected peers* could be recognized.[23] Using the network terminology, the *Indegree centrality for negative relations* is the measure which identifies who is rejected within a community. The popular peers are those high status adolescents who have several "friendship" or "liking" indegree nominations (Becker & Luthar, 2007). By calculating the *Indegree centrality for positive relations*, the students' level of preference within their adolescent community could be described.[24]

The literature which examines the interrelation of these aforementioned network-based status measures exists, but it is still relatively scarce. Those who analyzed the connection between peer admiration, social visibility and social preference found that most sociometrically popular students were not high on perceived popularity, while most sociometrically unpopular students did not have high social visibility, thus they were not high on perceived popularity (LaFontana & Cillessen, 2002; Parkhurst & Hopmeyer, 1998). However, these studies have their own boundaries. The first is that these studies did not compare the "pure" forms of social preference such as rejected or popular peers. The second is that these studies did not focus on detecting who was influential in creating positive and negative connections, therefore how status positions could explain who nominated other peers negatively. The third is that they did not distinguish between the peers' own status attribution towards an individual from the perception of other peers' status attribution towards the same individual.

In this chapter, we go beyond this conceptualization in order to understand who are the rejected and the hostile peers, by examining the effect of perceived status measures. In network terminology, rejected peers are measured by indegree centrality, and hostile peers are measured by outdegree centrality in the negative network

Hypotheses

We introduce new terminologies for perceived status measures. We propose to differentiate between *first-degree status perception*, which reflects relative, personal status beliefs between individuals (when *i* reports to look up to / look down on *j*), and *second-degree status perception*, which reflects a personal status assessment of other peers (when *i* reports that he/she thinks that *j* is looked up to / looked down on by

[23] Coie and Dodge (1982) define rejected children those who receive many negative nominations and few positive nominations. We refer to those children as "refused" who receive negative nominations without taking into account the positive side of nominations.

[24] Coie and Dodge (1982) define popular children those who receive only positive nominations. Following their terminology, we also refer to these students as "popular".

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peers). This distinction results in four types of perceived status measures such as first-degree upward, first-degree downward, second-degree upward, and second-degree downward status position.[25]

We operationalize these status positions as follows:

1.) *first-degree upward status position* describes who is respected, by accumulating nominations on the question "who do you look up on";

2.) *first-degree downward status position describes who is* disrespected by aggregating nominations on the question "who do you look down on";

3.) *second-degree upward status position second-degree upward status position* describes who is seen as respected by others when aggregating nominations on the question "who is looked up on by peers";

4.) *second-degree downward status position* who is seen as disrespected by others when adding up the nominations on the question "who is looked down on by peers".

The following illustrative example describes how these measures might be captured in a community. Let us assume that there is a group of five students, Ian, Jane, Kate, Noah and Tom. Our task is to monitor how Ian perceives the status position of their four group mates. Ian looks up to Jane; therefore Ian has a first-degree status upward nomination towards Jane. However, Ian does not look up to Kate; therefore Ian gives a first-degree status downward nomination towards Kate. Ian thinks that Jane is also looked up on by two other peers, namely by Noah and Tom. Thus, Ian has a second -degree status upward nominations toward Jane. Finally, Ian indicates that Kate is also looked down on by others, such as Noah and Tom; therefore Ian has a second-degree status downward nomination towards Kate. To sum up, Jane is perceived by Ian as respected and respected by other members in their group. Jane collects one first-degree and one second-degree upward status nomination by Ian. By contrast, Kate is perceived by Ian as disrespected and disrespected by other members in their five-member group. Kate receives both first-degree and second-degree downward status nominations from Ian. Figure 3.1 illustrates how Ian perceives Jane's and Kate's status in their group.

[25] In Chapter 4, we introduce the tie level form of the same status differentiation schema (see also Table 4.2).

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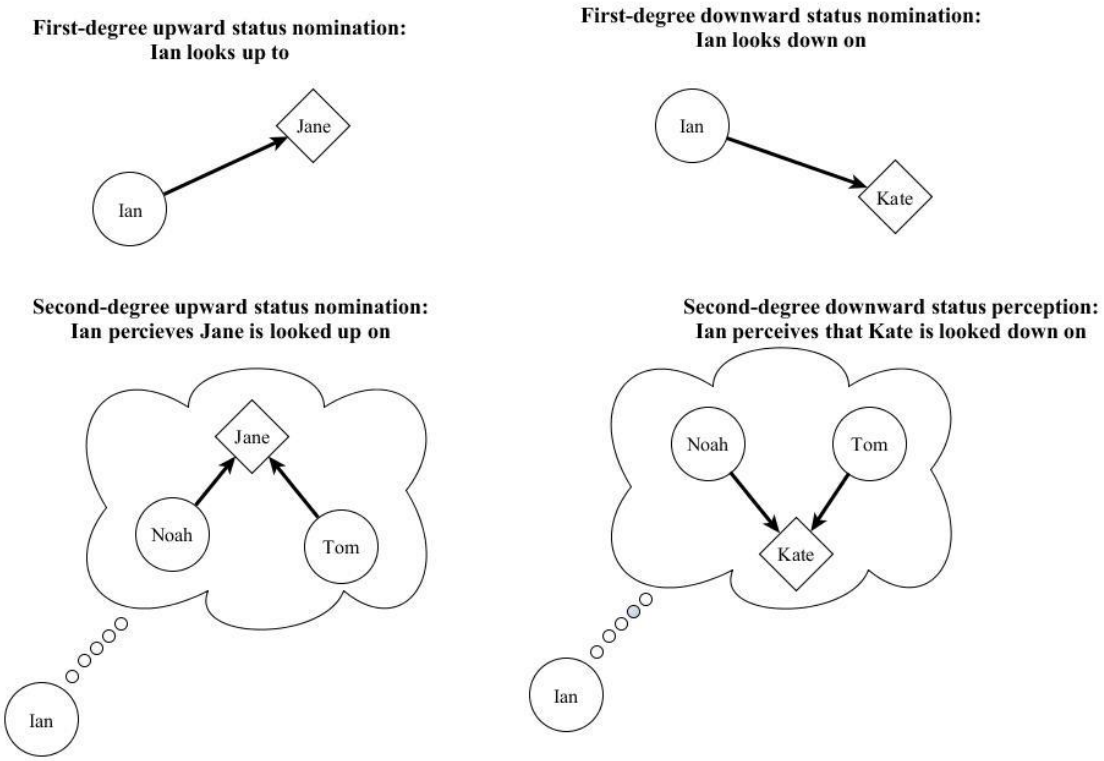
Figure 3.1: *Illustrative example on the proposed perceived status measures*



Note: The circle indicates males, while the squares females.

To describe the interrelation between perceived status positions and being rejected and hostile, we expect the following. First, we describe how the first-degree and second-degree status positions indicate high indegree centrality for negative relations, therefore rejection in the classroom. We expect that the association between perceived status positions and being rejected is consistent, if it does not contain any logical contradiction. Hence, we think that having *first-degree and second-degree downward status position* influence who is rejected in a community. Thus, those who are indicated as disrespected or disrespected by others are likely to be rejected. Whereas having *first-degree upward status position* does not indicate rejection. Those who are indicated as respected are unlikely to be rejected.

We expect that the association between perceived status positions and being rejected might be *controversial,* if it contains any logical contradiction. Hence, we think that the *second-degree status upward* position could also influence who is rejected. The argument behind this mechanism is that those who are indicated as respected by others are likely to be rejected at the same time. This controversial mechanism might especially occur, if we suppose that being respected by others might help to detect

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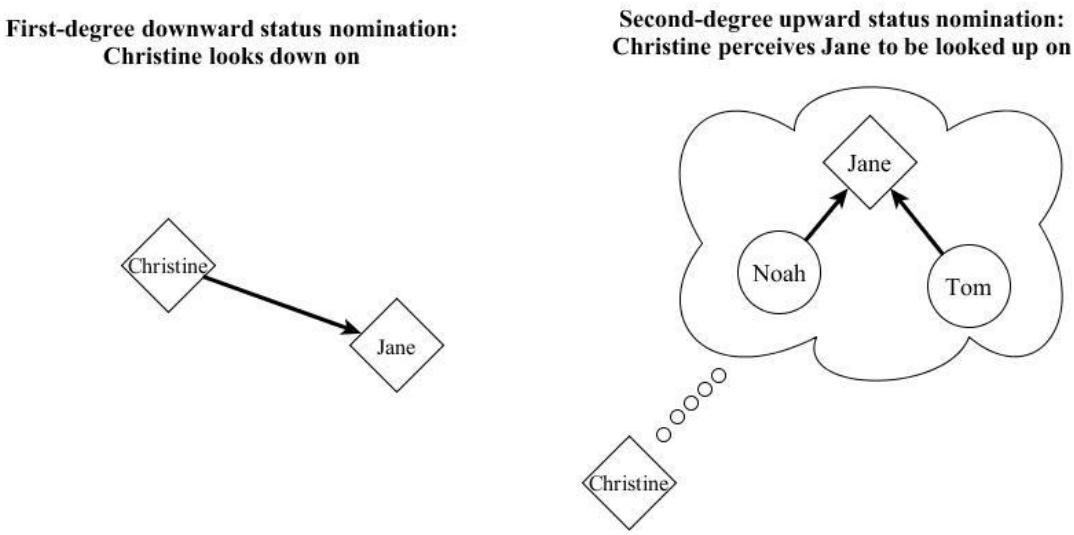
controversial figures. Controversial figures are those individuals who are popular and well-respected in their own groups, but may be disliked by others. For instance, following our illustrative example above, let us assume that two other people, Christine joins the five-member group. Now, there are six people in the group. Christine is in agreement with Ian that Noah and Tom respect Jane. However, Christine disrespects Jane. As Jane is seen respected and disrespected by Christine, Jane might be identified as a controversial person, therefore we could expect that Christine will also nominate Jane as disliked. Figure 3.2 illustrates the case of "becoming a controversial figure" in a community.

Figure 3.2: *Illustrative example of becoming a controversial figure*



Note: The circle indicates males, while the square females. Jane is a controversial figure in Christine's eyes, as Christine sees her as respected by Noah and Tom, but she disrespects her. Therefore, it is more likely that she will dislike Jane.

In what follows, we describe how the first-degree and second-degree status positions indicate high outdegree centrality for negative relations, therefore hostility. For hostility, we expect a positive association between perceived status positions and nominating others negatively. The main explanation is related either to *dominance* or *dissatisfaction* mechanisms. Students, especially those who are seen as dominant focus on maintaining their own status reject the others (Berger & Dijkstra, 2013). As status is always relative to peers (as not everybody can possess a very high status position), competition for occupying high status positions is likely to occur (Berger & Dijkstra,

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2013). Reinforcement occurs when high status adolescents nominate negatively those who have low status positions, particularly to show their power to the community or their own sub-group. Yet, dissatisfaction could also turn low status individuals into influential ones by nominating others negatively (Berger & Dijkstra, 2013). Because of jealousy or envy, they do not accept their own or the other's status positions, and they nominate other peers negatively, mainly those ones who are perceived as high status individuals (Berger & Dijkstra, 2013). This might be the case for those who are disrespected in the community.

Based on these theoretical origins, our hypotheses are the following.

Consistency occurs when:

H1a*: The first-degree upward status position* will negatively affect the indegree centrality for negative relations, therefore the student will not be rejected.

E.g. those students who are perceived as respected are unlikely to be nominated as disliked.

H1b*: The first-degree downward status position* will positively influence the indegree centrality for negative relations, therefore the student will be rejected.

E.g. those students who are perceived as disrespected are likely to be nominated as disliked.

H1c*: The second-degree downward status position* will positively influence the indegree centrality for negative relations, therefore the student will be rejected.

E.g. those students who are perceived as disrespected by others are likely to be nominated as disliked.

Controversy occurs when:

H2: *The second-degree upward status position* will positively influence the indegree centrality for negative relations, therefore the student will be rejected.

E.g. those students who are perceived as respected by others are likely to be nominated as disliked.

Dominance occurs when:

H3a: *The first-degree upward status position* will positively affect the outdegree centrality for negative relations, therefore the student will be hostile.

E.g. those students who are perceived as respected are likely to nominate others as disliked.

H3a: *The second-degree upward status position* will positively affect the outdegree centrality for negative relations, therefore the student will be hostile.

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E.g. those students who are perceived as respected by others are likely to nominate others as disliked.

Dissatisfaction occurs when:

H4a*: The first-degree downward status position* will positively affect the outdegree centrality for negative relations, therefore the student will be hostile.

E.g. those students who are perceived as disrespected are likely to nominate others as disliked.

H4b: *The second-degree downward status position* will positively affect the outdegree centrality for negative relations, therefore the student will be hostile.

E.g. those students who are perceived as disrespected by others are likely to nominate others as disliked.

Table 3.1 summarizes the proposed assumptions and the direction of the expected estimates.

Table 3.1: *Summary of the proposed hypotheses*

Terminology / definition	**Indegree centrality for negative relations/** being rejected
Consistency: **First-degree upward status position**/being respected (H1a)	-
Controversy: **Second-degree upward status position** / being respected by others (H2)	+
Consistency: **First-degree downward status position**/being disrespected (H1b)	+
Consistency: **Second-degree downward status position**/being disrespected by others (H1c)	+
	Outdegree centrality for negative relations/ being hostile
Dominance: **First-degree upward status position/** being respected (H3a)	+
Dominance: **Second-degree upward status position/** being respected by others (H3b)	+
Dissatisfaction: **First-degree downward status position**/being disrespected (H4a)	+
Dissatisfaction: **Second-degree downward status position**/ being disrespected by others (H4b)	+

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Further contributions

Furthermore, we also control for individual characteristics that could possibly explain the level of perceived status positions. First, we check for gender as it might be an important factor to describe status positions of adolescents (Closson, 2009). Second, we also control for ethnicity, as being the member of a minority group could be an important factor of defining adolescents' status, and there are very few studies which examined this (Bellmore, Nishina, & Graham, 2011). Third, we control for socio-economic status, which might be a relevant factor to determine adolescents' status, especially among girls (Adler, Kless, & Adler, 1992).

3.3 Methods

3.3.1 Sample and participants

We used the first three waves of the study "Wired into Each Other: Network Dynamics of Adolescents in the Light of Status Competition, School Performance, Exclusion and Integration". Students were 9th graders in the first and in the second wave, and 10th graders in the third wave.

Table 3.2 describes the number of participants in our sample. The starting sample comprised 1,771 students and 5,313 observations through the three waves in total. The number of students was reduced to 1,568 respondents, and the number of observations was decreased to 3,724 observations when no dependent (indegree and outdegree centrality for negative relations) and no main explanatory variables (perceived status positions) had missing values (this sample is referred to as *joint-sample without control variables*). When also controlling for other factors (gender, ethnicity - being Roma and non-Roma, socio-economic status, and age) the sample was further reduced to 1,281 students and 2,973 observations (this sample is referred to as *joint-sample with control variables*).

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Table 3.2: *Total number of students and observations in the sample*

Total number of students in the sample			
	Starting sample	Number of students with the main dependent and independent variables (N)	Number of students with the main dependent, independent and control variables
	1,771	1,568	1,281
Total number of observations of the sample, by wave			
Wave	Starting sample	Number of students with the main dependent and independent variables (N)	Number of students with the main dependent, independent and control variables
1	1,771	1,315	1,034
2	1,771	1,271	1,000
3	1,771	1,138	939
Total number of observations	*5,313*	*3,724*	*2,973*

Note: The *starting sample* refers to the original, the full sample. As certain students did not have observations, we had to drop them. The column of the number of students with the main dependent and independent variables refers to the *joint-sample without control variables.* Number of students with the main dependent, independent and control variables refers to the *joint-sample with the control variables.*

Table 3.3 contains information on general descriptive statistics of the sample. 63% of students were female, while 22% themselves as Roma. The ethnic identification is based on self-declaration (Boda & Néray, 2015). The gender distribution over-represented females compared to the figures in secondary schools during the academic year 2010/2011 (KSH, 2012).[26] On average, students were 15.98 years old (*SD* = 2.78), and there were ten students who were older than 20 years.[27]

[26] The Central Statistical Office of Hungary (KSH=Központi Statisztikai Hivatal) did not collect data on students' ethnicity. Therefore, there was no information about the distribution of Roma students in the target population.

[27] We did not exclude them from the analysis, as their number was very low compared to the rest of the sample. Consequently, these students did not have a major influence on the results.

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Table 3.3: *Descriptive statistics of the sample*

Name	Mean	Median	SD	Min.	Max.
General descriptive statistics (main individual control variables					
Gender (1=female)	63%	1.00	-	0.00	1.00
Roma (1=Roma)	22%	0.00	-	0.00	1.00
SES	0.02	0.02	0.98	-2.32	1.77
Age	15.98	15.83	0.89	14.25	22.08

Notes: The result shows the descriptive statistics of the joint sample with the control variables. This indicates those students were included in the analyses where information on the main dependent, explanatory and control variables was available. The total number of students is 1,281, and the total number of observations is 2,973.

Dependent variables: centrality measures for negative relations

We used a five-point Likert-scale to collect sociometric data on the social ties between students. Each student had to indicate his or her relationship with other classmates according to the following descriptions: "I hate him/her" (-2), "I dislike him/her" (-1), "He/she is neutral to me" (0), "I like him/her" (+1), or "He/she is a good friend" (+2). We merged the values -1 and -2 of the scale to create the negative social network. We decided to merge the value of disliking and hate in order to maximize the number of nominations in the negative network. To check the validity of our results, we created a positive network per class and across the waves as well.[28] We used the value +1 and +2 of the scale, in order to generate the positive network. Then, we created binary matrices for negative and positive networks for all three waves where 1 indicated when a tie existed (negative or positive), and 0 if not. Missing values were treated as non-existing ties and were coded as 0.

Based on this scale, we calculated the normalized version of the indegree and outdegree centrality for the negative and positive networks respectively. The normalized version of centrality degree divides the simple degree by the maximum possible nominations within the network, which is usually N-1.[29] The measure is ranging from 0 to 1 (Hanneman & Riddle, 2005). The normalization process offers the possibility to

[28] For the validity check, we also have results for the PN centrality, which is a centrality measure created in 2014 by Everett and Borgatti. PN centrality takes positive and negative networks together, and calculates the centrality of each actor in the so-called mixed network. More information about the estimation of the PN centrality measures do not represent the core of the chapter, but we report results in the Appendix, see Tables A. 3.4, 3.5, 3.6 and 3.7.

[29] Normalization favors small networks as with growing network size, the maximum possible nominations increases exponentially.

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compare the value of each student who attends classes with different size. Those students who were identified as rejected were conceptualized by normalized indegree values, while students who were hostile were conceptualized by normalized outdegree values. Table 3.4 summarizes the formula of Freeman centrality indegree and outdegree used in this chapter.

Table 3.4: *Formula of the Freeman centrality measures*

Formula	Equation	Conceptualization
Indegree Freeman centrality	$C_1\ (i) = \sum_{j=1}^{n} x_{ji}$	Absolute number of received nominations
Normalized indegree Freeman centrality	$C'_1\ (i) = \frac{C_1\ (i)}{n-1}$	Normalized number of received nominations
Outdegree Freeman centrality	$C_0\ (i) = \sum_{j=1}^{n} x_{ij}$	Absolute number of giving nominations
Normalized outdegree Freeman centrality	$C'_0\ (i) = \frac{C_0\ (i)}{n-1}$	Normalized number of giving nomination

Independent variables: the four types of perceived status positions

As outlined in the theoretical part of the chapter, we used four perceived status measures to test our hypotheses. The full roster method was used to measure the status perception[30]. With regard to test hypothesis 1a and hypothesis 3a, we used the question "who do you look up to" (indicating first-degree upward status position). To estimate hypothesis 2 and hypothesis 3b, "who is looked up on by their peers" (indicating second-degree upward status position) was used. To observe hypothesis 1b and hypothesis 4a, the question "who do you look down on" (indicating the first-degree downward status position) was used. To analyze hypothesis 1c and hypothesis 4b, "who is looked down on by their peers" (indicating second-degree downward status position was used. We created four binary coded matrices for these status perception measures

[30] For further explanation on the full roster method, please see Chapter 1.

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similarly to the negative and positive networks. To identify the four types of student status positions, we calculated the normalized indegree centrality measures for each student. The normalization procedure was chosen in order to compare students who were attending classes with different size.[31] Table 3.5 summarizes the main variables used in this chapter.

Table 3.5: *Summary of the main variables*

Type of variable	Terminology used in this chapter	Survey question	Peer position	Network measure
Dependent	Indegree centrality for negative relations	"I dislike him/her." +'I hate him/her."	Rejected	Indegree centrality
Dependent	Outdegree centrality for negative relations	"I dislike him/her." +'I hate him/her."	Hostile	Outdegree centrality
Dependent	Indegree centrality for positive relations	"I like him/her." + "He or she is my friend".	Accepted	Indegree centrality
Dependent	Outdegree centrality for positive relations	"I like him/her." + "He or she is my friend".	Kind	Outdegree centrality
Independent	First-degree upward status position	"I look up to him/her."	Respected	Indegree centrality
Independent	First-degree downward status position	"I look down on him/her."	Disrespected	Indegree centrality
Independent	Second-degree upward status position	"I think he/she is looked up to (by others)."	Respected by others	Indegree centrality
Independent	Second-degree downward status position	"I think he/she is looked down on (by others)."	Disrespected by others	Indegree centrality

[31] In the Appendix (see, A. Table 3.3, A. Figures 3.1a and 3.1b), we show correlation values between perceived status measures and indicators which capture "status" by possible roles a student could have in the class (17 in total). These status indicators were measured by sociometric methods. We calculated the normalized freeman indegree centrality for each status indicator, and then their average value through all three waves. For more sophisticated methods, please consult Vörös & Snijders, 2015.

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Control variables

To operationalize socio-economic background (SES), similarly to Chapter 2 and Chapter 4, factor points were calculated from the student-reported mother's highest education level measured on a 7-point scale. A 3-category variable was created, where scores between 0-40% were coded as low, scores between 40-80% were coded as medium, and scores over 80% were coded as high socio-economic status.

In addition, we included gender (male = 0; female = 1) and Roma (0=non-Roma; and 1=Roma) as an important control variable. To identify who was Roma and non-Roma, students were asked to classify themselves as "Hungarian", "Roma", "both Hungarian and Roma", or "other ethnicity". We recoded students belonging to the "Hungarian" or "other" ethnicity as non-Roma, and students belonging to the "Roma" or "both Roma and Hungarian" category as Roma. We also included age, as older students might have higher status than younger ones.

3.4 Analytical strategy

We modeled the effect of four forms of status positions on changes in negative indegree and outdegree by using fixed-effects regression.[32] The panel approach is possible because each student was surveyed repeatedly over multiple (three) years in our data.

There are basically two types of information in panel data: the cross-sectional information reflected in *the differences across students,* and the time-series or within-subject information reflected in the *changes within subjects over time* (across survey waves). Panel regression allows us to control for time-invariant, potentially omitted factors, both observed and unobserved ones. This is achieved by including individual level (in our case, student level) fixed effects in the regressions. This allows for a more rigorous test of our hypotheses on the relationship between status positions and sociometric status measures (McManus, 2011).

Therefore, panel regressions with student fixed effects were our baseline specifications in the analysis below. We also compared them with specifications that include only class but not student fixed effects. Doing so also allowed us to investigate the role of time-invariant student characteristics such as socio-economic background, ethnicity and gender.

[32] We used Stata to estimate the models.

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More precisely, we estimated panel regressions of the following forms at the level of student × wave observations:

$$IndegreeCentrality_{it} = \sum_{j,k} \beta^{j,k}\, StatusPosition_{it}^{j,k} + \gamma X_i + D_t^{wave} + D_c^{class} + \epsilon_{it} \quad (1)$$

$$OutdegreeCentality_{it} = \sum_{j,k} \beta^{j,k}\, StatusPosition_{it}^{j,k} + \gamma X_i + D_t^{wave} + D_c^{class} + \epsilon_{it} \quad (2)$$

where *i*, *t* and *c* denote individuals (students), time (year for each wave) and class, respectively; *j* denote degree and could take values of 1st or 2nd; and *k* denotes the direction, and can take values of upward or downward. *X* includes a set of time-invariant control variables, D_t^{wave} denotes wave (or equivalently, time) fixed effects and D_c^{class} denotes class fixed effects. Observations (N = 2,973) are time-variant (t=1, 2, 3) and nested in individual students (N_i = 1,281), which are nested in classes (N_c =44) (see Table 3.2). In the main specifications where student fixed effects were included, the time-invariant control variables and class fixed effects were removed.

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3.5 Results

3.5.1 Descriptive statistics

Table 3.6 presents the descriptive statistics of the main dependent, independent and control variables. The average number of the absolute value of negative centrality per student received through the three observed waves is 6.38 (*SD*=4.93), which is less than third of the number of the absolute number of positive nominations (*M*=18.79, *SD*=6.21). The median of the normalized indegree centrality for negative relations value is 0.19, indicating that less than 50% of the sample received 6 or fewer negative nominations. The relatively high standard deviation in the case of indegree centrality for negative relations reflects that there might be a few students who receive many negative nominations. The negative centrality outdegree value describes who is influential in a negative network, therefore who is hostile. On average, students give 3.75 negative nominations (*SD*=4.82), and they give positive nominations more than four times more often than negative nominations (*M*=16.89; *SD*=7.46). This is not surprising: strategically giving positive nominations represents lower risk than nominating others negatively.

For the main independent variables, the value of average and the median indicate that the majority of students do not have very high or low positions on the four status measures. The results also show that the average value is the highest for the second-degree upward status positions (0.24). Intuitively, it might happen that it is easier to express personal status attributions towards a peer than to estimate what the others think of the same peer.[33]

The correlation values for normalized in- and outdegrees in the final column of Table 3.6 describe how stable the main dependent and independent variables are through the three waves. The values, except for the negative and outdegree centrality for positive relations, are over 0.5 with high significance for the main dependent variables and the four explanatory variables. This might also indicate that there are changes in negative and indegree centrality for positive relations, but more than half of the students have the same value through the three waves. This might also explain that the students change the number of their nominations through the observed waves.

[33] Further descriptive results regarding the full sample and the joint sample without the control variables are found in the Appendix, see Tables A. 3.1a and 3.1b.

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Table 3.6: *Descriptive statistics of the main variables in the joint sample*

Name	Mean	Median	SD	Min.	Max.	Stability measure (r)
Absolute value of the dependent variables						
Indegree centrality for negative relations (being rejected)	6.38	6.00	4.93	0.00	29	
Indegree centrality for positive relations (being accepted)	18.79	19.00	6.21	1.00	35	
Outdegree centrality for negative relations (being hostile)	3.75	2.00	4.82	0.00	38	
Outdegree centrality for positive relations (being kind)	16.89	16.00	7.46	0.00	38	
Normalized value of the dependent variables						
Indegree centrality for negative relations (being rejected)	0.21	0.19	0.16	0.00	0.85	0.60*
Indegree centrality for positive relations (being accepted)	0.61	0.63	0.18	0.03	1.00	0.59*
Outdegree centrality for negative relations (being hostile)	0.12	0.07	0.16	0.00	1.00	0.28*
Outdegree centrality for positive relations (being kind)	0.55	0.54	0.22	0.00	1.00	0.33*
Normalized value of the independent variables						
First-degree upward status position (being respected)	0.16	0.13	0.13	0.00	0.65	0.50*
First-degree downward status position (being disrespected)	0.17	0.14	0.13	0.00	0.67	0.65*
Second-degree upward status position (being respected by others)	0.24	0.22	0.16	0.00	0.85	0.60*
Second-degree downward status position (being disrespected by others)	0.18	0.16	0.15	0.00	0.89	0.63*

Notes: Correlations with * were significant at least with $p < 0.05$. The total number of students is 1,281, and the total number of observations is 2,973.

We calculated simple correlation values between the main dependent, independent and control variables through the three waves. The values show the correlation values per students. Table 3.7 shows the correlations coming from *between*

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variations, e.g. from differences across average student-level, time-invariant values.[34] This unconditional correlation calculation shows that there are connections between the main dependent and independent variables.

Generally, the correlation values are higher for the negative indegree than for the negative outdegree variables. The *consistent* associations between indegree centrality for negative relations and the first-degree and the second-degree downward status positions seem to be supported by the simple correlation values. Those who hold a high value on the first-degree (r=0.85) and the second-degree (r=0.76) downward status positions strongly associate with the indegree centrality for negative relations, therefore with being rejected. Yet, we observe a positive relation between the first-degree status upward position and the indegree centrality for negative relations (r=0.67), which might indicate a controversial association rather than a consistent one. For robustness check, we examine the effect of the same status position measures with the indegree centrality for positive relations. We find that except for the second-degree downward status position (r=-0.21), the other status perception measures correlate positively with the indegree centrality for positive relations values. The result for the first-degree status downward position is especially interesting as it has a slightly positive connection with the indegree centrality for positive relations (r=0.05), indicating that even if an individual is disrespected; he or she could get positive nominations.

The *controversial association*, the positive association between the second-degree upward status position and the Indegree centrality for negative relations, is also supported by the correlation results (r=0.37). Interestingly, the second-degree upward status position has a positive association with the indegree centrality for positive relations as well (r=0.50).

For the outdegree centrality for negative relations, being the hostile actors, we find the following. To test whether the association between outdegree centrality for negative relations and status perception measures occur because of dominance, we find that those who have a high status position are likely to send negative nominations, we find that both the first-degree (r=0.37) and the second-degree (r=0.19) upward status position show a positive association with indegree centrality for negative relations. This might indicate that those who are respected or seen as respected by others are likely to

[34] In Appendix A. Table 3.2 contains the correlation results based on within variations. This is the variation that comes from the changes over time, for the same students. It is the opposite of the between variation, which comes from differences across students (and where each student outcome is measured as a single value, the average outcome over time). The results are similar in both cases.

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behave hostile and send disliking nominations toward their peers. Interestingly, these actors seem to send positive nominations, but with less enthusiasm than sending negative ties towards their peers. This correlation value is 0.16 for the first-degree and 0.09 for the second-degree status upward position.

To check whether the association between becoming hostile and being disrespected or seen as disrespected in a class occurs because of dissatisfaction, we observe that students who possess first-degree (r=0.37) and the second-degree downward status position (r=0.45) behave hostile in the community; therefore they send negative nominations towards their peers. This supports that because of being dissatisfied with their situation, they are likely to nominate others as disliked. We observe a positive association between the same status position measures and the indegree centrality for positive relations, but the value of the estimates is lower. The correlation value for the first-degree status upward measure is 0.11, while for the second-degree downward measure is 0.04. Thus, those who are disrespected or seen as disrespected by the others send negative nominations and, with "less enthusiasm", positive nominations as well.

The correlation results between the main independent variables are relatively high (the values vary from 0.23 to 0.81, see rows 5, 6, 7 and columns 6, 7, 8 in Table 1.7). However, due to the relatively large number of observations, this does not seem to pose a problem for identifying their effects separately in the regression models.

We also find that being Roma is associated with being rejected (r=0.37) and being hostile (r=0.23), and with all perceived status positions as well. Socio-economic background seems negatively associated with negative and indegree centrality for positive relations, and we can see that low status indicates negative indegree and outdegree centrality. We find no evidence for gender effects. An interesting result is that the fact of having left the sample is more likely to correlate with negative indegree nominations, and negatively correlate with positive indegree nominations. Although those who left the sample show significant differences from the others, based on bivariate correlations, their fraction is very small for the sample where all relevant variables are available (for more information on the number for those who left the sample, see also Chapter 1).

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Table 3.7: *Correlation values of all variables, using between variations through all three waves*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Indegree centrality for negative relations (being rejected)	-												
(2) Indegree centrality for positive relations (being accepted)	-0.09*	-											
(3) Outdegree centrality for negative relations (being hostile)	0.57*	-0.15*	-										
(4) Outdegree centrality for positive relations (being kind)	0.20*	0.10*	0.54*	-									
(5) First-degree upward status position (being respected)	0.67*	0.36*	0.37*	0.16*	-								
(6) First-degree downward status position (being disrespected)	0.85*	0.05*	0.45*	0.11*	0.81*	-							
(7) Second-degree upward status position (seen as respected by others)	0.37*	0.50*	0.19*	0.09*	0.70*	0.50*	-						
(8) Second-degree downward status position (seen as disrespected by others)	0.76*	-0.21*	0.36*	0.04**	0.61*	0.85*	0.23*	-					
(9) Gender (1=female)	-0.01	-0.02	0.01	0.05*	0.00	-0.03	-0.04**	0.01	-				
(10) Roma	0.37*	0.1*	0.23*	0.07*	0.36*	0.40*	0.22*	0.24*	0.03	-	-		
(11) SES	-0.43*	-0.07*	-0.23*	-0.02	-0.37*	-0.46*	-0.12*	-0.32*	0.01	-0.60*	-		
(12) Age	0.18*	0.05**	0.02	-0.12*	0.21*	0.21*	0.11*	0.15*	-0.03*	0.08*	-0.18*	-	
(13) Left the sample	0.26*	-0.2*	0.33*	0.16*	0.15*	0.25*	0.09*	0.25*	0.09*	0.21*	-0.24*	-0.01	-

Notes: Correlations are calculated between students, across variables combining all students in all three waves from all classes in the analysis. Correlations with * were significant at least with $p < 0$ .05. The total number of students is 1,281, and the total number of observations is 2,973. The normalized version of the in- and outdegrees are taken into account.

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3.5.2 Regression results

The results of the estimated panel regressions are presented in Table 3.9a and 3.9b. Two models are estimated. Model 1 includes all control variables, school and wave fixed effects. Model 2 contains the student fixed effects. In order to properly isolate the effect of each factor, we include them together in the regressions. We use these two model setups to investigate whether the control variables have a significant effect on the dependent variables (model 1), and also to examine whether the results on the main explanatory variables are robust to using either only within-student variation or across-student variation (model 2). Our estimates show the average across the three waves, as we are interested in these values. We do not assume that the effects would differ across waves.

Indeed, our results show that the main hypotheses hold for both of these cases (except for hypothesis 1, which holds only when student fixed effects are not included). Furthermore, R squared values – which are usually in the range of 0.15-0.9 – show that our models fit well. The student and class fixed effects are always jointly significant. The wave fixed effects also tend to be significant, although very small. This indicates that it is unlikely that all students systematically change their responses across the different waves, either due to facing different interviewers during the data collection or for other reasons.

Indegree centrality for negative relations ("being rejected"), explained by the effect of first-degree and second-degree status positions

The estimates of the four types of status positions on indegree centrality for negative relations, that is being rejected, are the core estimates in this chapter, directly related to our hypotheses 1-2.

Hypothesis 1a states that the first-degree upward status position will negatively affect the indegree centrality for negative relations, therefore being rejected. We find evidence for this hypothesis, indicating that one unit increase (0.1) in first-degree upward status position is associated with 0.09 unit decrease in the indegree centrality for negative relations value, therefore the student will be rejected (*est.* =0.09***). The estimate becomes non-significant when the student fixed effects are included. This implies that the effect in model 1 originates in differences between students, and not in changes within students.

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Hypothesis 1b states that the first-degree downward status position will positively influence the indegree centrality for negative relations, therefore the student will be rejected.

We find evidence for this hypothesis in both model 1 and model 2. The positive estimate of the first-degree downward status position indicates that one unit increase in being disrespected is associated with a 0.69 unit increase in being rejected. When we use student fixed effects, the association holds. Translating this effect into standard deviations means that one standard deviation increase (*est.* =0.13) in first-degree downward status position is associated with 0.69*0.13 = 0.09 increase in the indegree centrality for negative relations, which is more than 50% of the total standard deviation of the dependent variable. This is a quantitatively important effect, describing the consistent association between personal downward status perceptions and refusing someone.

Hypothesis 1c states that th*e second-degree downward status position* will positively influence the indegree centrality for negative relations, therefore the student will be rejected. We also find clear evidence for this hypothesis in both model 1 and model 2. The estimate indicates that one unit increase is associated with a 0.31 unit increase in the indegree centrality for negative relations measure. This association increases slightly in the fixed effect model as well. This result indicates if someone is perceived as having low status by the other peers are more likely to be rejected.

Hypothesis 2 describes the controversial association between who are seen as respected by others and who are rejected. The hypothesis claims that the *second-degree upward status position* will positively influence the indegree centrality for negative relations; therefore the student will be rejected. We find evidence for this controversial figure mechanism in both model 1 and model 2. The effect of being perceived as respected by many indicates that one unit increase is associated with a 0.08 unit increase in the indegree centrality for negative relations. This association increases slightly in the fixed effect model as well. If we translate this effect into standard deviations, it means that one standard deviation increase in being looked up on by others (0.24) is associated with 0.08*0.24 = 0.02 increase in the indegree centrality for negative relations, which is less than 10% of the total standard deviation of the dependent variable.

The results also point out that individuals' perception of who has high and low status has a stronger effect than the perception of other's status attribution.

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Outdegree centrality for negative relations ("being hostile"), explained by the effect of first-degree and second-degree status positions

The effects of the four types of status positions on the outdegree centrality for negative relations (being hostile) are the core estimates in this chapter, directly related to our hypotheses 3-4.

Hypothesis 3a states that *the first-degree upward position* will positively influence the outdegree centrality for negative relations, therefore the student will be hostile. This might be explained by the dominance theory. Students who have high status are more likely to reject others in order to show that they dominate the community. We do not find evidence for this hypothesis. Indicating that one unit increase (0.1) in first-degree status upward position is associated with 0.04 unit decrease in becoming hostile.

Hypothesis 3b states that individuals who *the second-degree upward position* will positively influence the outdegree centrality for negative relations, therefore the student will be hostile. We find clear evidence for this hypothesis in both model 1 and model 2, and the estimate is stronger in model 2, it increases from 0.04 to 0.23. The effect of the high perceived status position indicates that one unit increase is associated with a 0.23 unit increase in being hostile. Therefore, those who are indicated as having high upward status position that is respected by others are more likely to send negative nominations. Translating this effect into standard deviations, it means that one standard deviation increase in being looked up on by many (0.22) is associated with 0.23*0.22 = 0.05 increase in the outdegree centrality for negative relations, which is about 25% of the total standard deviation of the dependent variable, the outdegree centrality for negative relations. Intuitively, the positive finding for the second-degree status upward position on hostility indicates that those who are seen as consensually important and respected will nominate others negatively. This might happen due to status competition (e.g. by nominating those who are also seen as respected), or status reinforcement (e.g. by demonstrating that they are the leaders of their own group).

Hypothesis 4a states that *the first-degree downward position* will positively influence the outdegree centrality for negative relations, therefore the student will be hostile. We find no evidence for this hypothesis in either model. We could conclude that it is not obvious that being disrespected by peers will result in anger, by hating others. *Hypothesis 4b* states that individuals who are being looked down on by many are likely

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to give negative nominations. We find clear evidence for this hypothesis in both model 1 and model 2. The effect of the highly perceived low status positions indicates that one unit increase is associated with a 0.31 unit increase in the negative peer regard. This association increases slightly in the fixed effect model 1 as well. Translating this effect into standard deviations, it means that one standard deviation increase in being looked down on (0.13) is associated with 0.31*0.13 = 0.04 increase in negative peer regard, which is about 30% of the total standard deviation of the dependent variable. This is a quantitatively important effect, showing that those who are disrespected by peers are more likely to become hostile. This might be explained by the social segregation mechanism.

Robustness checks: Estimates in the positive networks

The four effects, which relate to the four hypotheses on indegree centrality for negative relations, are also included in describing indegree centrality for positive relations. It is important to underline that we do not have a specific hypothesis about the positive network. Our aim is to double-check how the estimates influence the results in the counterpart of the negative networks. We find that having *the first-degree upward status position* increases the probability of the indegree centrality for positive relations, therefore the student will be popular. The values decrease from model 1 (0.76***) to model 2 (0.62^{***}). This implies that not only differences across students, but also changes over time for the same student may explain who is popular.

Having a high value of being looked down on (first-degree status downward position) decreases the probability of the indegree centrality for positive relations (-0.12^{**}). This value decreases in the fixed effect model; therefore differences between students could determine who is popular. For the second-degree status position, we found a positive effect (0.35***), indicating that if someone is seen as having respected by their peers, they are likely to become a popular student. As we find the same direction of the estimates for the indegree centrality for negative relations, we could conclude the controversial person mechanism. Therefore there are actors who are perceived as respected by others, and are popular, but at the same time they are rejected actors. The *first-degree status downward position* has a negative effect on the indegree centrality for positive relations, but the negative effect becomes substantially smaller from model 1 to model 2 (-0.55* to -0.16).

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The four effects, which relate to the four hypotheses on the outdegree centrality for negative relations, are also included in describing the outdegree centrality for positive relations. We find that nomination on the first-degree status upward measure increases the probability of being kind in model 1 (0.27***). However, this effect disappeared in the fixed effect model (-0.01). This implies that it is not only the changes within students, but probably some differences across students that may also explain who is kind.

On the other hand, having high values of "looking down on someone" (first-degree status downward perception) decreases the probability of being kind; however, this estimate is not significant. For the second-degree status perceptions we found a positive and significant effect (0.35***), but only in model 1, in the fixed effects model, indicating that if someone is seen as having respected by their peers, they are more likely to become kind. The estimates for the second-degree upward status downward position also change their direction between the models (-0.12** and 0.09 in model 1 and model 2 respectively). The effect of the estimates is smaller when only student variations are taken into account.

We could conclude that the results in the models for the indegree centrality for positive relations are logically those the validity of which we could expect to check in the indegree centrality for negative relations model. Thus, the nomination on the first-degree and the second-degree upward status measures have a positive, while the first-degree and second-degree upward status positions have a negative effect on indegree centrality for positive relations, therefore the student will be kind. However, the effects are more diverse in the positive outdegree model, and change a lot from model 1 to model 2. Table 3.8 summarizes the main findings.

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Table 3.8: *Summary of the main findings*

Terminology / definition	**Indegree centrality for negative relations/** being hostile	**Indegree centrality for positive relations/** being popular
Consistency: **First-degree upward status position**/being respected (H1a)	-	+
Controversy: **Second-degree upward status position** / being respected by others (H2)	+	+
Consistency: **First-degree downward status position**/being disrespected (H1b)	+	-
Consistency: **Second-degree downward status position**/being disrespected by others (H1c)	+	-
Terminology / definition	**Outdegree centrality for negative relations/** being rejected	**Outdegree centrality for positive relations/** being kind
Dominance: **First-degree upward status position/** being respected (H3a)	-	+
Dominance: **Second-degree upward status position/** being respected by others (H3b)	+	+
Dissatisfaction: **First-degree downward status position/** being disrespected (H4a)	+	-
Dissatisfaction: **Second-degree downward status position/** being disrespected by others (H4b)	+	-

Note: The *first-degree upward status position* defines who is respected by accumulating nominations on the question "who do you look up on". The *second-degree upward status position* designates who is seen as respected by others when aggregating nominations on the question "who is looked up to by peers". The *first-degree downward status position* describes who is disrespected by aggregating nominations on the question "who do you look down on". The *second-degree downward status position* detects who is seen as disrespected by others when adding up the nominations on the question "who is looked down on by peers". Bold and sign in grey background indicates the significant results.

Negative indegree and outdegree centrality explained by control variables

We control for the effect of gender, Roma, socio-economic status and age as potentially important factors when acquiring status. We test whether females, Roma and those who have higher SES are more likely to be rejected or associated with hostility. These control effects are described in model 1. We find a very weak evidence for the fact that girls are more likely to be negatively, but also positively regarded (by about 1%). For the negative, positive and mixed influence, we do not find even this weak effect. Further, we find no evidence for the role of socio-economic status. We find a significant but small effect of being Roma on the indegree centrality for positive

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relations: the Roma are about 1% less likely to be popular. The age effects show that those who are younger than the average are more likely to nominate their peers positively. However, as the students are around the same age, this effect is probably not important quantitatively.

Overall, these small and sometimes not even significant effects indicate that once the perceived status positions are included as explanatory factors for peer regard and influence, there is very minor role for these student characteristics.

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Table 3.9a: *Regression results, indegree centrality for negative relations ("being rejected") and indegree centrality for positive relations ("being popular")*

	Indegree centrality for negative relations ("being rejected")						*Indegree centrality for positive relations ("being accepted")*					
	Model 1			Model 2			Model 1			Model 2		
	Est.		SE	Est.		SE	Est.		SE	Est.		SE
First-degree status upward position (H1a)	-0.09	***	0.02	-0.02		0.03	0.74	***	0.04	0.62	***	0.04
Second-degree status upward position (H2)	0.08	***	0.01	0.09	***	0.02	0.33	***	0.02	0.35	***	0.03
First-degree status downward position (H1b)	0.69	***	0.04	0.60	***	0.04	-0.12	**	0.05	-0.23	***	0.05
Second-degree status downward position (H1c)	0.31	***	0.02	0.29	***	0.03	-0.55	***	0.03	-0.16	***	0.04
Gender, female=1	0.01	***	0.00				0.01	*	0.01			
Roma, dummy=1	0.00		0.00				-0.013	*	0.01			
SES	0.002		0.002				-0.004		0.00			
Age	0.00		0.00				-0.08	**	0.00			
Wave 2	0.02	***	0.00	0.08	***	0.00	0.00		0.01	0.05	***	0.01
Wave 3	-			0.05	***	0.00	-			0.03	***	0.01
Class fixed effects	yes			no			yes			no		
Student fixed effects	no			yes			no			yes		
R-squared	0.82			0.91			0.54			0.82		
Number of students	1,281			1,567			1,281			1,567		
Number of observations	2,973			3,724			2,973			3,724		

Notes: * p <0.1; ** p < 0.05; *** p<0.01. The regression model estimates are non-lagged models. The reason for these very small coefficients is that these variables vary on a larger range than the dependent variable.

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Table 3.9b: *Regression results, outdegree centrality for negative relations ("being hostile") and outdegree centrality for positive relations ("being kind")*

	Outdegree centrality for negative relations ("being hostile")				*Outdegree centrality for positive relations ("being kind")*			
	Model 1		Model 2		Model 1		Model 2	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE
First-degree status upward position (H3a)	-0.03	0.04	-0.16	0.11	0.27 ***	0.06	-0.01	0.09
Second-degree status upward position (H3b)	0.04 **	0.02	0.23 **	0.06	0.03	0.04	0.33 ***	0.05
First-degree status downward position (H4a)	0.07	0.06	0.12	0.12	-0.11	0.08	-0.11	0.11
Second-degree status downward position (H4b)	0.09 ***	0.03	0.31 ***	0.09	-0.12 **	0.05	0.08	0.08
Gender, female=1	0.01	0.01			0.02 **	0.01		
Roma, dummy=1	-0.01	0.01			0.04 ***	0.01		
SES	0.01	0.004			0.008	0.01		
Age	-0.005	0.005			-0.02 **	0.01		
Wave 2	0.01	0.01	0.12 ***	0.01	0.04 ***	0.01	0.07 ***	0.01
Wave 3	-	-	0.10 ***	0.01	-	-	0.06 ***	0.01
Class fixed effects	yes		no		yes		no	
Student fixed effects	no		yes		no		yes	
R-squared	0.20		0.66		0.14		0.64	
Number of students	1,281		1,567		1,281		1,567	
Number of observations	2,973		3,724		2,973		3,724	

Notes: * p <0.1; ** p < 0.05; *** p<0.01. The regression model estimates are non-lagged models. The reason for these very small coefficients is that these variables vary on a larger range than the dependent variable.

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3.6 Discussion

In this chapter, we analyzed how perceived status positions associate with who is rejected, seen as "*important in the negative network",* and also with who is hostile, seen as "*influential in the negative network"* among 15-year old adolescents. Students who are rejected or become hostile in their school are more likely to become aggressive, have externalizing problems, and have school adjustment problems than those who are not part of the negative game (Laird et al., 2001).

As being important and influential in the negative network is not independent from the internal status processes within a group, the chapter makes two central contributions to the literature. The first is that the chapter uses takes four types of status positions. This distinction followed earlier literature highlighting the role of personal peer admiration and perceived popularity (LaFontana & Cillessen, 2002; Parkhurst & Hopmeyer, 1998). We differentiated between those who respondents "looked up to" or "looked down on" (defined as *first-degree upward* and *downward status* perceptions respectively), and those who they perceived as being "looked up to by others" or "looked down on by others" (defined as *second-degree upward* and *downward status* perceptions respectively). These measures were all aggregated and normalized by calculating Freeman indegree centrality. The second contribution is that we analyzed how these perceieved status positions influences who were the rejected and the hostile actors in the class. Negative networks were defined by merging the questions "I dislike him or her" and "I hate him or her". The rejected actors were measured by the normalized version of the Freeman indegree centrality, while the hostile actors were measured by the Freeman outdegree centrality in the negative network.

A third contribution of the chapter is that we analyzed this association using panel regression. By using this method, we were able to show that estimates between students are explained by changes over time rather than by external factors such as gender, ethnicity, socio-economic status or age difference, and that all students systematically change their status positions and indegree centrality across the different waves.

Consequently, we had three research questions. The first was how indegree nominations on the four aggregated status measures affected the indegree centrality for negative relations and the outdegree centrality for negative relations. The second was whether status positions on individuals' own beliefs or the perception of other peers'

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view had a greater influence on being rejected or hostile. The third was how results for negative indegree and outdegree centrality differed from what we observed in the positive networks. We compared our results with the estimates in the positive networks, measured by merging the two scales "I like him or her" and "He or she is my friend". As previous research showed, negative and positive networks were not the mirror images of each other (Csaba & Pál, 2010; Huitsing et al., 2012; Roda, 2010), thus we did not expect the same direction of estimates in the negative and the positive networks. We expected that the non-identical nature of the positive and negative network is true, and we would observe, estimates with the same signs.

We applied panel regression, using the first three waves of the data to test our questions. We intended to show the average effect across the three waves. We built two models. In the first model between-subject variability was tested by taking into account the impact of socio-economic background, ethnicity and socio-economic background. In the second-model within-subject variability was tested, so we analyzed what could lead to changes in individuals' values over time. We also tested the effects of individual characteristics, such as gender, ethnicity and socio-economic status. By including individual fixed effects, we controlled for all types of individual specific – observed and unobserved – characteristics. In this way, we could estimate how changes over time in the various forms of status positions affect indegree centrality for negative relations and outdegree centrality for negative relations.

Our results on the association between the perceived status positions and indegree centrality for negative relations, when the student is rejected show the following. The negative association between first-degree status upward position and negative peer regard implies a consistent relationship; hence those who are looked up on are less likely to be rejected (H1a). A positive association implies consistency between between rejection and high levels on first-degree (H1b) and second-degree status position (H1c). A positive association between second-degree upward status position and indegree centrality for negative relations suggests a situation in which individuals who are seen as looked up on by many are also nominated negatively (H2). The same positive relation with indegree centrality for positive relations implies that there might be controversial students who have high status in their subgroups, but are seen negatively by the members of other subgroups. On the one hand, these results are in line with earlier findings, showing that if an individual is important in a negative network, they are likely to be disrespected or seen as disrespected by others in the community.

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On the other hand, the result suggests that if someone is seen as respected by others, that is there is a consensus that he or she has high status in a community; it does not mean that this person is preferred by everybody in the same community. If someone is seen as the leader of a subgroup within a larger group does not mean that this person is liked by everybody from the larger group.

The findings regarding the association between perceived status positions and hostility are presented next. The positive association between the upward part of status positions and outdegree centrality for negative relations is in line with the social dominance theory, which claims that negative ties could be used in order to maintain the existing status hierarchy (Hawley, 1999). Sending negative ties towards others could reinforce or enhance an individual's status. We find evidence for this social dominance mechanism for the second-degree upward status position (H3b), but not for the first-degree upward status position (H3a). The results indicate that it might happen that only controversial figures nominate others negatively in order to strengthen their status position or to reduce the possible threat for them. The association between the the first-degree and second-degree downward status position is in line with theories on sending negative ties because of envy or jealousy (Berger & Dijstra, 2013). Those who are indicated or seen as low status children become hostile because they are frustrated and do not accept their low position in the social ledger. The positive association between the first-degree (H4a) and second-degree downward (H4b) status position with outdegree centrality for negative relations is reinforced due to dissatisfaction. Those who are looked down on by their peers or who are seen as looked down on by peers become active in nominating others negatively.

The results of this chapter are promising despite certain limitations. Future research needs to validate our results in other cultures to determine whether the observed results universally exist. Second, we did not treat status positions as the dependent variable in order to check if the reverse pattern may occur. Future studies should analyze how being rejected or hostile is interrelated. Third, we did not discuss other possible explanations for indegree centrality for negative relations, when the student is rejected such as educational attainment, physical ability or personal attribution. Fourth, we did not analyze the case of students who are being rejected and hostile at the same. Nevertheless, a tie level analysis, discussed in Chapter 4, is displayed. Fifth, we did not check how this observed association occur on the tie level, the interrelation between individuals on different status measures; nevertheless we show

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results related to this limitation in Chapter 2 and Chapter 4. Sixth, we did not assume that the effects would differ across waves, but even if they did, we were interested in the average effect. But again we were interested in the average effect, not how it differed across students.[35]

Being a popular high-status member of a group suggest important aspects for adolescents' social development. Those who are liked are likely to enjoy the social support from peers. Those who are seen high status members in the school are more likely to study well and feeling goof at school. Particularly, lack of understanding and negative peer influence are crucially important as they are related to severe individual outcomes such as low satisfaction, aggression, low performance and stress (Card, 2010; Betts & Stiller, 2014). The implication of the results is that individuals' own status attributions are not always consistent with how individuals think of the status order in their own community. Consequently, this inconsistent connection between these two distinct forms of status perceptions might result in rejection and hostility. Monitoring various dimensions of connections within a community might help reveal the complex nature of human relations within a group. We are confident that our theoretical arguments as well as our modeling approach will contribute to the understanding of how status positions affect being rejected and becoming hostile.

[35] If we want to do that, it is better to do it (i) either by interacting the explanatory variables with student characteristics (e.g. gender) or (ii) by running two separate regressions, one for one group and one for the other (e.g. girls vs. boys). The advantage if (i) is that the significance of the difference between the two groups can be seen immediately from the significance of the coefficient estimate of the interaction term.

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CHAPTER 4 Status Perceptions Matter: Understanding Disliking among Adolescents[36]

Chapter Summary

The emergence of disliking relations is the origin of severe social problems depends on how adolescents perceive the relative informal status of their peers. This notion is examined on a longitudinal sample using dynamic network analysis (585 students across 16 classes in 5 schools).

As hypothesized in this chapter, individuals dislike those who they look down on (*disdain*) and conform to others by disliking those who they perceive as being looked down on by their peers (*conformity*). The inconsistency between status perceptions also leads to disliking, when individuals do not look up to those who they perceive to be admired by peers (*frustration*). Adolescents are not more likely to dislike those who they look up to (admiration). Moreover, disliking agreement with friends could lead to friendship formation and status perception hierarchy leads to the formation of disliking ties, as those who are low in the hierarchy are also more likely to be nominated as disliked.

Result also suggests that same-gender students are slightly more likely to dislike one another or to become friends. The findings also indicate gender homophily in the friendship network. Further, boys received more friendship nominations than girls. The study manages to demonstrate the role of status perceptions on disliking tie formation.

Keywords: disliking ties, social networks, status perception, adolescents, RSiena models

[36] Chapter 4 is the extended version of the study 'Pál, Judit; Stadtfeld, Christoph; Grow, André & Takács, Károly (2015): Status Perceptions Matter: Understanding Disliking among Adolescents'. The original version of the paper is accepted for publication for the *Journal of Research on Adolescence*. The co-authors agreed to use our joint work as part of my PhD thesis.

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4.1 Introduction

Peer relations play a central role in the social development of adolescents. Existing research has predominantly focused on positive peer relations, such as friendship and liking, and on the benefits that such relations can have to adolescents (Bollmer, Milich, Harris, & Maras, 2005; Hartup, 1993; Ladd & Burgess, 2001; Lansford, Criss, Pettit, Dodge, & Bates, 2003; Newcomb, Bukowski, & Pattee, 1993b). Research on disliking relations, by contrast, is relatively scarce, possibly because disliking ties are reported less frequently than liking ties (Baldwin, Bedell, & Johnson, 1997). This might be explained by the fact that the conceptualization of disliking varies considerably across the literature, ranging from aversion or active avoidance (Card & Hodges, 2007) to more intense disliking such as enmity or hatred (Card, 2007). In this article, we define disliking relations as negative feelings that one individual holds towards another (Abecassis, Hartup, Haselager, Scholte, & Van Lieshout, 2002; Labianca & Brass, 2006).

Despite their scarcity, disliking ties are present in adolescents' everyday life and can affect their development in fundamental ways (Card, 2010). The harmful effects that disliking relations can have on satisfaction, mood, performance, stress, and community structure tend to be greater than the positive effects that positive relations have on these outcomes (Bruggeman, Traag, & Uitermark, 2012; Moerbeek & Need, 2003). Disliking relations have a negative influence on adolescents in a number of ways: they are often associated with externalizing and internalizing problems, lower prosocial behavior, fewer friendship relations, victimization, and rejection by peers (Card, 2010). In addition, disliking relationships strongly influence school adjustment and achievement (Betts & Stiller, 2014; Buhs, Ladd, & Herald, 2006). Furthermore, if one youth dislikes another, then open conflict or aggression between them becomes more likely, especially if the disliking is mutual (Abecassis et al., 2002; Erath, 2009; Pope, 2003; Witkow, Bellmore, Nishina, Juvonen, & Graham, 2005).

The scant research on the origins of disliking ties suggests that their emergence can partly be explained by individual attributes. In social networks, unpopular individuals often receive disproportionally more disliking nominations than popular ones (Dijkstra, Cillessen, & Borch, 2012; Eder, 1985). Additionally, individuals who possess traits and characteristics that make them radically different from the rest of the group (Barrera, 2008) or who belong to low-status groups (Nangle, Erdley, & Gold,

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1996; Rydgren, 2004) are often considered as "black sheep" and therefore receive disliking nominations.

Furthermore, disliking ties are also affected by the group setting. Each disliking relation is embedded in the larger peer context and might be amplified by the opinions and emotional positions of relevant others, especially of friends (Heider, 1958). This may occur due to balancing motives (Cartwright & Harary, 1956). From this perspective, disliking ties create balance in a group when friends create common "enemies" (Marvel, Kleinberg, Kleinberg, & Strogatz, 2011). In addition, common disliking might bring individuals together (Davis, 1967). Whereas being liked and having friends are protective factors against bullying, those who have a greater proportion of mutual dislikes are more likely to be bullied or becoming the target of negative actions as they are not defended by their peers (Card & Hodges, 2007; Hafen, Laursen, Nurmi, & Salmela-Aro, 2013).

In this paper, we aimed to contribute existing research by studying the evolution of disliking ties in relation to dyadic status perceptions with a social network approach. We suggest that dyadic status differences are important in the emergence of disliking ties. We take into account both the status that an individual personally attributes to another group member, and also the status that the individual believes peers in the group attribute to this particular group member.

4.2 Theory explaining disliking by status perceptions

From a developmental perspective, adolescents are mainly competing for admiration and dominance in closed groups (Faris & Felmlee, 2014; Pellegrini & Long, 2002). In school classes, those who have high status are more likely to make decisions for the group, whereas low status is associated with adjusting opinions to those of other group members and decreased participation in decision-making processes (Anderson et al., 2006; Berger et al., 1980). Individuals position themselves in the status hierarchy by choosing their friends or by disliking their peers. At the same time, an acquired status position defines who is liked or disliked by others.

Status has been conceptualized in various ways. *Positive peer regard or acceptance* was measured by liking nominations; and negative peer regard or rejection was measured by disliking other students in the community (Cillessen & Rose, 2005; Coie et al., 1982; Coie & Kupersmidt, 1983; Newcomb & Bukowski, 1983). *Peer admiration* describes who is perceived as competent and of high status (Coleman,

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1961; Cuddy et al., 2008; Fiske et al., 2007). Peer admiration is often operationalized by peer ratings on "who is admired" or "respected" (Becker & Luthar, 2007). These measures have in common that they all aggregate individual nominations about a direct relationship between the respondent and the target individual to a general score (most typically indegree). By contrast, *perceived popularity* describes social reputation, and defines the importance of power and influence in a group by asking students about who they *perceive* as popular or unpopular in the class (de Bruyn & Cillessen, 2006; Luthar & McMahon, 1996; Prinstein & Cillessen, 2003). Hence, this measure aggregates individual perceptions on popularity.

There are very few studies that examined the association between status and disliking relations (Rodkin, Pearl, Farmer, & Van Acker, 2003), and only recent research analyzed how status shapes the evolution of disliking ties (Berger & Dijkstra, 2013, Rambaran, Dijstra, Munniksma & Cillessen, 2015). Berger and Dijkstra (2013) define status as the aggregation of perceived popularity and suggest that if there is dissimilarity in status between individuals, this will lead to mutual disliking between lower status individuals and higher status individuals. Moreover, high status children seem to be more pleasing than low status individuals, and also to attract positive affection (Dijkstra, Lindenberg, & Veenstra, 2007). At the same time, high status individuals are potentially disliked by their peers because they were characterized as dominant and aggressive (Parkhurst & Hopmeyer, 1998). In contrast, low status individuals tend to attract negative social relations solely (Asher & Wheeler, 1985).

Status perceptions have a dyadic character and therefore they could be described as directed relationships. In this study, we examine how dyadic concepts of peer admiration influence the evolution of disliking relations. In particular, we measure *first-degree status perceptions* by asking students who they look up to or look down on. This is to be differentiated from the perceived status position, which we define as *second-degree status perception*. It was measured by asking students who they think that their peers look up to or look down on.

We argue that taking the interrelation of the first-degree and second-degree status perceptions into account could lead to a better understanding of how disliking ties are established. In particular, it might happen that there is a discrepancy between the two forms of status perceptions. In case individuals indicate differences in the first-degree and second-degree status perceptions, they are likely to experience cognitive dissonance between their own status evaluations and the perceived status order. We expect that

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dissonance can result in anger, envy, jealousy and conflicts in the group. This expectation is based on the belief disconfirmation paradigm (Festinger, 1962), which underlines that cognitive dissonance can occur when people are confronted with views that are inconsistent with their beliefs. According to this paradigm, cognitive dissonance can create frustration, which is an emotional response to social situations (Pastore, 1950). Frustration is particularly strong in case of fierce social competition (Dill & Anderson, 1995), and when an individual does not agree with the established social hierarchy. For instance, individual *i* is especially likely to experience frustration when he or she perceives that his or her peers *j, k,* and *l* accord more status to individual *m* than *i* believes *m* deserves. To dissolve his or her inconsistent feelings, *i* may dislike *m.*

Dissonance might not only lead to frustration or disliking. Individuals might also try to resolve their cognitive dissonance by aligning their status evaluations with that of their peers (Fiske, Cuddy, Glick, & Xu, 2002; Smith, 2000). This *conformity* process is in line with the fact that people tend to accommodate to the norms and beliefs of the community they are members of (Cialdini & Goldstein, 2004). For instance, dissonance regarding the perception of *low* status peers might result in conforming to the opinion of the majority, and individuals might start to dislike those who they perceive as being looked down on by others.

Taken together, based on research in social psychology, we step beyond identifying status as an individual variable and argue that dyadic status perceptions, and especially dissonance regarding these perceptions, can lead to either frustration or conformity and it contributes to the development of disliking ties. For status perceptions, we operationalize:

1.) *first-degree upward status perception* by asking individuals to nominate peers who they look up to;

2.) *first-degree downward status perception* by asking individuals to nominate peers who they look down on;

3.) *second-degree upward status perception* by asking individuals to nominate peers who they think other peers look up to;

4.) *second-degree downward status perception* by asking individuals to nominate peers who they think other peers look down on.

In addition, we operationalize:

5.) *aggregated status perceptions* as the difference between indegree ties of first-degree upward and first-degree downward status perceptions.

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The aggregated status attribution is parallel to the conceptualization of popularity by LaFontana and Cillessen (2002), and Berger and Dijkstra (2013).

Table 4.1 summarizes the status concepts and their measurement in our study.

Table 4.1: *Definition of the different status dimensions*

Terminology	Definition	Type	Survey question	Abbrev.
First-degree upward status perception	The perception of *j*'s relative high status by *i*	Dyadic	"I look up to him/her."	1↑
First-degree downward status perception	The perception of *j*'s relative low status by *i*	Dyadic	"I look down on him/her."	1↓
Second-degree upward status perception	The perception of *i* about *other* actors' opinions of *j*'s high status	Dyadic	"I think he/she is looked up to (by others)."	2↑
Second-degree downward status perception	The perception of *i* about *other* actors' opinions of *j*'s low status	Dyadic	"I think he/she is looked down on (by others)."	2↓
Aggregated status attribution	Defining *i*'s position by subtracting nominations of first-degree downward status perception from first-degree upward status perception	Attribute	Indegree of "I look up to him/her." *minus* Indegree of "I look down on him/her."	

Based on the arguments above, we hypothesize that not only first-degree status perceptions, but also the *inconsistency* between first- and second-degree status perceptions could be major determinants of disliking relations. We define:

6.) inconsistency in upward status perceptions (*InconsistencyUp*) as the presence of second-degree status upward perception and the lack of first-degree status upward perception in the given directed relationship;

7.) inconsistency in downward status perceptions (*InconsistencyDown*) as the presence of second-degree status downward perception and the lack of first-degree status downward perception in the given directed relationship.

We formulate four hypotheses about how different status conceptualizations could be related to the formation of disliking ties. The first two are related to first-degree status perceptions:

H1 (*admiration hypothesis*): Individual *i* who has a *first-degree upward status perception* of individual *j* is *less* likely to develop a disliking tie to *j*.

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H2 (*disdain hypothesis*): Individual *i* who has a *first-degree downward status perception* of individual *j* is *more* likely to develop a disliking tie to *j*.

The third and fourth hypotheses relate to status inconsistencies between first- and second-degree status perceptions. Note that it is the *inconsistency* between the first- and second-degree status perceptions, and *not* the direct effect of second-degree status perceptions, that we hypothesize to result in the emergence of disliking relations:

H3 (*frustration hypothesis*): Individual *i* who has a *second-degree upward status perception* of individual *j* (who believes that *j* is looked up to by peers), but has no first-degree upward status perception of *j* is more likely to develop a disliking tie to *j*.

H4 (*conformity hypothesis*): Individual *i* who has a *second-degree downward status perception* of individual *j* (who believes that *j* is looked down on by peers), but has no first-degree downward status perception of *j* is more likely to develop a disliking tie to *j*. Table 4.2 summarizes the four hypotheses.

Table 4.2*: Proposed hypotheses on disliking*

		Second-degree status perception		
		Upward 2↑	No nomination	Downward 2↓
First-degree status perception	Upward 1↑	H1 -		
	No nomination	H3 +		H4 +
	Downward 1↓		H2 +	

As discussed earlier, disliking relations are not independent from friendship. Moreover, disliking is often observed as the opposite of strong positive feelings and friendship (Heider, 1946). Consequently, in our analyses, we study disliking together with friendship. We study the dynamic interplay of these two forms of relations and we control for a number of related mechanisms in the disliking as well as in the friendship network. In particular, we take into account that friendship ties are often reciprocated due to homophily and balancing motives (Krackhardt & Kilduff, 1999; Laursen, 1993). Furthermore, earlier research has shown that friends of friends tend to become friends, high status individuals often attract more friends than low status individuals, and friends tend to agree about who their "enemies" are (Davis, 1967; McPherson & Smith-Lovin, 1987). We also control for possible differences between males and females. Same-gender interactions and friendships are more frequent than cross-gender interactions and

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friendship ties, and most disliking is also directed to same-gender peers (Garandeau, Wilson, & Rodkin, 2010). Furthermore, we control for similarity in socio-economic background, as it is a major factor in tie development among adolescents. Research studying disliking has shown that those who are from families with similar levels of income and parental education are more likely to become friends (Mayer & Puller, 2008; Verbrugge, 1983). By contrast, it is not known whether dissimilarities in socio-economic background result in disliking or not.

We test our hypotheses in secondary school classes using stochastic actor-based models (Snijders et al., 2010) and a meta-analytical approach (Snijders & Baerveldt, 2003).

4.3 Methods

4.3.1 Sample and participants

We used three waves of the Hungarian longitudinal network study "Wired into Each Other: Network Dynamics of Adolescents in the Light of Status Competition, School Performance, Exclusion and Integration". The collection of the first wave took place in November 2010, the second in April-May 2011, and the third in April 2012. Students were 9th graders in the first and in the second wave, and 10th graders in the third wave. A subsample of 16 out of 40 classes was included in our analysis. We first selected all classes with at least 20 students and with fewer than 30% missing participants as these criteria would generally allow for a convergence of the estimation method. Second, in classes where negative relations changed dramatically between waves, it was theoretically unreasonable and technically impossible to model the formation of disliking ties as a network process. More precisely, we considered classes in which the Jaccard-index was greater than 0.1 between subsequent waves. Classrooms in the resulting subsample differed from our total sample along several important dimensions, such as gender composition and type of education. Classes dropped from the analysis turned out to be mainly vocational training and vocational secondary schools, with a lower average socio-economic status of students. One reason for this is that in the Hungarian educational system the dropout rate is higher in vocational training and vocational secondary schools than in grammar schools (Horn, 2013), which leads to higher shares of missing cases in classes in these school forms.

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Classrooms in the resulting subsample differed from our total sample along several important dimensions, such as gender composition and type of education. Due to our selection criteria, the classes were larger and more stable in their composition than average. As student turnover and absence rates were much higher in the dropped classrooms, we could observe that status perceptions as well as disliking relations fluctuated considerably between observations. Although we were unable to perform the same dynamic analyses in the dropped classrooms, simple correlations are reported in the supplementary material (see Table 4.6). No radical differences are visible among the analyzed and the dropped classes at this bivariate level.

Table 4.4 contains descriptive statistics of our subsample. The subsample comprised 585 respondents in total (N_1=535, N_2=522, N_3=501). On average, 1.81 (*SD*=1.83) students per class joined or left between wave 1 and wave 2, whereas 6.44 (*SD*=6.32) joined or left between wave 2 and wave 3. On average, students were 15.26 years old in wave 1 (*SD*=.54), and the average number of enrolled students per school class was 32.46 (*SD*=2.78). 62.5% of students in the subsample were female. In the selected subsample, thirteen classes were from grammar schools, two were from vocational secondary schools, and one was from a vocational training school. This distribution of school types could partly explain the skewed gender ratio: in Hungarian grammar schools the number of females is higher (58%), whereas in vocational training schools the number of female and male students are more or less equal (KSH, 2012). Six classes were located in the capital city Budapest, six in towns with approximately 13,000 inhabitants, and four classes were located in towns with a population of 55,000 inhabitants.

4.3.2 Measures

Dependent variables: disliking and friendship relations[37]

We used a five-point Likert-scale to collect network data on disliking and friendship. Each student had to indicate his or her relationship with each classmate according to the following descriptions: "I hate him/her" (-2), "I dislike him/her" (-1), "He/she is neutral to me" (0), "I like him/her" (+1), or "He/she is a good friend" (+2). Missing answers were coded as 0. We merged the values -2 and -1 of the scale to create

[37] Table A. 4.2 in the Appendix summarizes the descriptive statistics on hate (-2) and disliking (-1) nominations. Additional information on second-degree status perceptions is also included to the same table.

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social networks of disliking, given that hate can be conceived of as a strong form of disliking (S. Table 1 in the supplementary material provides an overview over hate and dislike nominations). For friendship, we used the +2 value of the scale. Based on this, we created *two* binary adjacency matrices (disliking and friendship) for each school class in each of the three waves. For example, if student *i* disliked student *j*, then the corresponding entry (*i*,*j*) in the disliking matrix was marked 1 (0 otherwise). If a student joined the class after the data collection started or he or she left, and would therefore not appear in some of the questionnaires, this student was nevertheless included in all matrices. All values in the corresponding row and column, however, were marked as "structural zeros" to indicate that sending or receiving nominations was technically impossible (as the student was not the member of the class in the given period (Ripley, et al., 2014, p. 24).

Independent variables: dyadic status measures. As we have outlined in Table 4.1 we used certain network items to test our hypotheses. With regard to the *admiration hypothesis* (H1), we used the question "who do you look up to" (indicating first-degree status upward perception). For the *disdain hypothesis* (H2), the question "who do you look down on" (indicating first-degree status downward perception) was used. *Second-degree upward status perception* was measured by the network item "who do you think a lot of people look up to" whereas the network item "who do you think a lot of people look down on" was used to specify our *second-degree downward measure*.

For testing the *frustration* (H3), and the *conformity* (H4) *hypotheses*, we created two variables: (1) *InconsistencyUp*: when individual *i* perceived *j* as being high in status in general (*i* had second-degree status upward perception of *j*), but did not look up to *j* herself (*i* did not have first-degree status upward perception of *j*); and (2) the mirror case of downward status perceptions (*InconsistencyDown*): individual *i* perceived *j* as being low in status in general (*i* had second-degree status downward perception of *j*), but did not look down on *j* herself (*i* did not have first-degree status downward perception of *j*). We created binary coded matrices for these status perception measures similarly to disliking and friendship networks. In the *InconsistencyUp* matrix, if student *i* had second-degree status downward perception of *j* but at the same time looked down on *j*, then the corresponding entry (*i*,*j*) is marked 1 (0 otherwise). In the *InconsistencyDown* matrix, if student *i* had second-degree status downward perception of *j* but at the same time looked down on *j*, then the corresponding entry (*i*,*j*) is marked 1 (0 otherwise).

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We used the first two waves of status perception measures in our analysis, because we tested the effect of status perceptions at the beginning of a period on subsequent changes in disliking and friendship ties.

Participants' covariates. In addition to the dyadic status perceptions discussed above, we constructed an aggregated status attribution variable. It was calculated by subtracting the first-degree status downward measure ("who do you look down on") from the first-degree status upward measure ("who do you look up to"). Then, we standardized the values creating z-scores within classes. Following the recommendation of Snijders, van de Bunt, and Steglich (2010), status was transformed into a categorical variable. Cut-off points using increases of .50 of the continuous z-score were used to create a 4-point scale status measure. In the resulting measure, a value of 1 indicates when someone has a low and 4 when someone has a high aggregated status perception.

To operationalize socio-economic background (SES), factor points were calculated from the student-reported mother's highest education level measured on a 7-point scale (1=fewer than 8 years of primary school, 7=university degree (MA/MSc), and the number of books families had at home (1=0-10; 2=11-25; 3= 26-100; 4=101-200; 5=201- 500; 6=more than 500 books) with a categorical principal component analysis (CATPCA). The goal was to decrease an original set of variables into a smaller set of uncorrelated components that represent most of the information found in the original variables. This approach has *"the same goal as traditional principal component analysis, but it is suited for variables of mixed measurement level that may not be linearly related to each other"* (Maniser et al., 2010, p. 101). As the mother's education level and the number of books families have did not change significantly in the majority of cases during the time of the data collection; we calculated the average values from the three waves. We created a 3-category variable based on quintiles (Vyas & Kumaranayake, 2006), where scores between 0-40% were coded as low, scores between 40-80% as medium, and over 80% were coded as high socio-economic status. In addition, we included gender as an important constant covariate (male = 0; female = 1).

4.4 Analytical strategy

We modeled longitudinally the effect of dyadic status perceptions on changes in disliking relations with stochastic actor-based models (SABMs, Snijders et al., 2010) We estimated these models with RSiena 4.0 (Ripley et al., 2014). The SABMs that we specified model the co-evolution of disliking and friendship as two mutually exclusive

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networks. The simulation-based RSiena method took the disjoint nature of both networks into account, and did not allow for the existence of overlapping disliking and friendship ties. If a disliking tie was to be turned into a friendship tie, this can only happen in two steps, first, by dissolving the disliking tie, second, by adding a friendship tie. Changes in either of the networks are assumed to be based on actors' preferences. The preferences are operationalized as linear terms in actor-oriented, objective functions. The terms express if changes in the set of outgoing ties of one actor are endogenously determined (e.g., structures in the disliking network explain changes of disliking relations), if they depend on participant covariates (e.g., gender homophily), if they depend on dyadic covariates (e.g., status perceptions), or if the networks co-evolve (e.g., students who dislike the same classmates are more likely to become friends) (Ripley et al., 2014).

SABMs assume that actors in a network are evaluating their position in the network according to the current network characteristics. More formally, when there is an opportunity for an actor to make a change, the probability of any given change is assumed to be proportional to the exponential transformation of the objective function (Snijders et al., 2010). We simultaneously modeled disliking and friendship as dependent network processes. In both networks, we examined the following structural effects: *outdegree* (density, the number of outgoing ties), *reciprocity* (the tendency that ties will be reciprocated), *indegree popularity* (the tendency that actors with a high number of incoming ties will attract extra incoming ties; in the case of disliking relations this is called "black-sheep effect"), *outdegree popularity* (the tendency that actors with a high number of outgoing ties will attract extra incoming ties; in the case of disliking relations this is called "hater effect"), *transitive triplets* (the tendency of individuals to be "friends of the friends of their friends" or to be "enemies of the enemies of their enemies"), and *3-cycles* (the tendency of actors to form circular friendship or disliking structures). Especially in the disliking network, some individuals might have a preference for maintaining an outdegree of zero. Therefore, we also included the *outdegree isolates* effect to incorporate that the transition from having zero outgoing tie to having one tie is not the same as increasing a positive number of ties by one.

We controlled for *aggregated status attributions*. We tested whether those who scored high on aggregate status tended to nominate more disliked peers and friends (*ego effect*), tended to be more frequently nominated than those low on the scale (*alter*

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effect), and whether participants tended to nominate those who have a similar level of aggregated status (*similarity effect*).

We also controlled for socio-economic background (SES). We tested whether those who are similar in SES were more likely to nominate each other as liked or disliked. Similarly to SES, gender was included as an actor covariate. We tested whether girls were more likely to send and receive friendship and disliking nominations, and whether same-gender nominations were more likely than cross-gender nominations in both networks (gender homophily).

Finally, we included two cross-network effects. The effect of *friends' agreement on disliking* reflects that being friends will lead to disliking the same person. The effect of *disliking agreement on friendship* models whether sharing the same disliking ties facilitates friendship creation and maintenance. Both effects are in line with structural balance arguments (Hummon & Doreian, 2003; Marvel et al., 2011).The two networks were further coupled by the design of the questionnaire: friendship and disliking were mutually exclusive. The estimation process took this into account. The estimation was done in two steps. First, we analyzed classes separately and made sure that the algorithm converged well for each class according to the procedure described in Ripley et al. (2014, p. 57). Second, we conducted a meta-analysis of the results per class as described in Snijders and Baerveldt (2003). The meta-analysis combined the analyzed parameter estimates across classrooms by testing the mean and variance of parameter values between classrooms. The aim of the meta-analysis was to identify universal patterns of network evolution.

To test how well the proposed model specifications fitted our observations, we conducted goodness of fit (GOF) analyses (Ripley et al., 2014, p. 48–49). If the p-value (*p*) of the GOF statistics is less than the chosen significance level, the distributions of network characteristics that the model generates does not follow the distributions observed in the data. We assessed the GOF class by class for indegree and outdegree distributions both in the disliking and friendship networks (Huitsing et al., 2014). Results showed that *p* values in 13 classes were greater than 0.1, so we managed to observe statistically good model specifications in most of the classes, thus a meta-analyses could be performed.

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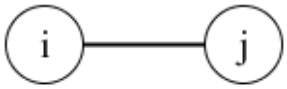
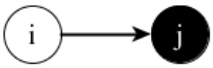
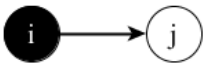
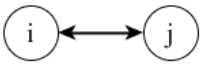
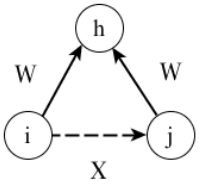
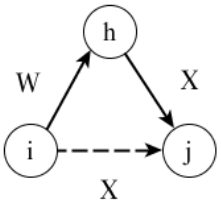
Parameter	Equation	Figure	Conceptualization
Dyadic changing covariate effects (varCovar)			
Dyadic varCovar (X)	$\sum_j x_{ij}(w_{ij} - \bar{w})$		The tendency that if a tie exists between two actors will indicate e.g. disliking between the same actors.
	Constant covariate effects (coCovar)		
Ego effect (egoX)	$v_{ij}x_{i+}$		The tendency that e.g. females are more like dislike males.
Alter effect (alterX)	$\sum_j x_{ij}(v_{ij})$		The tendency that e.g. females are more likely to be disliked by males.
Same effect (sameX)	$\sum_j x_{ij} I\{v_i = v_j\}$		The tendency that e.g. females are more likely to dislike females.
Multiple effects			
W leading to agreement along X, (X: W to agreement) (to)	$\sum_{j \neq h} x_{ij} w_{ih} w_{jh}$		The tendency that e.g. the same disliking ties facilitate friendship creation.
Agreement along W leading to X, (X: from W agreement)	$\sum_{j \neq h} x_{ij} w_{ih} x_{hj}$		The tendency that e.g. being friends will lead to disliking the same person.

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To test how well the proposed model specifications fitted our observations, we ran goodness of fit (GOF) analyses (Ripley et al., 2014, pp. 48–49). We ran GOFs class by class for indegree and outdegree distributions both in the disliking and friendship networks (Huitsing et al., 2014). Results showed that *p* values in 13 classes were greater than 0.1, so we managed to observe statistically good model specifications in most of the classes, thus a meta-analyses could be performed.[38]

4.5 Results

4.5.1 Descriptive statistics

The upper part of Table 4.4 presents descriptive statistics of the disliking and the friendship network and contains information about the first-degree status upward and downward measures, the inconsistency measures, aggregated status attributions, and gender. The average number of disliking nominations per student received through the three observed waves is 2.39 (*SD*=3.06), which is less than half of the number of friendship nominations (*M*=5.85, *SD*=3.47). The relatively high standard deviation in the case of disliking ties reflects that there might be a few students who receive many disliking nominations. In fact, 16.5% of students received more than five, and 4.8 % had ten or more disliking nominations. In disliking networks, the clustering coefficient is much lower (*M*=0.18, *SD*=0.8) than in friendship networks (*M*=0.50, *SD*=0.08). This suggests that in disliking networks it is less common that actors form cohesive subgroups (Everett & Borgatti, 2014). Indegree centralization indicates whether a network is rather centralized (value over .50) or decentralized (value lower than .50). The mean indegree centralization is slightly higher in disliking than in friendship networks (0.28 compared to 0.20), but both networks are rather decentralized. The Jaccard-indices indicate that disliking relations (*M*=0.18 from wave 1 to wave 2; and *M*=0.17 from wave 2 to wave 3) tend to be less stable over time than friendship relations (*M*=0.34 from wave 1 to wave 2; and *M*=0.38 from wave 2 to wave 3). The increase in the number of those who joined and left between waves is mainly explained by the fact that the first and second wave of the data were gathered in the same academic year, whereas the third wave was collected in the subsequent year.

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[38] Class 5 is used to illustrate how the output of the Goodness of Fit tests alike. Figure A. 4.1 in the Appendix section presents this illustration.

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Table 4.4: *Descriptive statistics of the sample and the main variables*

	Mean	SD	Min.	Max.
General descriptive statistics				
Class size w1	32.46	2.78	25	37
Network missings per class (%)	8	10.02	0	27.27
Number of students joining & leaving w1-w2	1.81	1.83	0	6
Number of students joining & leaving w2-w3	6.44	6.32	1	19
Number of disliking nominations (>5) w1-w3 (%)	16.5			
Number of disliking nominations (>10) w1-w3 (%)	4.6			
Age w1	15.26	0.54	14.25	18.33
Disliking Network				
Indegree w1-w3 (D)	2.39	3.06	0	19
Reciprocity (D)	0.18	0.12	0	0.45
Clustering (D)	0.18	0.08	0	0.41
Indegree centralization (D)	0.28	0.11	0.12	0.51
Jaccard coefficient w1-w2 (D)	0.18	0.04	0.11	0.23
Jaccard coefficient w2-w3 (D)	0.17	0.05	0.1	0.27
Friendship Network				
Indegree w1-w3 (F)	5.85	3.47	0	24
Reciprocity (F)	0.56	0.1	0.26	0.72
Clustering (F)	0.50	0.08	0.36	0.69
Indegree centralization (F)	0.20	0.06	0.09	0.42
Jaccard coefficient w1-w2 (F)	0.38	0.1	0.21	0.55
Jaccard coefficient w2-w3 (F)	0.34	0.11	0.16	0.51
Independent variables				
First-degree status Upward Network				
Indegree w1-w2 (Upward 1↑)	1.86	2.11	0	16
Jaccard coefficient w1-w2 (Upward 1↑)	0.18	0.09	0.04	0.34
First-degree status Downward Network				
Indegree w1-w2 (Downward 1↓)	1.14	1.53	0	12
Jaccard coefficient w1-w2 (Downward 1↓)	0.09	0.08	0	0.29
Inconsistency Upward Network				
Indegree w1-w2 (InUp)	5.61	5.14	0	27
Jaccard coefficient w1-w2 (InUp)	0.14	0.07	0.02	0.24
Inconsistency Downward Network				
Indegree w1-w2 (InDown)	2.47	3.12	0	17
Jaccard coefficient w1-w2 (InDown)	0.13	0.04	0.08	0.21

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Control variables				
Aggregated status attribution w1-w3	2.49	1.14	1	4
Socio-economic status (SES)	2.26	0.67	1	3
Female (%)	62.5			

Table 4.5 shows the cross tabulation of the main independent variables which are related to our hypotheses. Dyadic status perceptions of the first two waves are displayed, as they are included in the RSiena analysis as changing covariates. Downward status nominations in general are more frequent than upward status nominations. This is true for first-degree as well as for second-degree status perceptions. First-degree downward status nominations (1,938) in general are more frequent than first-degree upward status nominations (1,175). This is also true for second-degree status perceptions. Second-degree downward status nominations (5,929) occur more than twice as often as upward status nominations (2,448). Moreover, second-degree status perceptions in general are more than 2.5 times as frequent as first-degree status perceptions. Moreover, second-degree status perceptions (8,373) in general are about than three times as frequent as first-degree status perceptions (3,113). Consequently, we find that a large number of upward nominations are only second-degree (1,826) and fewer are only first-degree (503) or both first- and second-degree (523). This relates to the *frustration hypothesis* (H3). Furthermore, we find that the majority of downward nominations are only second-degree status perceptions (4,793) and fewer are only second-degree (890) both first-and second-degree (983). These cases should explain disliking according to the *conformity hypothesis* (H4).

Table 4.5: *Cross tabulation of the first- and second-degree status perceptions in waves 1-2*

		Second-degree status perception			
		Upward 2↑	No nomination	Downward 2↓	Sum
First-degree status perception	Upward 1↑	523 (5.4%)	503 (5.2%)	149 (1.5%)	1,175 (12.0%)
	No nomination	1,860 (19.0%)	-	4,793 (49.1%)	6,653 (68.1%)
	Downward 1↓	65 (0.7%)	890 (9.1%)	983 (10.1%)	1,938 (19.8%)
	Sum	2,448 (25.1%)	1,393 (14.3%)	5,925 (60.7%)	9,766 (100%)

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We calculated the correlations between the standardized values of indegree and outdegree nominations of the main dependent, independent and control variables in waves 1 and 2. We can conclude that both first- and second-degree downward status perceptions correlate positively with the indegree of disliking, whereas we can see the opposite for friendship ties. We also find that those who have high values on aggregated status attribution and socio-economic background are more likely to receive friendship nominations, whereas we can see that low status indicates disliking nominations. Simple correlations do not support an association between gender, indegree and outdegree nominations (see Table 4.6).

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Table 4.6: *Correlations of main variables in waves 1-2*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Indegree Friendship	-	-0.32*	0.40*	-0.18*	0.23*	-0.09*	0.40*	0.09*	0.20*	0.07*	0.15*	0.05	0.21*	0.35*	0.02
(2) Indegree Disliking	-0.38*	-	-0.17*	0.53*	-0.08*	0.37*	-0.17*	0.09*	-0.09*	0.08*	-0.07*	0.09*	-0.09*	-0.36*	-0.02
(3) Indegree Upward 1↑	0.38*	-0.30*	-	-0.10*	0.73*	-0.05	0.21*	0.12*	0.22*	0.10*	0.15*	0.08*	0.08*	0.65*	0.08*
(4) Indegree Downward 1↓	-0.25*	0.59*	-0.23*	-	-0.05*	0.82*	-0.07*	0.11*	-0.08	0.10*	-0.06*	0.13*	-0.08*	-0.59*	-0.04
(5) Indegree InconsistencyUp	0.20*	-0.19*	0.70*	-0.17*	-	-0.01	0.11*	0.08*	0.14*	0.02	0.13*	0.03	0.01	0.45*	0.10*
(6) Indegree InconsistencyDown	-0.11*	0.39*	0.10*	0.79*	-0.09*	-	-0.04	0.10*	-0.06*	0.08*	-0.05	0.10*	-0.45*	-0.13*	-0.04
(7) Outdegree Friendship	0.41*	-0.12*	0.17*	0.12*	0.09*	-0.10*	-	0.27*	0.34*	0.19*	0.25*	0.15*	0.18*	0.13*	0.27*
(8) Outdegree Disliking	-0.01	0.20*	0.01	0.18*	0.02	0.16*	0.01	-	0.24*	0.50*	0.22*	0.42*	0.08*	0.06*	0.24*
(9) Outdegree Upward 1↑	0.17*	-0.04	0.11*	-0.08*	0.08*	-0.07*	0.27*	0.08*	-	0.34*	0.81*	0.31*	0.15*	0.09*	0.34*
(10) Outdegree Downward 1↓	-0.02	0.15*	-0.04	0.17*	-0.04	0.14*	0.06	0.45*	0.19*	-	0.28*	0.86*	0.07*	0.08*	0.28*
(11) Outdegree InconsistencyUp	0.13*	-0.02	0.09*	-0.07*	0.13*	-0.03	0.17*	0.09*	0.76*	0.14*	-	0.27*	0.11*	0.06*	0.27*
(12) Outdegree InconsistencyDown	-0.02	0.13*	-0.07*	0.14*	-0.06	0.10*	0.07*	0.35*	0.2*	0.83*	0.16*	-	0.04	0.04	0.04
(13) Aggregated status attribution	0.35*	-0.39*	0.13*	-0.12*	0.45*	-0.11*	0.05	0.09*	0.06	-0.02	0.05	0.00	-	0.02	0.07*
(14) SES	0.08*	-0.10*	0.65*	0.55*	0.07*	-0.38 *	0.11*	-0.02	0.01	-0.02	0.02	-0.04	0.02	-	-0.04
(15) Gender	0.04	0.01	0.07*	-0.04	-0.01	-0.03	0.09*	-0.05	0.05	0.09*	0.06	-0.04	0.09*	0.05	-

Notes: Correlations for selected classes below and for non-selected classes above the diagonal. Correlations with * were significant at least with p <0 .05
As we used lagged models, therefore the explanatory variables are only come from the first two waves of the data collection. All variables based on indegree and outdegree are z-standardized within classes

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4.5.2 SABM results

The results of the stochastic actor-based models are presented in Table 4.8a and 4.8b. The model displayed contains the effects related to the hypotheses of this paper, and it includes all control variables. Tables 4.8a and 4.8b present all effects that are related to the dynamics of the disliking and friendship networks respectively. The two processes are interdependent. The reported estimates and standard errors are based on the models estimated separately for the 16 school classes, which are combined in a meta-analysis (Snijders & Baerveldt, 2003). We further report the estimated standard deviation of estimates between school classes (σ), and whether the standard deviation significantly differs from zero. The final column shows the number of school classes (*C*) that are combined in the meta-analysis. If there were parameters that could not be estimated, they were still included and fixed to zero. More information on the estimation method, meta-analysis and effect interpretation can be found in the RSiena manual (Ripley et al., 2014). More model variants including the independent variables separately are found in the appendix (see the Appendix, S. Tables 4.2a and 4.2b).

Disliking by first-degree and second-degree status perceptions

The effect of status attributions and the inconsistency between first- and second-degree status perceptions (effects 8-11) in the disliking network are the core effects in this article and test our four hypotheses.

Hypothesis 1 (*admiration*) stated that individuals who look up to someone (first-degree upward status perception) are less likely to nominate this person as someone they dislike. We have found *no evidence* for this admiration mechanism in the disliking networks.

Hypothesis 2 (*disdain*) states that individuals who look down on someone (first-degree downward status perception) are more likely to dislike this person. This hypothesis is supported by our data. The effect of *first-degree downward status perception* on disliking (0.20^{*}) indicates that the log odds of creating a disliking tie to someone who is perceived to be in a lower-status position are 1.22.

Hypothesis 3 (*frustration*) is also supported by our results. The hypothesis states that individuals who perceive someone as having high status in the eyes of others (second-degree upward status perception), but do not look up to this person themselves (no positive first-degree upward status perception), will be more likely to dislike this person. The positive inconsistency effect (0.13^{*}) underlines the presence of this

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mechanism. The log odds of a disliking tie to emerge in the situation of positive status inconsistency are 1.14.

Hypothesis 4 (*conformity*) states that if an individual perceives someone else as low in status according to others (second-degree downward status perception) but does not look down on that person (no first--degree downward status perception) then the probability of disliking will increase. We argue that in the case of negative status attributions, status perception effects will outweigh the status attribution effects. We find strong evidence for this conformity hypothesis (*InconsistencyDown*=0.22*).

The log odds of a corresponding choice are 1.25. Table 4.7 summarizes the main findings.

Table 4.7: *Summary of the main findings*

		Second-degree status perception		
		Upward 2↑	No nomination	Downward 2↓
First-degree status perception	Upward 1↑	H1 -		
	No nomination	**H3 +**		**H4 +**
	Downward 1↓		**H2 +**	

Note: The bold letters indicate when our findings were consistent with our initial predictions.

Disliking explained by endogenous effects

Disliking can partly be explained by endogenous network effects. Endogenous disliking effects are shown in rows 1-7 in Table 4.8a. We find that the number of ties maintained by an actor is limited (*density*=-1.42), and that individuals tend to reciprocate (*reciprocity*=0.52***) disliking nominations. The transitive triplets in disliking networks describe the lack of evidence for "enemies of an enemy to become enemies". Moreover, we find that, in disliking networks, circular tie formation (*three-cycles*= -0.16***) is avoided ("enemies of an enemy are not my enemies"). The interpretation of negative three-cycle effects in combination with a transitivity parameter, however, is dubious. It might either indicate a tendency for hierarchization in networks, or reflect a decreased tendency for reciprocation in cliques (Block, 2015). The joint interpretation of these triadic effects in negative networks is not straightforward either. Nevertheless, we think that both triadic parameters are important

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control effects that describe various mechanisms that may potentially induce clustering in the disliking network.

Indegree popularity is the tendency to dislike those who are disliked by many peers. In the disliking network this effect is clearly observed (0.09^{***}). *Outdegree popularity* is the tendency that actors with a high number of outgoing ties will attract extra incoming nominations. In the disliking network, the effect is positive, but not significant, which means that we do not find evidence that there are "haters who are becoming hated". The *outdegree isolate* effect is significant in the disliking network (-3.07^{***}). Its negative value indicates that the transition from no nomination to one disliking nomination is less likely than a transition from *n>0* to *n+1* disliking nominations. By nominating no one, some students may intentionally choose not to participate in the "disliking game".

Disliking explained by aggregated status perceptions

We used the aggregated status perception measure as a baseline control variable. Our results are in line with the findings of Berger and Dijsktra (2013). Individuals who have a high aggregated status attribution are less likely to dislike their peers and to be disliked by their counterparts (*aggregated status ego* = -0.08^{**}, *aggregated status alter* = -0.07^{***}). We do not find evidence that disliking ties would be formed more likely as a result of aggregated status homophily. It is noteworthy that net of these aggregated status effects, we find clear evidence for the dyadic status perception effects that we proposed (*aggregated status similarity*=-0.05).

Disliking explained by control effects

We control for the effect of socio-economic status and gender on the formation and maintenance of disliking. We only find evidence for one of the SES-related covariates: higher SES students seem to attract more disliking nominations (*SES alter* $=0.10^{*}$). We find weak evidence for one gender-related effect: same-gender students are slightly more likely to dislike one another (*same gender*$=0.11^{+}$). This indicates gender homophobia in the disliking network. This is in contrast to a strong gender homophily effect that we find in the friendship network.

Disliking explained by friendship

The effect of *friends' agreement on disliking* describes the tendency of individuals to dislike those people who their friends dislike. This effect is significantly positive and

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strong (0.18). The log odds of disliking someone are 1.19 for each additional friend who dislikes that person. The effect shows the tendency to become and remain friends with someone who dislikes the same peers.

Table 4.8a: *Results for the SIENA meta-analysis (N=585): Disliking network*

	Est.		SE	σ		C
Disliking network						
(1) Rate (period 1)	8.60		0.69	1.09		13
(2) Rate (period 2)	8.67		0.67	1.24	+	13
(3) Density	-1.42	***	0.08	0.17		15
(4) Reciprocity	0.52	***	0.08	0.00		16
(5) Transitive triplets	-0.01		0.04	0.07		16
(6) 3-cycles	-0.16	**	0.05	0.00		14
(7) Indegree popularity	0.09	***	0.01	0.03	+	16
(8) Outdegree popularity	0.03		0.02	0.00		15
(9) Outdegree isolate	-3.07	***	0.15	0.00		15
(10) Upward 1↑ (H1)	0.00		0.12	0.00		15
(11) Downward 1↓ (H2)	0.20	*	0.08	0.00		16
(12) InconsistencyUp (H3)	0.13	*	0.06	0.00		16
(13) Inconsistencydown (H4)	0.22	**	0.07	0.10		16
(14) Aggregated status ego	-0.08	**	0.03	0.06	+	16
(15) Aggregated status alter	-0.07	***	0.02	0.00		16
(16) Aggregated status similarity	-0.05		0.06	0.10		16
(17) SES ego	0.02		0.04	0.07	+	16
(18) SES alter	0.10	*	0.05	0.07		16
(19) SES similarity	-0.09		0.06	0.00		16
(20) Gender ego	0.06		0.08	0.14		15
(21) Gender alter	0.05		0.06	0.00		15
(22) Same gender	0.11	+	0.06	0.10		15
(23) Friends' agreement on disliking	0.18	***	0.04	0.06		16

Note: + p <0.1; * p < 0.05; ** p<0.01; ***p<0.001

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4.5.3 Analysis regarding friendship

The analysis reported in Table 4.8b in the main text also includes estimation of the dynamics of the friendship network. We used the same model specification for the friendship network in order to assess whether our results are in line with earlier research on positive ties. Furthermore, our aim was to assess the robustness of our results on disliking by comparing them with the same model estimation using the friendship network as the dependent variable. In the next paragraphs, we explain our results on friendship network.

For the friendship networks, both *reciprocity* (1.75***) and *transitive triplets* (0.24***) ("friends of a friend become my friend") are positive and significant. For *indegree popularity*, we find a positive but non-significant effect (0.01). We therefore do not observe a tendency towards indegree centralization. The negative and significant effect of *outdegree popularity* (-0.15***) means that those who nominate many friends are less likely to be nominated as friends. The effect *of disliking agreement on friendship* (0.07*) indicates that the log odds to become friends with someone who dislikes the same person is 1.07 for each shared disliked peer.

The four effects that relate to the four hypotheses on disliking relations were also included in the friendship network model. We did not have specific hypothesis on friendship and simply assumed that the processes related to friendship would be the "mirror image" of the processes related to disliking. We found that looking up to someone (first-degree status upward perception) increases the probability of creating a friendship tie (0.36***), whereas looking down on someone (first-degree status downward perception) decreases the probability of friendship relations (-0.38**). These two findings are in line with the predictions of the admiration (H1) and the disdain hypothesis (H2), if we assume that friendship can be considered the opposite of disliking. In the case of upward status inconsistency, however, we find that the opposite of what we might expect based on our hypotheses. That is, individuals who perceive that someone is popular in the eyes of others but do not look up to the same person are more likely to become friends with that person (0.11*). Thus, in the friendship network we observe a positive conformity effect rather than frustration as a response to this perceived inconsistency (H3). The effect of downward status inconsistency on friendship (-0.22*) (H4) indicates that also in this case conformity processes dominate decisions on the creation of network ties.

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In the friendship network, ego effects of aggregated status attributions are negative (-0.07***), which means that high status participants are less likely to nominate others as friends. However, we find a positive alter effect (0.05*), which indicates that high aggregated status participants are more likely to be nominated as friends. The effect of *aggregated status similarity* is positive but not significant.

Furthermore, whereas there was no gender difference in the disliking network, in the friendship network boys received more nominations than girls (*gender alter*=-0.20***). We also find strong evidence for same-gender students are more likely to become friends (*same gender*=0.34***). In line with other studies, this indicates strong gender homophily in the friendship network.

Taken together, we found that status perceptions affect the evolution of friendship networks. First-degree status perceptions explained both the formation of friendship ties (in the case of "looking up") and the avoidance of friendship ties (in the case of "looking down"). These findings are in line with the predictions of hypotheses 1 and 2 about disliking ties, if we assume that the processes that lead to friendship are the mirror image of the processes leading to disliking. Status inconsistency regarding lower status peers related to an avoidance of friendship ties, which is in line with the arguments leading to hypothesis 4. The assumed processes that lead to the *frustration hypothesis* (H3) seem to have different implications in the friendship network. Individuals who do not look up to someone but think that many others do so are in fact more likely to form and maintain friendship ties. In the case of status competition, friendship and disliking thus may be equivalent strategies to cope with inconsistencies. However, this finding deserves further elaboration in future studies.

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Table 4.8b: *Results for the SIENA meta-analysis (N=585): Friendship network*

	Est.		SE	σ		C
Friendship network						
(1) Rate (period 1)	11.69	***	1.12	3.74	***	14
(2) Rate (period 2)	10.15	***	0.75	2.07	***	14
(3) Density	-1.45	***	0.11	0.25	*	15
(4) Reciprocity	1.75	***	0.09	0.24	**	15
(5) Transitive triplets	0.24	***	0.02	0.06	***	15
(6) 3-cycles	-0.03		0.02	0.00		15
(7) Indegree popularity	0.01		0.01	0.03	*	15
(8) Outdegree popularity	-0.15	***	0.01	0.00		16
(9) Outdegree isolate	3.41		2.34	8.65	***	14
(10) Upward 1↑ (H1)	0.36	***	0.06	0.00		16
(11) Downward 1↓ (H2)	-0.38	**	0.14	0.00		15
(12) InconsistencyUp (H3)	0.11	*	0.05	0.07		16
(13) Inconsistencydown (H4)	-0.22	*	0.10	0.20	+	16
(14) Aggregated status ego	-0.07	***	0.02	0.00		16
(15) Aggregated status alter	0.05	*	0.02	0.06	*	16
(16) Aggregated status similarity	0.03		0.05	0.04		16
(17) SES ego	0.07		0.05	0.11	*	16
(18) SES alter	0.00		0.03	0.00		16
(19) SES similarity	0.07		0.06	0.14	+	16
(20) Gender ego	-0.04		0.07	0.20	**	16
(21) Gender alter	-0.20	***	0.05	0.06		16
(22) Same gender	0.34	***	0.04	0.00		16
(23) Disliking agreement on friendship	0.07	*	0.03	0.00		16

Note: + p <0.1; * p < 0.05; ** p<0.01; ***p<0.001

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4.6 Discussion

We analyzed the effect of status perceptions on the formation of disliking ties among adolescents from a longitudinal social network perspective. We used stochastic actor-based models to test our hypotheses. In the models we considered the simultaneous co-evolution of disliking and friendship ties, structural effects, status-related measures, as well as the impact of socio-economic background and gender.

Our study makes two central contributions to the literature on disliking. First, it has shown that dyadic status perceptions do matter in the evolution of disliking relations. Second, we demonstrated how disliking relations can be modeled in a larger peer context that takes into account friendship relations and status perceptions.

The first main contribution of our study is the differentiation between and the application of the concepts of first-degree and second-degree status perceptions. This differentiation followed earlier literature emphasizing the role of social preference and perceived popularity in determining peer relations and peer regard (Becker & Luthar, 2007; Fiske et al., 2007). Previous studies mainly focused on the role of status by aggregating peer (Dijkstra et al., 2007; Steglich et al., 2006). However, we differentiated between those who respondents "look up to" or "look down on" (defined as *first-degree* status upward and downward perceptions respectively), and those who they perceive as being "looked up to by others" or "looked down on by others" (defined as *second-degree* upward and downward status perceptions respectively).

We formulated four hypotheses. The first and the second related to first-degree status perceptions. The *admiration hypothesis* (H1) stated that individuals who look up to someone (first-degree upward status perception) were expected to be less likely to nominate this person as someone they dislike. . We did not find evidence for this effect in the disliking network. According to the *disdain* hypothesis (H2), individuals were expected to be more likely to develop a disliking tie toward a person who they look down on. We found clear evidence for this mechanism.

The third and the fourth hypotheses were linked to the interplay between first and second-degree status perceptions. The *frustration* hypothesis (H3) states that individuals were expected to develop disliking relations if they do not look up to someone, but think that many others do so. We argued that inconsistencies of such kind could be related to cognitive dissonance (Festinger, 1962), which might create frustration (Pastore, 1950). We found clear evidence for this mechanism. The support

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for the *frustration* hypothesis (H3) suggests that perceived peer attributed status that is not considered legitimate has a strong effect on nominating the person as disliked (Berger, Ridgeway, Fisek & Norman, 1998).

The *conformity* hypothesis (H4) states that individuals were expected to develop disliking relations if they do not look down on someone, but think that many others do so. The argument was based on a conformity mechanism, in which people accommodate to the norms and beliefs of the community they are members of (Cialdini & Goldstein, 2004; Cialdini & Trost, 1998). Our results supported the conformity hypothesis. This is not surprising as social conformity is often related to adolescence and youth culture. Moreover, the unwillingness to conform carries the risk of social rejection (Turner, 1991).

The second main contribution of our paper is demonstrating how disliking networks can be modeled as part of a larger peer context. We demonstrated that disliking ties co-evolve with friendship networks, and both networks are affected by status perceptions. For example, our results showed strong evidence that friends tend to dislike the same persons, and that those who dislike the same individuals will be more likely to be friends.

We further found that status perceptions also affect the evolution of friendship networks. First-degree status perceptions explained both the formation of friendship ties (in the case of "looking up") and the avoidance of friendship ties (in the case of "looking down"). These findings are in line with the predictions of hypotheses 1 and 2 about disliking ties. Status inconsistency regarding lower status peers related to an avoidance of friendship ties, which is in line with the arguments leading to hypothesis 4. The *frustration hypothesis* (H3) does have an equivalent mechanism in the friendship network. Individuals who do not look up to someone but think that many others do so are in fact more likely to form and maintain friendship ties. In the case of status competition, friendship and disliking may be equivalent strategies to cope with inconsistencies. However, this finding deserves further elaboration in future studies.

A further finding of our study is that, in line with earlier findings, disliking ties were scarce and mutual (Card, 2010; Labianca & Brass, 2006; Taylor, 1967). In addition, we also found that disliking ties become mutual and less clustered rather than decentralized in time. We also found that disliking ties may follow a scale-free distribution (Barabási & Albert, 1999) by having many students who have a few, and few students who have a large number of disliking nominations. Those who received

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more than one disliking nomination were more likely to be disliked by many at a later time. Moreover, some students nominate noone as disliked. This would indicate that earlier and later stages of social development could not show significant differences in disliking tie formations. We found support for the principle that "the enemies of my friends are my enemies" - in line with balance mechanisms. It is important to underline that while the participants were older than in other studies that analyzed disliking by stochastic actor-based models, our structural parameter estimates showed very similar patterns (Berger & Dijkstra, 2013; Huitsing et al., 2012). This might indicate that disliking networks and their evolution can be described by certain general mechanisms that commonly occur in both pre-adolescence and adolescence.

The results of our study are promising despite certain limitations. First, we use data from a geographically restricted Hungarian sample. Future research needs to validate our results in other cultures and age-groups to assess whether the observed processes generally apply. Second, we did not explore how disliking is affected by the personal attributes and psychological traits of peers, such as extraversion and narcissism. A future study should explore whether disliking is related to such personality attributes. Third, we did not differentiate between disliking and hate, mainly because of the scarcity of hate nominations. Hate is a stronger emotional relation that is more likely related to interpersonal history with negative behavioral experiences than disliking. Future longitudinal research should explore whether disliking is a typical predecessor of hate at all, and whether there are differences in the status determinants of disliking and hate ties. Fourth, we did not treat status perceptions as a co-evolving dependent variable, though the causality might be reversed: individuals might, for example, resolve inconsistencies about status perceptions by adapting their status perceptions rather than changing their disliking/friendship perceptions. In addition, given the small number of cases per class, a use of multilevel SABMs may improve the power of analysis.

Interpersonal relations in general are highly important in the social development of adolescents. In particular, understanding the negative effects of disliking ties is crucially important as they are related to severe individual outcomes such as satisfaction, internalizing problems, aggression, performance, and stress. Our study makes an important contribution to the research on the dynamics of disliking by incorporating dyadic status perceptions. In particular, our paper is the first study that demonstrates how inconsistencies between first-degree and second-degree status perceptions affect

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the formation of disliking relations. Our results suggest that dyadic status perceptions are important predictors of the emergence of disliking. At the same time, our study contributed to the understanding of disliking ties by jointly modeling the evolution of friendships and disliking networks, and also their relation to status perceptions. We are confident that our theoretical arguments as well as our novel modeling approach will contribute to the understanding of how status perceptions affect the emergence of disliking between adolescents.

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General Concluding Remarks and Discussion for Future Research

This thesis analyzed the interrelation between negative interpersonal relations and status positions among 14-16 years old secondary school students in Hungary. The dissertation used social network methods in order to understand the proposed question. Negative relations were defined as negative feelings, actions which occur from one person towards another. Status position was explained as the position that a define student had in the informal ranking among peers. Status was identified by peer perceptions on individuals' positions in the class. The analysis was completed among adolescents, because observing students' social relations with their peers in the school context could contribute to a better understanding of students' emotional and social well-being or acute school problems, such as segregation, social exclusion, cliques, and subgroup formation.

As the examination of negative relations did not receive sufficient focus previously, a network panel data was gathered to analyze them. The data of the Hungarian project "Wired into Each Other" was collected in secondary school classrooms, where network boundaries were relatively stable over time. The data covered all types of secondary schools and various locations form Hungary. In total, 1,622 students were involved in the analysis, and six forms of negative relations, disliking, hate, gossiping, mocking, humiliating, fighting were measured. Survey methods were used to identify status positions by asking students *who they look up to or look down*, and *who they perceive as looked up or looked down on by other peers."* Descriptive analysis, panel regression, Exponential Random Graph Models (ERGM) and Stochastic Actor Based Models (SABMs) were used to understand the interrelation between students' status positions and negative ties.

This thesis presented one theoretical and three empirical chapters. The first chapter described the research framework, the research questions, the data and the methodology used.

The second chapter examined how peer admiration and peer acceptance influenced the formation of self-proclaimed bullying and victimization networks. The chapter used cross-sectional network methods by analyzing the structure of bullying and victimization networks. The results suggested a marked association with large variation between peer admiration and peer acceptance. Moreover, estimations seemed stronger in the bullying than in the victimization networks. In both networks, there were students

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who were "black sheep" as they received a considerable number of nominations, and there were students who were "active" in sending a large amount of nominations. As hypothesized, individuals became victims when they were mainly unaccepted or disrespected by their peers. Students were more likely to bully those who were dissimilar in the admiration or in the acceptance status hierarchy. The results also demonstrated gender similarity in the bullying and victimization processes.

The third chapter examined the association between perceived status positions, indegree centrality for negative relations, being rejected and outdegree centrality for negative relations, being hostile by analyzing negative networks on the individual, student level, using panel regression. Being rejected was described as receiving negative, e.g. disliking nominations, from peers. The results for outdegree centrality for negative relations suggested who nominated others negatively, e.g. nominate others as disliked. We found evidence between the association of low status, rejection and hostility. We also found that those who were perceived as high status individuals were more likely to be nominated as disliked or to give nominations to their peers. The existence of controversial actors might explain these phenomena. These were individuals who were respected, but also disrespected by other peers. Furthermore, we found evidence that nominating others as disliked could occur because of dominance (when high status individuals nominated others as disliked), or dissatisfaction (when low status students disliked their peers).

The fourth chapter focused on how structural parameters and dyadic status perceptions influenced the evolution of disliking relations. This paper focused on understanding the structural network patterns of negative relations by introducing longitudinal network methods. The results demonstrated that disliking ties were more likely to be mutual; being disliked by one peer increased the probability to be disliked by more peers. Friendship also led to disliking, as disliking the same person resulted in friendships between individuals. We found evidence for the effect of inconsistencies in dyadic status perceptions: individuals looked down on their peers and conformed to others by disliking those who they perceived as being looked down on by their peers. The inconsistency between status perceptions also led to disliking, when individuals did not look up to those who they perceived to be admired by peers.

The first main contribution of the dissertation is that it gave a detailed overview on existing research on negative relations. It demonstrates how disliking relations could be modeled as part of a larger peer context, co-evolving with friendship networks, and

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being affected by dyadic, tie level status perceptions. The thesis general finding, in line with earlier findings, is that negative relations are present, but relatively scarce. The results demonstrat that friends tend to dislike the same persons, and that those who disliked the same individuals are likely to be friends. The dissertation also emphasizes that negative ties (both disliking and bullying networks) are scarce, mutual, less clustered, and decentralized. Those who receive more than one disliking nomination are more likely to be disliked by many other peers at a later time point. The second main contribution is that the differentiation between self-status attribution and the application of the concepts of first-degree (those respondents who are "looked up to" or "looked down on") and second-degree status perceptions (those respondents who are perceived as being "looked up to by others" or "looked down on by others"). The third main contribution of the research is that it introduces peer admiration as a status measure which is more likely to induce bullying relations than peer acceptance. The fourth is that it seemed that victims are less eager to admit being part of the bullying game than the bullies. Finally, as the dissertation used Hungarian data, it also provides important insights into the Hungarian secondary education system. It shows that there is a very high dropout rate, especially in vocational training schools. A high number of school leavers are also identified in smaller cities. These two components reflect high segregation among schools of various locations and types based on location and school type. Future research should concentrate more on identifying who these school leavers are.

The dissertation has promising results, but it has its limitations. The first one is that many classes are dropped from the analysis. This is explained by the high dropout rates of the sample and the scarcity of negative ties. The second one is that the present research focused on negative relations between individuals only, neglecting such relations between groups. Thirdly, future work should identify who the group leaders are, and how they influence the evolution of negative ties. Fourthly, it would be crucial to identify groups by analyzing the interrelation between positive and negative relations. Using cluster analysis might help to identify how the interrelation of these two types of ties contributes to small group formation. Finally research should concentrate on the effect of students' characteristics, such as their personality traits, and physical features. Finally, they should also focus on differentiating between verbal and physical forms of bullying.

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Besides its limitations, the results revealed aspects of negative ties that social network research can greatly benefit from. The survey and statistical methods presented in this dissertation could provide direct policy benefits not only for researchers, but also for policy makers, teachers and school psychologists. Hopefully, these insights will help them to tackle problems of adolescents' hidden feelings of hatred, conflicts, aggression and social exclusion in school classes. It might be worthwhile to map not only the positive, but also the negative peer structure. The results help them to identify who are the isolated persons and who are bullied. By taking into account the variously measured status positions of individuals identify who are the leaders of a group or who are at the bottom of the social ladder. The identification of student roles might help to avoid serious conflicts and help to build a stronger community. Recent examples from Finland, the Netherlands and the U.S. show that understanding disliking and bullying could be the basis of preventive anti-bullying programs against school aggression, violence and exclusion in Hungary. Furthermore, I believe that my theoretical and empirical results provide practical implications for small group research, for organizational studies, for the study of criminal groups, and for other related areas of social science research as well.

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Appendix

Chapter 1: Appendix

Table A. 1.1: *Distribution and percentage of survey response and non-response, by institutional training programme, type of settlement and schools*

			Wave 1			Wave 2			Wave 3		
			Completed	Survey-non response	Total data	Completed	Survey-non response	Total data	Completed	Survey-non response	Total data
School tpye	General grammar school	Count	462	25	487	458	25	483	453	16	469
		%	94.9	5.1	100.0	94.8	5.2	100.0	96.6	3.4	100.0
	Vocational secondary school	Count	343	46	389	328	46	374	274	42	316
		%	88.2	11.8	100.0	87.7	12.3	100.0	86.7	13.3	100.0
	Vocational training school	Count	418	129	547	360	160	520	288	81	369
		%	76.4	23.6	100.0	69.2	30.8	100.0	78.0	22.0	100.0
Type of settlement	County Capital - 70.000 inhabitants	Count	377	75	452	393	75	468	343	66	409
		%	83.4	16.6	100.0	84.0	16.0	100.0	83.9	16.1	100.0
	Town 1: 13.000 inhabitants	Count	212	33	245	195	53	248	166	22	188
		%	86.5	13.5	100.0	78.6	21.4	100.0	88.3	11.7	100.0
	Town 2: 13.000 inhabitants	Count	275	26	301	245	50	295	230	14	244
		%	91.4	8.6	100.0	83.1	16.9	100.0	94.3	5.7	100.0
	Capital	Count	331	64	395	313	53	366	276	37	313
		%	83.8	16.2	100.0	85.5	14.5	100.0	88.2	11.8	100.0

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			Wave 1			Wave 2			Wave 3		
			Completed	Survey-non response	Total data	Completed	Survey-non response	Total data	Completed	Survey-non response	Total data
School	School 1	Count	155	11	166	152	9	161	161	3	164
		%	93.4	6.6	100.0	94.4	5.6	100.0	98.2	1.8	100.0
	School 2	Count	250	64	314	241	66	307	182	63	245
		%	79.6	20.4	100.0	78.5	21.5	100.0	74.3	25.7	100.0
	School 3	Count	212	33	245	195	53	248	166	22	188
		%	86.5	13.5	100.0	78.6	21.4	100.0	88.3	11.7	100.0
	School 4	Count	124	0	124	122	1	123	105	1	106
		%	100.0	0.0	100.0	99.2	0.8	100.0	99.1	0.9	100.0
	School 5	Count	151	28	179	123	49	172	125	13	138
		%	84.4	15.6	100.0	71.5	28.5	100.0	90.6	9.4	100.0
	School 6	Count	124	12	136	130	6	136	122	11	133
		%	91.2	8.8	100.0	95.6	4.4	100.0	91.7	8.3	100.0
	School 7	Count	207	52	259	183	47	230	154	26	180
		%	79.9	20.1	100.0	79.6	20.4	100.0	85.6	14.4	100.0

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Table A. 1.2: *Distribution and percentage of survey response and non-response, by classes*

		Wave 1						Wave 2						Wave 3						
		Survey non-response		Completed		Total		Survey non-response		Completed		Total		Survey non-response		Completed		Total		
School	Class	Count	Within class (%)	Count	Within class (%)	Count	Within total (%)	Count	Within class (%)	Count	Within class (%)	Count	Within total (%)	Count	Within class (%)	Count	Within class (%)	Count	Within total (%)	Within class (%)
School 1	1	2	6.3	30	93.8	32	2.2	0	.0	31	100.0	31	2.3	2	6.5	29	93.5	31	2.7	100.0
School 1	2	0	0.0	34	100.0	34	2.4	3	8.8	31	91.2	34	2.5	1	2.8	35	97.2	36	3.1	100.0
School 1	3	0	0.0	36	100.0	36	2.5	0	.0	35	100.0	35	2.5	0	.0	34	100.0	34	2.9	100.0
School 1	4	8	22.9	27	77.1	35	2.5	6	18.2	27	81.8	33	2.4	0	.0	33	100.0	33	2.9	100.0
School 1	5	1	3.4	28	96.6	29	2.0	0	.0	28	100.0	28	2.0	0	.0	30	100.0	30	2.6	100.0
School 2	6	6	20.7	23	79.3	29	2.0	8	29.6	19	70.4	27	2.0	0	.0	15	100.0	15	1.3	100.0
School 2	7	5	18.5	22	81.5	27	1.9	1	4.0	24	96.0	25	1.8	4	14.8	23	85.2	27	2.3	100.0
School 2	8	2	6.5	29	93.5	31	2.2	2	7.7	24	92.3	26	1.9	12	48.0	13	52.0	25	2.2	100.0
School 2	9	10	33.3	20	66.7	30	2.1	6	21.4	22	78.6	28	2.0	6	26.1	17	73.9	23	2.0	100.0
School 2	10	1	3.4	28	96.6	29	2.0	2	6.5	29	93.5	31	2.3	2	7.7	24	92.3	26	2.3	100.0
School 2	11	8	22.9	27	77.1	35	2.5	11	30.6	25	69.4	36	2.6	7	30.4	16	69.6	23	2.0	100.0
School 2	12	12	34.3	23	65.7	35	2.5	10	29.4	24	70.6	34	2.5	8	29.6	19	70.4	27	2.3	100.0
School 2	13	14	40.0	21	60.0	35	2.5	13	37.1	22	62.9	35	2.5	8	30.8	18	69.2	26	2.3	100.0
School 2	14	3	9.4	29	90.6	32	2.2	3	10.0	27	90.0	30	2.2	6	22.2	21	77.8	27	2.3	100.0
School 2	15	3	9.7	28	90.3	31	2.2	10	28.6	25	71.4	35	2.5	10	38.5	16	61.5	26	2.3	100.0
School 3	16	1	3.4	28	96.6	29	2.0	0	.0	29	100.0	29	2.1	1	3.6	27	96.4	28	2.4	100.0
School 3	17	0	0.0	34	100.0	34	2.4	3	8.6	32	91.4	35	2.5	0	.0	32	100.0	32	2.8	100.0
School 3	18	5	13.5	32	86.5	37	2.6	1	2.8	35	97.2	36	2.6	5	16.1	26	83.9	31	2.7	100.0
School 3	19	1	2.8	35	97.2	36	2.5	6	16.7	30	83.3	36	2.6	0	.0	32	100.0	32	2.8	100.0
School 3	20	10	27.0	27	73.0	37	2.6	16	42.1	22	57.9	38	2.8							
School 3	21	9	25.7	26	74.3	35	2.5	13	37.1	22	62.9	35	2.5	3	11.1	24	88.9	27	2.3	100.0
School 3	22	7	18.9	30	81.1	37	2.6	14	35.9	25	64.1	39	2.8	13	34.2	25	65.8	38	3.3	100.0
School 4	23	0	0.0	17	100.0	17	1.2	1	5.9	16	94.1	17	1.2	0	.0	16	100.0	16	1.4	100.0
School 4	24	0	0.0	35	100.0	35	2.5	0	.0	36	100.0	36	2.6	0	.0	35	100.0	35	3.0	100.0
School 4	25	0	0.0	34	100.0	34	2.4	0	.0	33	100.0	33	2.4	1	3.4	28	96.6	29	2.5	100.0
School 4	26	0	0.0	38	100.0	38	2.7	0	.0	37	100.0	37	2.7	0	.0	26	100.0	26	2.3	100.0

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		Wave 1						Wave 2						Wave 3						
		Survey non-response		Completed		Total		Survey non-response		Completed		Total		Survey non-response		Completed		Total		
School	Class	Count	Within class (%)	Count	Within class (%)	Count	Within total (%)	Count	Within class (%)	Count	Within class (%)	Count	Within total (%)	Count	Within class (%)	Count	Within class (%)	Count	Within total (%)	Within class (%)
School 5	27	6	18.2	27	81.8	33	2.3	8	23.5	26	76.5	34	2.5	4	12.9	27	87.1	31	2.7	100.0
School 5	28	3	11.5	23	88.5	26	1.8	6	25.0	18	75.0	24	1.7							
School 5	29	9	47.4	10	52.6	19	1.3	18	100.0	0	.0	18	1.3	3	18.8	13	81.3	16	1.4	100.0
School 5	30	4	11.4	31	88.6	35	2.5	6	15.8	32	84.2	38	2.8	2	5.6	34	94.4	36	3.1	100.0
School 5	31	3	8.6	32	91.4	35	2.5	7	20.0	28	80.0	35	2.5	0	.0	34	100.0	34	2.9	100.0
School 5	32	3	9.7	28	90.3	31	2.2	4	17.4	19	82.6	23	1.7	4	19.0	17	81.0	21	1.8	100.0
School 6	33	2	6.1	31	93.9	33	2.3	1	3.0	32	97.0	33	2.4	0	.0	32	100.0	32	2.8	100.0
School 6	34	0	0.0	34	100.0	34	2.4	0	.0	34	100.0	34	2.5	5	13.9	31	86.1	36	3.1	100.0
School 6	35	9	27.3	24	72.7	33	2.3	5	15.2	28	84.8	33	2.4	5	15.2	28	84.8	33	2.9	100.0
School 6	36	1	2.8	35	97.2	36	2.5	0	.0	36	100.0	36	2.6	1	3.1	31	96.9	32	2.8	100.0
School 7	37	0	0.0	32	100.0	32	2.2	5	16.7	25	83.3	30	2.2	0	.0	26	100.0	26	2.3	100.0
School 7	38	10	32.3	21	67.7	31	2.2	6	21.4	22	78.6	28	2.0							
School 7	39	1	3.2	30	96.8	31	2.2	4	13.8	25	86.2	29	2.1	3	10.7	25	89.3	28	2.4	100.0
School 7	40	5	15.2	28	84.8	33	2.3	6	19.4	25	80.6	31	2.3	8	23.5	26	76.5	34	2.9	100.0
School 7	41	12	36.4	21	63.6	33	2.3	9	34.6	17	65.4	26	1.9	2	9.1	20	90.9	22	1.9	100.0
School 7	42	9	27.3	24	72.7	33	2.3	7	24.1	22	75.9	29	2.1	4	16.0	21	84.0	25	2.2	100.0
School 7	43	7	22.6	24	77.4	31	2.2	7	25.0	21	75.0	28	2.0	3	12.0	22	88.0	25	2.2	100.0
School 7	44	8	22.9	27	77.1	35	2.5	3	10.3	26	89.7	29	2.1	6	30.0	14	70.0	20	1.7	100.0
Total		200	14.1	1 223	85.9	1 423	100.0	231	16.8	1 146	83.2	1377	100.0	139	12.0	1015	88.0	1 154	100.0	100.0

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Chapter 2: Appendix

Table A. 2.1: *Descriptive statistics of the self-proclaimed bullying network, by class*

				Indegree					Outdegree				
Class ID	Number of actors	Density	Reciprocity	Mean	SD	Sum	Min.	Max.	Mean	SD	Sum	Min.	Max.
1	31	0.07	8	2.1	2.3	66	0.0	7.0	2.1	2.5	66	0.0	10.0
2	34	0.02	0	0.5	0.9	18	0.0	4.0	0.5	1.2	18	0.0	5.0
3	35	0.02	1	0.8	1.0	28	0.0	3.0	0.8	1.7	28	0.0	6.0
4	33	0.03	0	1.0	1.2	33	0.0	5.0	1.0	1.9	33	0.0	8.0
5	28	0.05	5	1.4	1.6	38	0.0	6.0	1.4	1.3	38	0.0	3.0
6	25	0.06	0	1.4	1.8	35	0.0	7.0	1.4	2.0	35	0.0	8.0
7	26	0.09	8	2.2	1.6	57	0.0	6.0	2.2	2.0	57	0.0	9.0
8	27	0.10	6	2.6	1.8	69	0.0	6.0	2.6	3.6	69	0.0	14.0
9	31	0.05	3	1.4	1.6	43	0.0	7.0	1.4	2.4	43	0.0	12.0
14	30	0.04	4	1.2	1.2	35	0.0	5.0	1.2	1.7	35	0.0	7.0
16	29	0.04	3	1.2	1.2	34	0.0	4.0	1.2	1.5	34	0.0	4.0
17	35	0.02	1	0.8	1.1	27	0.0	4.0	0.8	1.4	27	0.0	5.0
19	36	0.07	5	2.3	2.0	82	0.0	7.0	2.3	2.5	82	0.0	9.0
23	17	0.10	4	1.5	1.4	26	0.0	5.0	1.5	1.9	26	0.0	7.0
24	33	0.05	4	1.6	1.7	54	0.0	8.0	1.6	2.2	54	0.0	8.0
25	37	0.08	15	3.1	4.0	113	0.0	16.0	3.1	3.5	113	0.0	16.0
28	22	0.10	4	2.1	1.9	46	0.0	9.0	2.1	3.0	46	0.0	10.0
30	36	0.04	2	1.3	1.2	46	0.0	4.0	1.3	2.6	46	0.0	13.0
31	35	0.06	2	1.9	1.5	66	0.0	7.0	1.9	4.8	66	0.0	26.0
32	23	0.07	1	1.5	1.8	34	0.0	7.0	1.5	3.0	34	0.0	13.0
33	33	0.12	14	3.9	3.1	129	1.0	12.0	3.9	6.0	129	0.0	32.0
34	34	0.03	0	0.9	1.1	31	0.0	4.0	0.9	1.6	31	0.0	6.0
35	33	0.04	2	1.3	1.0	42	0.0	3.0	1.3	2.9	42	0.0	12.0
36	36	0.07	6	2.5	2.6	91	0.0	10.0	2.5	3.4	91	0.0	14.0
37	29	0.05	1	1.3	1.2	39	0.0	5.0	1.3	2.5	39	0.0	9.0
39	29	0.06	2	1.6	1.7	46	0.0	7.0	1.6	3.3	46	0.0	16.0
41	30	0.04	2	1.1	1.8	33	0.0	9.0	1.1	1.7	33	0.0	7.0
42	27	0.04	0	1.1	1.6	30	0.0	7.0	1.1	1.6	30	0.0	6.0
43	29	0.09	8	2.5	2.4	72	0.0	10.0	2.5	3.4	72	0.0	14.0

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Table A. 2.2: *Descriptive statistics of the self-proclaimed victimization network, by class*

				Indegree					Outdegree				
Class ID	Number of actors	Density	Reciprocity	Mean	SD	Sum	Min.	Max.	Mean	SD	Sum	Min.	Max
1	31	0.05	5	1.6	2.1	49	0.0	8.0	1.6	1.8	49	0.0	6.0
2	34	0.01	0	0.2	0.5	8	0.0	2.0	0.2	0.9	8	0.0	5.0
3	35	0.01	0	0.4	0.7	15	0.0	3.0	0.4	0.9	15	0.0	4.0
4	33	0.02	0	0.7	0.8	22	0.0	3.0	0.7	1.5	22	0.0	7.0
5	28	0.02	0	0.6	1.0	18	0.0	4.0	0.6	1.2	18	0.0	5.0
6	25	0.05	2	1.2	1.4	31	0.0	5.0	1.2	2.5	31	0.0	12.0
7	26	0.05	4	1.3	1.5	33	0.0	5.0	1.3	2.1	33	0.0	9.0
8	27	0.04	0	1.0	1.7	28	0.0	8.0	1.0	1.6	28	0.0	5.0
9	31	0.02	2	0.7	0.9	21	0.0	3.0	0.7	1.2	21	0.0	5.0
14	30	0.04	3	1.0	1.1	31	0.0	3.0	1.0	1.8	31	0.0	6.0
16	29	0.05	1	1.3	1.0	37	0.0	3.0	1.3	2.8	37	0.0	11.0
17	35	0.03	0	1.0	1.2	35	0.0	4.0	1.0	2.3	35	0.0	12.0
19	36	0.04	4	1.3	1.6	46	0.0	7.0	1.3	1.8	46	0.0	7.0
23	17	0.15	6	2.4	2.3	41	0.0	7.0	2.4	2.3	41	0.0	7.0
24	33	0.04	5	1.2	1.5	38	0.0	6.0	1.2	1.7	38	0.0	6.0
25	37	0.05	9	1.7	2.3	64	0.0	9.0	1.7	2.4	64	0.0	11.0
28	22	0.05	0	1.0	0.9	23	0.0	3.0	1.0	2.5	23	0.0	11.0
30	36	0.02	0	0.9	0.8	31	0.0	3.0	0.9	2.2	31	0.0	10.0
31	35	0.03	3	1.1	1.1	38	0.0	4.0	1.1	2.2	38	0.0	9.0
32	23	0.03	1	0.7	0.8	16	0.0	2.0	0.7	1.9	16	0.0	9.0
33	33	0.06	4	1.8	2.0	60	0.0	8.0	1.8	3.8	60	0.0	20.0
34	34	0.02	1	0.7	0.8	23	0.0	3.0	0.7	1.3	23	0.0	5.0
35	33	0.02	1	0.6	0.7	21	0.0	2.0	0.6	1.5	21	0.0	7.0
36	36	0.05	5	1.7	2.0	62	0.0	7.0	1.7	1.8	62	0.0	7.0
37	29	0.03	0	1.0	1.3	28	0.0	5.0	1.0	1.6	28	0.0	7.0
39	29	0.03	3	0.8	0.9	23	0.0	3.0	0.8	1.7	23	0.0	6.0
41	30	0.03	1	0.9	1.2	28	0.0	4.0	0.9	1.6	28	0.0	7.0
42	27	0.04	2	1.0	1.5	28	0.0	6.0	1.0	1.8	28	0.0	6.0
43	29	0.07	4	1.9	1.8	54	0.0	7.0	1.9	2.7	54	0.0	11.0

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Table A. 2.3: *Descriptive statistics of networks used as attributes in the analysis*

	Name	Mean	SD	Min.	Max.	Sum
Positive Network						
	Indegree (P)	14.56	5.97	0	32	12 857
	Outdegree (P)	14.56	7.92	0	35	12 857
	Density (P)	0.48	0.08	0.35	0.62	
	Reciprocity (P)	0.65	0.08	0.49	0.81	
	Clustering (P)	0.74	0.06	0.6	0.82	
	Indegree centralization (P)	0.29	0.06	0.17	0.42	
Negative Network						
	Indegree (N)	2.99	3.3	0	22	2 636
	Outdegree (N)	2.99	3.29	0	20	2 636
	Density (N)	0.1	0.05	0.03	0.21	
	ReciNrocity (N)	0.22	0.11	0	0.43	
	Clustering (N)	0.2	0.11	0	0.46	
	Indegree centralization (N)	0.3	0.11	0.15	0.54	
Look up Network						
	Indegree (LU)	1.54	1.77	0	16	1 357
	Outdegree (LU)	1.54	3.26	0	34	1 357
	Density (LU)	0.05	0.02	0.01	0.14	
	Reciprocity (LU)	0.14	0.09	0	0.31	
	Clustering (LU)	0.24	0.1	0.13	0.6	
	Indegree centralization (LU)	0.00	0.98	-3.71	3.56	
Look down Network						
	Indegree (LD)	1.4	1.85	0	16	1 233
	Outdegree (LD)	1.4	2.92	0	24	1 233
	Density (LD)	0.05	0.03	0	0.13	
	Reciprocity (LD)	0.08	0.11	0	0.38	
	Clustering (LD)	0.13	0.08	0	0.34	

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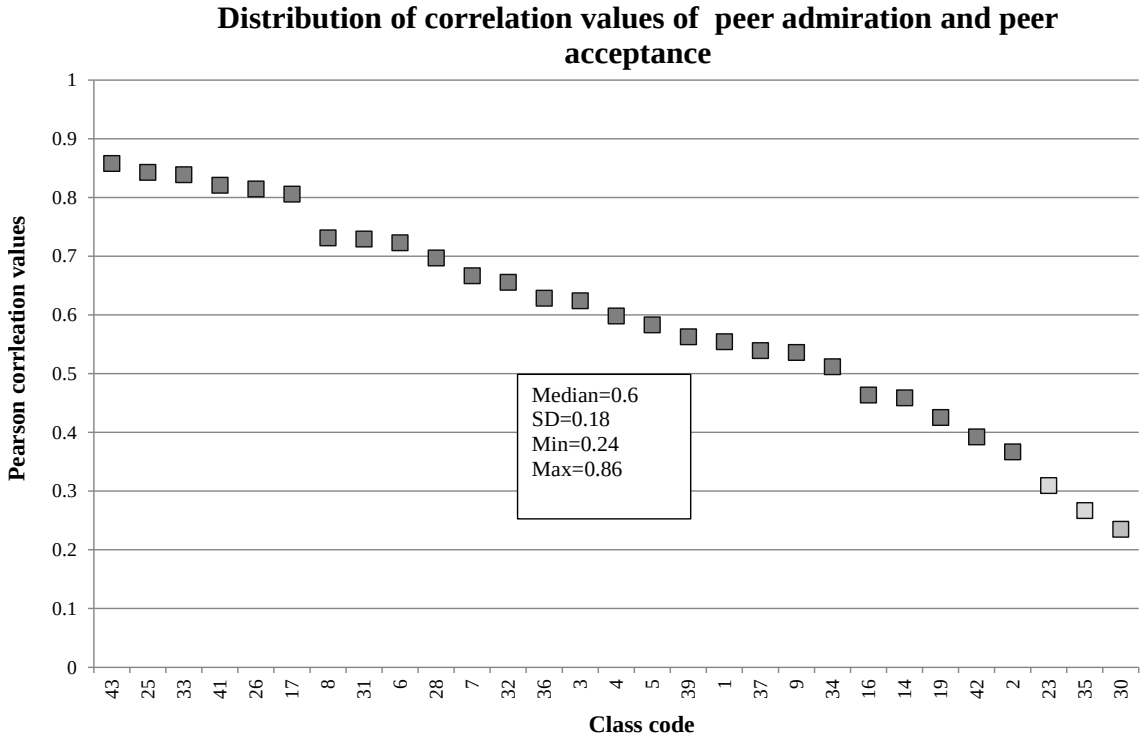
Figure A. 2.1. *Distribution of Pearson correlation values between peer admiration and peer acceptance*



Note: Lighter grey colors show insignificant correlation results. Results are descending order by the correlation value.

Figure A. shows the Pearson correlations of the main independent variables that are related to the hypotheses formulated in the theory section. The distribution of correlation values show that the association between the perceived status and peer acceptance varies a lot between classes (*Min.*=0.24, while *Max.*=0.86), however the median value is relatively high (0.6), with large variation (*SD*=0.18). The results indicate that the proposed hypothesis could be tested in the sample, but in some classes we could predict the same direction of the result.

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Chapter 3: Appendix

Table A. 3.1a: *Additional descriptive statistics, , by the starting sample*

Name	Number of students	Observation	Mean	Median	SD	Min.	Max.
Starting sample							
Dependent variables							
Indegree centrality for negative relations (being rejected)	1,771	3,724	0.24	0.22	0.18	0.00	1.00
Indegree centrality for positive relations (being accepted)	1,771	3,724	0.61	0.63	0.18	0.00	1.00
Outdegree centrality for negative relations (being hostile)	1,771	3,724	0.24	0.1	0.33	0.00	1.00
Outdegree centrality for positive relations (being kind)	1,771	3,724	0.61	0.58	0.26	0.00	1.00
Independent variables	1,771						
First-degree upward status position (being respected)	1,771	3,724	0.25	0.23	0.16	0.00	1.00
First-degree downward status position (being disrespected)	1,771	3,724	0.18	0.16	0.13	0.00	1.00
Second-degree upward status position (being respected by others)	1,771	3,724	0.2	0.18	0.15	0.00	1.00
Second-degree downward status position (being disrespected by others)	1,771	3,724	0.18	0.15	0.14	0.00	1.00
Control variables							
Gender	1,771	5,298	59%	2		1	2
Roma	1,771	4,212	28%	0	1	0	1
SES	1,771	4,101	-0.09	-0.17	0.99	-2.32	1.77
Age	1,771	3,261	15.99	15.83	0.89	14.25	22.08
Left the sample	1,771	5,313	9%	0	0.28	0	1

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Table A. 3.1b: *Additional descriptive statistics, by the joint sample, without the control variables*

Name	Number of students	Observation	Mean	Median	SD	Min.	Max.
Joint sample without controls							
Dependent variables							
Indegree centrality for negative relations (being rejected)	1,568	3,724	0.24	0.22	0.18	0.00	1.00
Indegree centrality for positive relations (being accepted)	1,5681	3,724	0.61	0.63	0.18	0.00	1.00
Outdegree centrality for negative relations (being hostile)	1,568	3,724	0.24	0.1	0.33	0.00	1.00
Outdegree centrality for positive relations (being kind)	1,568	3,724	0.61	0.58	0.26	0.00	1.00
Independent variables							
First-degree upward status position (being respected)	1,568	3,724	0.25	0.23	0.16	0.00	1.00
First-degree downward status position (being disrespected)	1,568	3,724	0.18	0.16	0.13	0.00	1.00
Second-degree upward status position (being respected by others)	1,568	3,724	0.2	0.18	0.15	0.00	1.00
Second-degree downward status position (being disrespected by others)	1,568	3,724	0.18	0.15	0.14	0.00	1.00

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Table A. 3.2: *Correlation values of all variables between students, using between variations through all three waves*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Indegree negative centrality degree	-							
(2) Indegree positive centrality degree	0.13*	-						
(3) Outdegree negative centrality degree	0.27*	0.02*	-					
(4) Outdegree positive centrality degree	0.14*	0.16*	-0.52*	-				
(5) First-degree upward status position	0.55*	0.45*	0.35*	0.58*	-			
(6) First-degree downward status position	0.71*	0.24*	-0.05*	0.13*	0.11*	-		
(7) Second-degree upward status position	0.21*	0.39*	-0.11*	0.17*	0.09*	0.50*	-	
(8) Second-degree downward status position	0.63*	0.16*	0.10*	0.02*	0.10*	0.85*	0.23*	-

Notes: Between variations, which come from differences across students, where each student outcome is measured as a single value, show the average outcome over time. Correlations are calculated between students, across variables combining all three waves, all classes and students in the analysis. Correlations with * were significant at least with $p < 0.05$. The total number of students is 1,281, and the total number of observations is 2,973.

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Appendix Table A. 3.3 and Figures A. 3.1a and 3.1b

In the following table and figures, we show correlation values between perceived status positions and indicators, which capture "status" by the possible roles a student could have in the class (17 in total). These status indicators were measured by sociometric methods. We calculated the normalized Freeman indegree centrality for each status indicator by students, and then their average value through all three waves. Then, we calculated the average correlation values between students, using within and between variations. Table A. 3.2 shows the description of these 17 status roles: their abbreviation used in Figure A. 3.1a and Figure A. 3.1b.

Table A. 3.3: *Description of the various sociometric status measures*

Abbreviation	Question	Dimension of status
Clever	Clever	Attribution
Charitable	Charitable	Attribution
Confront others	He/she dares to confront the headmaster.	Leadership
Knows what to do after school	He/she tells others what to do after school	Leadership
Funny	Funny	Attribution
Roma	He/she is Roma	Attribution
Gossipy	Gossipy	Attribution
Helps others	If I need help, I could ask for his/her help	Attribution
Makes Justice	He/she is able to make justice	Leadership
Has money	He/she has money	Attribution
Organizer	He/she would be a good organizer of the class trip.	Ability
Teacher's pet	Teacher's pet	Attribution
Pretty	Pretty/handsome	Attribution
Protects the weak	He/she protects the weak	Leadership
Quarrelsome	Quarrelsome, he/she is into fights	Attribution
Keeps secret	If I had a secret, I would tell it to him/her	Attribution
Stuck-up	Stuck-up	Attribution

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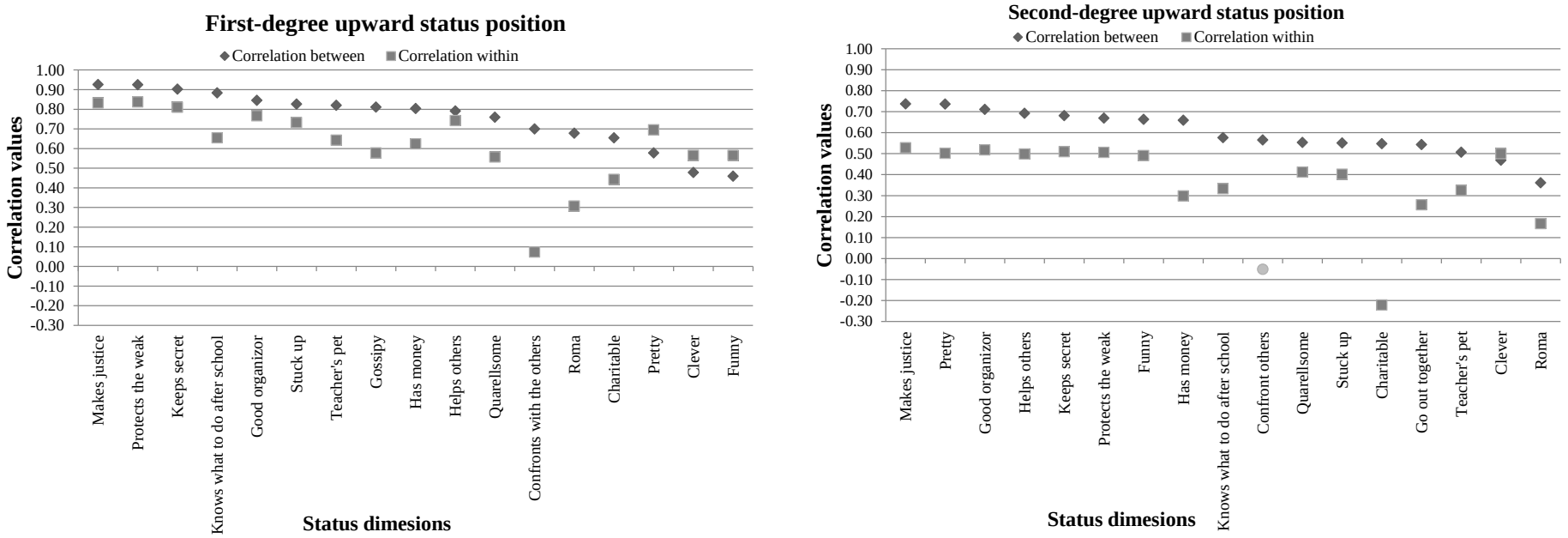
Figure A. 3.1a: *Association between sociometric status indicators and perceived status positions, through all three waves, between students*



Notes: Lighter grey and circle indicate that the correlation measures are not statistically significant. Within variation comes from the changes over time, within the same students. It is the opposite of between variations, which come from the differences across students. Correlations with * were significant at least with $p < 0.05$.

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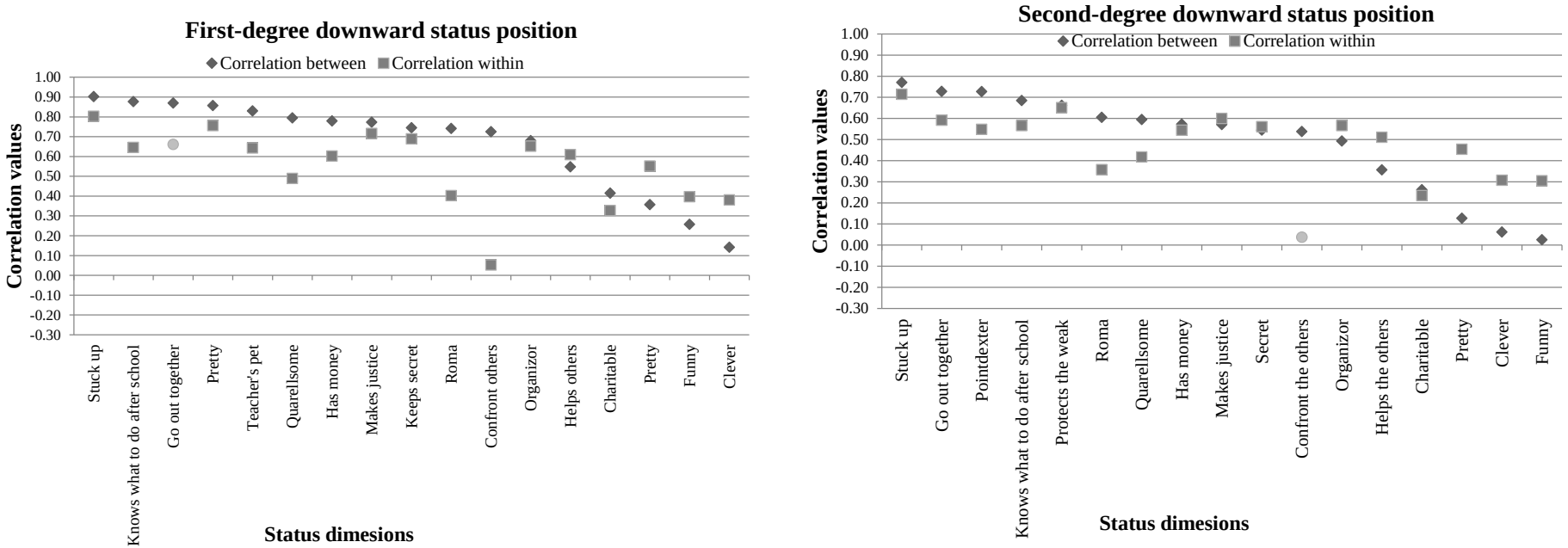
Figure A. 3.1b: *Association between sociometric status indicators and perceived status positions, through all three waves, between students*



Notes: Lighter grey and circle indicate that the correlation measures are not statistically significant. Within variation comes from the changes over time, within the same students. It is the opposite of between variations, which come from the differences across students. Correlations with * were significant at least with $p < 0.05$.

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Appendix: Additional estimations using PN centrality

Table A. 3.4 and Table A. 3.5

For robustness check, we also compared the results for the negative indegree, when the student is rejected being rejected, and outdegree centrality for negative relations, when the student is hostile, with the mixture of positive and negative nominations. We did this in order to check whether we find evidence for the controversial actor mechanism. For this purpose, we used a new centrality measure, the PN centrality measures introduced by Everett and Borgatti (2014). As for the positive indegree and outdegree centrality, we did not have specific hypotheses for the expectations regarding the estimates on the PN centrality measure. We included this measure, because we wanted to check what was happening when the positive and the negative networks were merged.

The PN centrality combines positive and negative measures in order to rank actors more precisely in a community (Everett & Borgatti, 2014). The theoretical assumption behind this measure is that it uses simultaneously both negative and positive networks, by giving an absolute value for each actor regarding its position in relation to actors who have many positive or many negative ties. This PN measure is similar to the Bonacich power measure and the Hubbell centrality (Everett & Borgatti, 2014)., which both takes into account that having positive ties to well-connected others contributes positively to a node's centrality measures. In brief, PN centrality counts the total mixed connections n, and each connection is given a weight, according to its length.

The interpretation of PN centrality is that with respect to the negative ties, it is better to be disliked by individuals who have low outdegree scores than by those who have high outdegree scores. Likewise, it is better to dislike people who have low indegree scores than people who have high indegree scores. (Everett & Borgatti, 2014). Similarly, for the positive ties, it is better to be liked by important people (e.g. those nominating many others), and it is better to like influential people (e.g. those chosen by many others) (Everett & Borgatti, 2014).

Everett and Borgatti (2014) also note that other combinations may be desirable, for example it may be better to be liked by individuals that nominate very few others, or to like individuals that are not as important (exclusive relationships) (Everett & Borgatti, 2014).[39]

[39] Negative scores occur when groups of positively connected actors all have negative connections to a minority of other actors. The most extreme example would be if every actor in the network had a negative connection to one actor and positive connections to every other actor. In this case the actor with all the negative ties would have a PN centrality score of −1 and all the other actors would have the maximum score of 2. Negative scores are apparently only possible when a majority of positively connected actors all dislike a small minority of other actors (Everett & Borgatti, 2014). More information on this can be found in the study of Everett and Borgatti (2014).

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The values of PN vary between -1 and 2. Table A. 3.4 shows the formula of the PN centrality degree measures.

Table A. 3.4: *Formula of the PN centrality degree measures (by Everett and Borgatti, 2014)*

Formula	Equation	Conceptualization
PN Indegree centrality	$PN_{out} = \left(I - \frac{1}{4(n-1)^2} AA^T\right)^{-1} \left(I + \frac{1}{2(n-1)} A\right) 1$	Normalized value of receiving positive and negative indegree nominations
PN Outdegree centrality	$PN_{in} = \left(I - \frac{1}{4(n-1)^2} A^T A\right)^{-1} \left(I + \frac{1}{2(n-1)} A^T\right) 1$	Normalized value of giving positive and negative indegree nominations

Descriptive results for the PN centrality measures

In order to create the PN centrality measures, we merged the values -1 and -2 of the scale to create social networks of negative ties coded as -1, while to create positive networks, we used the +1 and +2 values of the scale coded as +1. We then created binary matrices for all three waves where 1 indicated when a tie existed (negative or positive), and 0 if not. Missing values were treated as 0. We merged these measures in order to maximize the number of nominations in the negative network, and for robustness check in the positive network as well. Table A. 3.5 shows the mean value is 1.24 (*SD*=0.21), indicating that few actors have a negative value, but there are actors whose PN indegree centrality is low because of their connection to negative actors.

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Table A. 3.5: *Descriptive statistics of the PN indegree and outdegree centrality*

Name	Mean	Median	SD	Min.	Max.	Stability over the three waves	
PN centrality values in the joint sample with control variables							
PN-indegree	1.24	1.26	0.21	0.35	1.82	0.69	***
PN centrality-outdegree	1.25	1.25	0.24	-0.22	1.84	0.53	***
PN centrality values in the full sample							
PN-indegree	1.22	1.23	0.22	0.25	1.82		
PN centrality-outdegree	1.21	1.21	0.24	-0.22	1.84		

Notes: Correlations with * were significant at least with $p < 0.05$. The total number of students in the joint sample is 1,281, and the total number of observations is 2,973. The total number of students in the whole sample is 1,558, and the total number of observations is 3,724.

The correlation values between PN indegree centrality measures show a strong positive association with the indegree centrality for positive relations (0.71), and a strong negative correlation with the indegree centrality for negative relations (-0.73). The PN outdegree centrality has a weak correlation with the outdegree centrality for positive relations (0.30), and a strong negative correlation with the outdegree centrality for negative relations (-0.62). This mixed centrality measure shows that the positive ties have a stronger effect on one person's centrality than the negative ties in our sample. Table A. 3.6 shows this result.

Table A. 3.6: *Correlation values of the PN centrality and the main dependent variables, using between variations through all three waves*

	Indegree centrality for negative relations (being rejected)	Indegree centrality for positive relations (being popular)	Outdegree centrality for negative relations (being hostile)	Outdegree centrality for positive relations (being kind)
PN – indegree	-0.73*	0.71*	-0.15*	0.10*
PN centrality-outdegree	-0.48*	0.26*	-0.62*	0.30*

Notes: Correlations with * were significant at least with $p < .05$. The total number of students is 1,281, and the total number of observations is 2,973.

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Regression results for the PN centrality

Table 3.7 shows the regression results for the PN indegree and outdegree measures. For the PN indegree centrality, we find a similar direction for the estimates as for the indegree centrality for positive relations. Yet, the estimates support that the association is consistent for the first-and second-degree upward and downward, and the second-degree downward status positions Furthermore, the positive estimates for the second-degree upward status positions also support the controversy mechanism in the indegree centrality for negative relations.

For the PN outdegree, we find more robust results than in the outdegree centrality for positive relations, indicating the role of the second-degree status upward measure in nominating others negatively and positively as well.

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Table A. 3.7: *Regression results, PN indegree and outdegree centrality measure*

	PN indegree centrality						*PN outdegree centrality*					
	Model 1			Model 2			Model 1			Model 2		
	Est.		SE	Est.		SE	Est.		SE	Est.		SE
First-degree status upward position (H1a; H3a)	0.73	***	0.05	0.56	***	0.05	0.24	***	0.06	0.10		0.07
Second-degree status upward position (H2; H3b)	0.16	***	0.03	0.25	***	0.03	0.00		0.03	0.12	***	0.04
First-degree status downward position (H1b; H4a)	-0.63	***	0.06	-0.65	***	0.05	-0.15	*	0.09	-0.20	**	0.08
Second-degree status downward position (H1c; H4b)	-0.74	***	0.04	-0.42	***	0.04	-0.21	***	0.06	-0.18	***	0.06
Gender, female=1	-0.01		0.01				0.00		0.01			
Roma, dummy=1	-0.01		0.01				0.03	**	0.01			
SES	-0.01		0.00				-0.01		0.01			
Age	-0.01		0.00				-0.03	**	0.01	-0.04	***	0.01
Wave 2	-0.02	**	0.01	-0.03	***	0.01	-		-	-0.03	***	0.01
Wave 3				-0.03	***	0.01	-					
Class fixed effects	yes			no			yes			no		
Student fixed effects	no			yes			no			yes		
R-squared	0.61			0.85			0.27			0.73		
Number of students	1,281			1,567			1,281			1,567		
Number of observations	2,973			3,724			2,973			3,724		

Notes: * p <0.1; ** p < 0.05; *** p<0.01. The regression model estimates are non-lagged models. The reason for these very small coefficients is that these variables vary on a larger range than the dependent variable

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Chapter 4: Appendix

Table A. 4.1: *Descriptive statistics of disliking, hate and second-degree status down measures*

	Mean	SD	Min.	Max.
-1 Dislike Network				
Indegree w1 (Do)	1.48	1.98	0	12
Indegree w2 (Do)	1.76	2.16	0	16
Indegree w1-w2 (Do)	1.62	2.07	0	16
Density (Do)	0.05	0.02	0	0.09
Reciprocity (Do)	0.09	0.07	0	0.25
Clustering (Do)	0.12	0.07	0	0.26
Indegree centralization (Do)	0.19	0.08	0.1	0.46
Jaccard coefficient w1-w2 (Do)	0.12	0.03	0.1	0.18
Hate Network				
Indegree w1 (H)	0.45	1.03	0	11
Indegree w2 (H)	0.68	1.16	0	7
Indegree w1-w2 (H)	0.56	1.1	0	11
Density (H)	0.02	0.01	0	0.05
Reciprocity (H)	0.07	0.09	0	0.29
Clustering (H)	0.06	0.08	0	0.31
Indegree centralization (H)	0.11	0.06	0	0.31
Jaccard coefficient w1-w2 (H)	0.09	0.08	0	0.22
Second-degree status Upward Network				
Indegree w1 (Upward 2↑)	8.22	6.41	0	28
Indegree w2 (Upward 2↑)	2.96	3.65	0	19

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Indegree w1-w2 (Upward 2↑)	5.62	5.85	0	28
Density (Upward 2↑)	0.17	0.11	0	0.4
Reciprocity (Upward 2↑)	0.15	0.12	0	0.37
Clustering (Upward 2↑)	0.45	0.19	0.1	0.78
Indegree centralization (Upward 2↑)	0.31	0.11	0.1	0.53
Jaccard coefficient w1-w2 (Upward 2↑)	0.15	0.08	0	0.31
Second-degree status Downward Network				
Indegree w1 (Downward 2↓)	1.17	1.52	0	12
Indegree w2 (Downward 2↓)	1.12	1.53	0	11
Indegree w1-w2 ((Downward 2↓)	1.14	1.53	0	12
Density (Downward 2↓)	0.04	0.02	0	0.09
Reciprocity (Downward 2↓)	0.06	0.08	0	0.28
Clustering (Downward 2↓)	0.11	0.08	0	0.26
Indegree centralization (Downward 2↓)	0.12	0.08	0	0.33
Jaccard coefficient w1-w2 (Downward 2↓)	0.15	0.06	0	0.27

Notes: N=585. These statistics refer to the subsample of the selected 16 classes.

As we indicated in the main text, here we further clarify why we merged the two scales (disliking and hate) into one. Theoretically, hate can be conceived as a stronger type of dislike, and therefore the two are not clearly distinct. Furthermore, we also added a detailed descriptive analysis on the hate (+2), and (-1) disliking networks. Results clearly show that hate nominations were rare. As the disliking (-1) networks did not contain a very high number of nominations either, we aimed to improve the power of our analysis by merging these two scales

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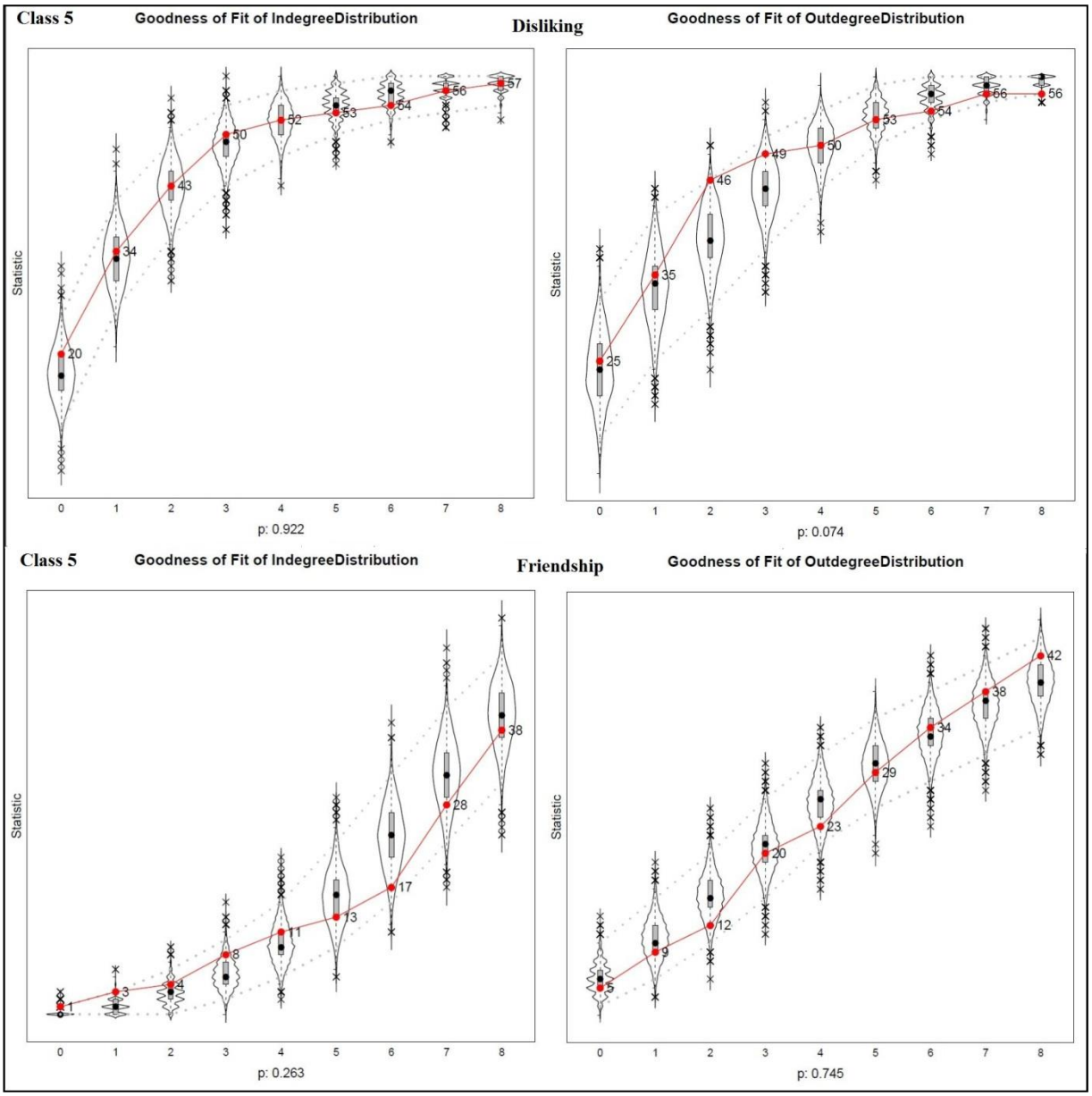
Figure A. 4.1: *Example: distribution for goodness of fit test (GOF) (Class 2, Model 2)*



Note: The vertical axis shows the probability of the distribution of in-and outdegrees.

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Table A. 4.2a:

Additional estimation for robustness check - results for the SIENA meta-analysis (Total=585)

	Model 1					Model 2					Model 3				
	Est.		SE	σ	C	Est.		SE	σ	C	Est.		SE	σ	C
Disliking network															
(1) Rate (period 1)	8.21	***	0.64	0.61	10	7.94	***	0.68	0.80	10	8.24		0.63	0	10
(2) Rate (period 2)	8.47	***	0.56	0.84	15	8.38	***	0.60	0.99	13	8.85		0.65	1.15 +	15
(3) Density	-1.45	***	0.07	0.12	16	-1.47	***	0.08	0.15	16	-1.4	***	0.08	0.16	15
(4) Reciprocity	0.53	***	0.09	0.00	16	0.52	***	0.09	0.00	16	0.5	***	0.09	0	16
(5) Transitive triplets	-0.03		0.04	0.09 +	16	-0.03		0.04	0.09 +	16	-0		0.04	0.08	16
(6) 3-cycles	-0.16	**	0.06	0.00	14	-0.16	**	0.05	0.00	15	-0.2	**	0.05	0	15
(7) Indegree popularity	0.10	***	0.01	0.03 +	16	0.10	***	0.01	0.02	16	0.09	***	0.01	0.03 *	16
(8) Outdegree popularity	0.03		0.02	0.00	15	0.03		0.02	0.00	16	0.03		0.02	0	15
(9) Outdegree isolate						-3.13	***	0.15	0.00	16	-3.1	***	0.15	0	15
(10) Upward 1↑ (H1)						-0.06		0.12	0.07	15					
(11) Downward 1↓ (H2)						0.24	**	0.08	0.00	16					
(12) InconsistencyUp (H3)						0.11	+	0.06	0.00	16					
(13) InconsistencyDown (H4)						0.23	**	0.07	0.12	16					
(14) Aggregated status ego											-0.1	**	0.03	0.06 +	16
(15) Aggregated status alter											-0.1	***	0.02	0.02	16
(16) Aggregated status similarity											-0.1		0.07	0.13	16

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(17) SES ego	0.02		0.05	0.09	+	16	-0.03		0.04	0.09	+	16	0.04		0.05	0.08	+	16
(18) SES alter	0.08		0.05	0.10		16	0.04		0.05	0.12	**	16	0.09	+	0.05	0.1		16
(19) SES similarity	-0.12	*	0.06	0.00		16	0.06		0.09	0.00		16	-0.1	+	0.06	0		16
(20) Gender ego	0.01		0.07	0.14	+	15	0.03		0.07	0.13		15	0.04		0.08	0.16		15
(21) Gender alter	0.05		0.07	0.13		16	0.06		0.07	0.11		16	0.06		0.07	0.09		15
(22) Same gender	0.10	+	0.06	0.08		15	0.10		0.07	0.12		15	0.11	+	0.07	0.12		15
(23) Friends agreement on disliking	0.17	***	0.04	0.07	+	16	0.16	***	0.03	0.05		16	0.17	***	0.04	0.07		16

Notes:+ p <0.10; * p <0.05; ** p<0.01; ***p<0.001

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Table A. 4.2b: *Additional estimation for robustness check - results for the SIENA meta-analysis (Total=585)*

	Model 1						Model 2						Model 3					
	Est.		SE	σ		C	Est.		SE	σ		C	Est.		SE	σ		C
Friendship network	11.40	***	1.03	3.53	***	15												
(1) Rate (period 1)	9.97	***	0.69	1.90	***	14	11.88	***	1.09	3.73	***	15	11.65	***	1.08	3.69	***	15
(2) Rate (period 2)	-1.50	***	0.10	0.26	*	16	10.24	***	0.75	2.06	***	14	10.01	***	0.70	1.89	**	14
(3) Density	1.77	***	0.09	0.24	**	16	-1.47	***	0.09	0.20		16	-1.46	***	0.11	0.25	+	16
(4) Reciprocity	0.25	***	0.02	0.06	***	16	1.75	***	0.09	0.26	**	16	1.76	***	0.09	0.23	**	15
(5) Transitive triplets	-0.03		0.03	0.02		16	0.25	***	0.02	0.06	***	16	0.25	***	0.02	0.06	***	15
(6) 3-cycles	0.02	*	0.01	0.02		16	-0.05	+	0.02	0.00		16	-0.04		0.02	0.00		15
(7) Indegree popularity	-0.16	***	0.01	0.02		16	0.01		0.01	0.02		16	0.01		0.01	0.03	*	15
(8) Outdegree popularity	3.60		2.87	10.65	***	14	-0.15	***	0.01	0.02		16	-0.15	***	0.01	0.00		16
(9) Outdegree isolate							-0.61	*	0.30	0.00		12	2.84		2.02	7.44	***	14
(10) Upward 1↑ (H1)							0.39	***	0.06	0.00		16						
(11) Downward 1↓ (H2)							-0.40	**	0.13	0.00		16						
(12) InconsistencyUp (H3)							0.14	**	0.05	0.09		16						
(13) InconsistencyDown (H4)							-0.20	*	0.09	0.09		16						
(14) Aggregated status ego													-0.06	***	0.02	0.00		16
(15) Aggregated status alter													0.07	**	0.02	0.05	*	16
(16) Aggregated status similarity													0.04		0.05	0.06		16
(17) SES ego	0.05		0.05	0.14	**	16	0.04		0.04	0.11	**	16	0.05		0.05	0.12	*	16

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(18) SES alter	0.01		0.03	0.00		16	0.01		0.03	0.00		16	0.01		0.03	0.00		15
(19) SES similarity	0.07		0.06	0.15	*	16	0.09		0.12	0.35	**	16	0.06		0.06	0.11	+	16
(20) Gender ego	-0.07		0.06	0.17	*	16	-0.07		0.07	0.18	**	16	-0.05		0.07	0.18	*	16
(21) Gender alter	-0.17	***	0.05	0.07		16	-0.17	***	0.05	0.06		16	-0.20	***	0.05	0.09		15
(22) Same gender	0.35	***	0.04	0.00		16	0.34	***	0.04	0.00		16	0.35	***	0.04	0.00		15
(23) Disliking agreement on friendship	0.07	*	0.03	0.02		16	0.07	*	0.03	0.00		16	0.07	*	0.03	0.00		16

Notes: + p <.10; * p < .05; ** p<.01; ***p<.001. The model is described by the effects included, the effect estimates and their standard errors.

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Publication List of the Author Related to the PhD project

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Journal articles

Pál, J., Stadtfeld, C., Grow, A. & Takács, K. (forthcoming): Status perceptions matter: Understanding disliking among adolescents. *Journal of Research on Adolescence,* http://doi.org/10.1111/jora.12231

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Book chapters

Csaba, Z.L. & Pál, J, (2013): QAP elemzése egy kelet-magyarországi kisváros középiskoláiban [Thousand faces of aggression – QAP analysis of hatred and aggression in two high schools in an Eastern Hungarian town]. In B. Néray, & A. Vörös (Eds.). *Wired schools – Network research in an Eastern Hungarian town* (pp. 13-30). Széchenyi István College for Advance Studies, Budapest: L'Harmattan, Budapest, ISBN 978-963-236-717-0 (in Hungarian)