Gossip and Reputation in Adolescent Networks

Authors: Dorottya Kisfalusi, Károly Takács, and Judit Pál

Hungarian Academy of Sciences, Centre for Social Sciences, Computational Social Science -

Research Center for Educational and Network Studies (CSS – RECENS)

This is not the final version. The finalized text can be accessed in the printed publication.

Abstract

Adolescence is an important age of development when collective norms emerge, social exclusion often takes place, and competition for reputation is relatively intense. Negative gossip is used with increasing intentionality to interfere in these processes. At the same time, being the object of negative gossip undermines chances to obtain good reputation. In this chapter, we review the role of gossiping in the formation of informal status relations of adolescents. We provide an overview of theoretical explanations and empirical findings on how reputation and gossip are related with a special focus on the school context. We present recent methodological advancements of social network methods used for analysing the complex interrelated dynamics of gossip, reputation, and peer relations among adolescents. As an illustration, we show that malicious gossip leads to disdain while disdain induces malicious gossip in a longitudinal analysis of Hungarian secondary school classes. Finally, we discuss the theoretical and practical implications of our illustrative analysis and formulate suggestions for future research.

Keywords: adolescence, status competition, gossip, reputation, social network, stochastic actor-based models

Introduction and problem formulation

Individuals in any social context devote significant time to evaluate others and assign them positive and negative reputations. This is important for social orientation in the group and for the individual adjustment to normative expectations. Positive reputations can be turned to power, while negative reputations might imply negligence and social exclusion. It is not surprising, therefore, that individuals strive for receiving positive evaluations from others and try to avoid negative evaluations. Evaluations are made in comparison with others; hence reputation is a scarce resource and is subject to competition.

Reputations are not only formed in dyadic interactions, but are exchanged in informal communication. A typical and widespread form of communication that strongly affects individual reputations is *gossip*. Not only information about other individuals are exchanged, but more importantly, perceptions and impressions are shared and provide the basis of evaluations at least as importantly as direct observations and interactions (Rauwolf, Mitchell, & Bryson, 2015; Smith, 2014; Smith & Collins, 2009; Sommerfeld, Krambeck, Semmann, & Milinski, 2007).

In operationalized terms, we define interpersonal communication that includes negative evaluative information about - and in absence of - a third party as *negative (malicious) gossip*. The physical absence of the *object* (or target) of gossip is a necessary characteristic that prevents the object (or the target) to influence the information that is spread about him- or herself.

It is widely believed that gossip is channelling information that is *destructive* to the *reputation* of the object (Besnier, 2009). While sharing favourable information about a third party could increase the target's reputation, the impact of positive and negative gossip might indeed be *asymmetric:* the effect of positive gossip may be less severe than the effect of negative gossip on reputation. Moreover, the communication of positive and negative information could also be beneficial to a

different extent for the production of collective goods. In line with the literature on altruistic punishment vs. altruistic reward for cooperation (Bowles & Gintis, 2004; Fehr & Gächter, 2002), and also in line with the asymmetric impact of positive and negative gossip on cooperation (Giardini & Vilone, 2016), negative gossip might play a more important role for the collective than positive gossip. Being the object of malicious gossip might in fact effectively undermine somebody's chances to obtain good reputation.

Once gossip is effective, it could be used strategically to destroy the good standing of others and to improve the relative position of the sender of gossip (van de Bunt, Wittek, & de Klepper, 2005; Wittek & Wielers, 1998). In this perspective, malicious gossip is a political tool (Besnier, 2009) and intended to defame specific targets (Smith, 2014). The gossip action can only be instrumental, however, if it is effective (Faris & Felmlee, 2014).

Who becomes the object of *strategic* gossip is not independent of current reputations. Those who are looked down by others are likely to be the target of negative gossip. As a consequence of these self-reinforcing mechanisms, individuals with the lowest reputation could end up in a downward spiral by being subject of even more negative gossip over time.

In another view, the effectiveness of gossip is questionable. Gossip is often considered an unconscious activity that has the primary function of social bonding (Dunbar, 1996, 2004; Gluckman, 1963) and increasing trust between the discussants (Burt & Knez, 1995). Its prevalence might also have resulted in the emerging complexity of strategic social communication (Dunbar, 1996; Smith, 2010). Gossip reinforces interpersonal affection as it is a pleasure activity that parties enjoy (van de Bunt et al., 2005). If gossip is cheap talk, then everyone uses gossip without any reliable content. Consequently, senders of gossip are considered cautiously, which might underscore their reputation. This is in line with the frequent public condemnation of tell-tales.

All these concerns on gossip and reputation are also relevant in adolescence. Below, we review the explanations of the functions and origins of gossip and highlight the specific contextual features for adolescents in schools.

Gossip and its explanations among adolescents

Norms and behaviour are under development at the age of pre-adolescence and adolescence (Veenstra, Dijkstra, & Kreager, 2017). Therefore adolescence is an important stage of human life, in which rules of the game are learnt, practiced, and sometimes enforced to exaggeration (Coleman, 1961, 1961). The fundamental processes that govern the formation and dynamics of norms and behaviour among adolescents are studied across related disciplines (Coleman, 1960, 1961; Jessor, Donovan, & Costa, 1994; Lareau, 2011; Rutland, Nesdale, & Brown, 2017). Adolescents develop their identity and independence by trying to distance themselves from their parents and teachers and mimicking adult behaviour at the same time. They experiment continuously by testing the limits of what is possible, allowed, tolerated, prohibited, and punished. Growing their independence liberates them from adult coercion, but the realization of liberty is only followed by the internalization of the need for the social regulation by norms only later.

Moreover, adolescents are constrained in their behaviour as they spend most of their time in school. Schools and classroom units within them provide natural opportunities for the development of closed communities. Students are requested to obey to rules in school and to respect teacher's authority. Teachers sometimes implement policy methods aiming at integration or conflict prevention (Salmivalli, Kärnä, & Poskiparta, 2010). Otherwise, informal contacts, communication, and norms develop to a large extent in a self-organizing way among adolescents, since this is the life stage when peers' opinions become especially salient (Hartup, 1993). These dynamics are often

centred on status competition. Status competition among pre-adolescents and adolescents is relatively intense and status orders change more rapidly than in adulthood (Coleman, 1961; Corsaro & Eder, 1990).

Gossip and social bonding in schools

Research on gossip in schools mostly follows the widely accepted definition that gossip is the exchange of evaluative information about someone who is not present (Eder & Enke, 1991; McDonald, 2011). Following the literature that attributes the primary function of social bonding to gossip (Dunbar, 1996, 2004; Gluckman, 1963), one could expect that gossip serves the enjoyment of the sender and the receiver, but does not have large consequences for the target. This is because communication partners do not take the juicy information content very seriously. There is no guarantee that the communication is honest and it is not rational to believe any word of it. Instead, gossip is expected to trigger laughter and ridicule behind the back of the third party (Billig, 2005; Eder, 1991; Morreall, 1983; Wooten, 2006). Present already among children, adolescents find joy in laughing at others (katagelasticism); and this is related to bullying others (Proyer, Meier, Platt, & Ruch, 2013).

First responses in a gossip conversation are therefore highly consequential for further development. Turn-taking, interruptions, the flow of conversation, and the point of consensus, therefore, describe well the power relations between the discussants rather than the factual evaluation of the target (Eder & Enke, 1991; Gibson, 2003). Idle chit-chat is observed among children, but the importance of these complex patterns of evaluative discussions and their relation to status enhancement has increasingly been realized at the age of adolescence.

The view that social bonding is a key function of gossip is reflected in research among adolescents who display a high need of expressing shared viewpoints (Eder & Enke, 1991; Gottman & Mettetal, 1986). This agreement, however, most often promotes *negative* evaluations (Eder & Enke, 1991), which might decrease with age (Gottman & Mettetal, 1986).

Gossip as an informal sanction

In closed communities, such as the school, there are clear information benefits of gossip for the receiver. Information about individual skills and cooperation in academic and non-academic activities are particularly important. Gossip can therefore make an important contribution to the enhancement of cooperation and punishment of free-riders (Sommerfeld et al., 2007; Wu, Balliet, & Van Lange, 2016). In a positive reinforcement loop, free riding is punished with negative gossip and bad reputation (Bliege Bird & Smith, 2005; Gintis, Smith, & Bowles, 2001), which helps to establish or even to amplify reputation differences that are based on actual merits (Merton, 1968; Vaidyanathan, Khalsa, & Ecklund, 2016). Adolescent girls' talk have been found to be an important cooperative tool that is used for the construction and consolidation of social norms, for shepherding conformity, and for the survival of the group as a whole in competition with out-groups (Eckert, 1990). In a severe form, gossip can threaten to ostracize the target, which ensures cooperation within the group (Feinberg, Willer, & Schultz, 2014; Ouwerkerk, Kerr, Gallucci, & Van Lange, 2005).

Gossip and ostracism

One could become the target of gossip just because he or she has peculiar characteristics and is different from others. Adolescents find dissimilar others as easy targets of malicious talk, stigmatization, and ostracism (Smart Richman & Leary, 2009; Williams, 2002; Wooten, 2006). The characteristics, the targets, and the consequences of ostracism, however, change with age (Pharo, Gross, Richardson, & Hayne, 2011).

While being ostracized, the target could still have no objections or even appreciations towards those who ostracize them within the school (Cook, Hegtvedt, & Yamagishi, 1988; Fave, 1980; Stolte, 1983). Ostracizing gossip ties are expected to be asymmetric, because dissimilar targets are in a marginal social position that makes impossible for them to launch a "counter-attack" behind the back of their otherwise popular ostracizers (Salmivalli, Lagerspetz, Björkqvist, Österman, & Kaukialnen, 1996). Their chances to remain respected members of the group could better be achieved by remaining silent (Williams, 2002) and hoping for the empathy of peers (Wesselmann, Williams, & Hales, 2013).

Heterophobia could also be directed towards minority members and members of low-status groups. Negative gossip induced by heterophobia could in particular be intense in case of perceived out-group threat and scapegoating (Gemmill, 1989; Katz, Glass, & Cohen, 1973).

Gossip as relational aggression

Spreading negative gossip about someone is one of the various forms of aggression. Besides gossiping (Ellwardt, Labianca, & Wittek, 2012), these include bullying (Espelage, Green, & Wasserman, 2007; Huitsing, Veenstra, Sainio, & Salmivalli, 2012; Salmivalli, Huttunen, &

Lagerspetz, 1997; Veenstra, Huitsing, Dijkstra, & Lindenberg, 2010), mocking (Björkqvist, Lagerspetz, & Kaukiainen, 1992), and fighting (Arbona, Jackson, McCoy, & Blakely, 1999; Gest, Graham-Bermann, & Hartup, 2001; Mouttapa, Valente, Gallaher, Rohrbach, & Unger, 2004).

Students also display different types of relational aggression towards peers. Gossip is one possible type and can be also described as indirect non-physical bullying of the target. One needs to take it into account that other direct forms of aggression replace or supplement negative gossip acts. Macchiavellian social climbers might use gossip along with other forms of harassment and bullying (Faris & Felmlee, 2014).

While direct or overt aggression involves a face-to-face and visible verbal or physical act towards individuals with the intention to harm them, indirect or covert aggression, such as gossip or exclusion, does not involve direct confrontation with the victim (Björkqvist et al., 1992; Card, Stucky, Sawalani, & Little, 2008; Espelage & Swearer, 2003; Little, Henrich, Jones, & Hawley, 2003; Sijtsema et al., 2010). Hence gossip can be seen as a special form of indirect aggression, which refers to the manipulation of one's social relationships (Crick, 1995; Little et al., 2003).

Gossip and status competition

Gossip could be the tool but also the consequence of competition. Competition for limited resources that are acquired in social processes such as popularity, social status, power, and better grades create strategic alliances and counter-alliances, and they could induce envy, anger, and frustration. All these forms go beyond the scope of dyadic rivalry, as it is witnessed, facilitated, and sometimes appreciated or mediated by relevant others. Hence, these processes are embedded in the network structure and the dynamics of evaluative information exchange about others is intertwined with competition.

The informal status dimension is particularly important in the pre-adolescent and adolescent age (Gest, Davidson, Rulison, Moody, & Welsh, 2007; Moody, Brynildsen, Osgood, Feinberg, & Gest, 2011), when the competition for status is particularly intense (Coleman, 1960, 1961). Adolescents increasingly realize the importance of forming and manipulating the informal hierarchy with the use of negative information spreading (Wargo Aikins, Collibee, & Cunningham, 2015) and other forms of relational aggression.

Competition for popularity and status is a major source of relational aggression (Faris & Ennett, 2012). Popular adolescents are more likely to harass their peers than less popular ones (de Bruyn, Cillessen, & Wissink, 2010; Faris & Felmlee, 2014; Juvonen, Graham, & Schuster, 2003; Rodkin & Berger, 2008; Sijtsema, Veenstra, Lindenberg, & Salmivalli, 2009). This association is not only true for various forms of aggressions, but for gossip as well. (Cillessen & Mayeux, 2004; Wargo Aikins et al., 2015).

Gossip might thus be used in a strategic way to establish norms and defend adolescents' reputations. Two reasons for its use can be distinguished: whereas unpopular students might be targeted to maintain the group norms, high status students might be targeted because of status competition among the students (Faris & Felmlee, 2014). As a result, gossiping about high status peers is an instrumental way of gaining status in the peer group.

It is not uncommon to see huge investments in strategic activities such as gossip, mediation, intervention, relational aggression, and sanctions on others for the sake of reputation and popularity (Adler & Adler, 1995; Eder, 1985; Faris & Ennett, 2012; Faris & Felmlee, 2014). If everyone does so, huge efforts are invested, a few individuals are severely chastised (Cillessen & Mayeux, 2004), but only marginal gains are achieved in the reputation order (Eder, 1985; Gould, 2002). This could contribute to the radicalization of relational aggression over time and its transformation from

indirect means towards more overt or even demonstrative scenes (Houghton, Nathan, & Taylor, 2012).

Gender and gossip

According to a commonplace, gossip is a gendered activity. This perception might be attributed to prevalent gender differences in aggression (Eagly & Steffen, 1986; Lagerspetz, Björkqvist, & Peltonen, 1988). Girls are more likely the victims of bullying by girls; and boys bully girls more likely than the other way around (e.g., Faris & Felmlee, 2011, 2014; Veenstra, Lindenberg, Munniksma, & Dijkstra, 2010; Xie, Farmer, & Cairns, 2003). Moreover, girls and boys are likely to use different forms of aggression. Whereas boys are more likely than girls to use direct and overt physical or verbal forms of aggression (Card, Stucky, Sawalani, & Little, 2008), girls are more likely to use indirect and relational means such as exclusion and gossip (Olweus, 1993). Differences in girls' and boys' propensity to use indirect aggression, however, are not large in magnitude (Card et al., 2008), and mostly occur in specific age groups such as later childhood and adolescence (Archer, 2004). Indirect aggressive strategies are not yet fully developed in a younger age, but are already prominent among 11-year old girls (Björkqvist et al., 1992). Björkqvist et al. (1992) found that aggression assessed by the children themselves was highest in this age group. Except for 8-year olds, gossiping was found to be more frequent among girls than boys.

Different disciplines propose various theoretical explanations for these gender differences. From an evolutionary perspective, greater reproductive competition among males can explain more overt forms of aggression (Archer, 2004). Biological explanations emphasize that boys confront more often physically than girls due to their greater physical strength (Björkqvist, 1994; Xie, Cairns, & Cairns, 2005). In contrast, sociological explanations emphasize that the way how girls and boys

are socialized may explain gender differences in aggression. Girls face stricter normative constraints than boys not only in their romantic behaviour (Kreager & Staff, 2009) but also in their socially acceptable retaliation methods (Faris & Felmlee, 2014), and in their direct confrontational behaviours (Xie et al., 2005).

Gender might also interact with social status asymmetries in determining who bullies whom and who is gossiping about whom. Rodkin and Berger (2008) found that popular students bullies unpopular victims from their same gender, whereas unpopular boys are likely to bully popular girls.

The utility of a social network perspective in research on gossip and reputation among adolescents

Gossip and reputation dynamics among adolescents are embedded in the social relationships of the group. In many countries, the primary group adolescents belong to is the classroom with its well defined memberships and boundary. Also because peer relations are especially important for adolescents, social network analysis has become an important tool in adolescence research. Social network methods take adequate care of the embeddedness and dependencies of dyadic peer relations in the classroom. In social network studies, usually all students from a class or school are asked to report their own opinion, attitudes, behaviour, and relationships with their peers: students might be asked whom they like, whom they dislike, whom they consider popular or about whom they gossip.

Longitudinal models such as stochastic actor-based models (SABMs) (Snijders, van de Bunt, & Steglich, 2010) are used to analyse the co-evolution of two networks, or of one network and students' behaviour, attitudes, and opinion (Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). Several studies focus on the longitudinal analysis of adolescents' popularity, likeability, or peer

status over time. Rambaran et al. (2015) for instance, investigated the co-evolution of positive and negative relations among adolescents. They found that students establish friendships if they dislike the same classmate; that friends agree on which classmates they dislike; and that students are likely to dislike those peers who are friends of classmates they dislike. Pál et al. (2016) showed that adolescents' disliking relations depend on their perceptions of the status of their peers. They found that individuals dislike those who they look down on, and conform to others by disliking those who they perceive as being looked down on by their peers. When individuals do not look up to those who they perceive to be admired by peers, it is more likely that disliking will occur.

In the past decade, a growing number of studies use social network methods to analyse different forms of aggression and school bullying and its associations with students' characteristics and other type of relations as well (e.g. Dijkstra, Berger, & Lindenberg, 2011; Huitsing, Snijders, Van Duijn, & Veenstra, 2014; Sentse, Dijkstra, Salmivalli, & Cillessen, 2013; Sijtsema et al., 2010). We are not aware of any applications of stochastic actor-based models, however, focusing specifically on gossip among adolescents. In the next section, we illustrate the complex relation between gossip and reputation by analysing adolescents' school networks with SABMs.

Illustration: An empirical study among adolescents

To illustrate the bidirectional relationship between gossip and reputation, we present an exemplary analysis of longitudinal social network data from Hungarian secondary school classes. Following the path of earlier studies in organizations (Ellwardt, 2011; Ellwardt et al., 2012; Wittek & Wielers, 1998), we emphasize the embeddedness of gossip and reputations in adolescents' social network. The data stem from the first three waves of a four-wave panel study conducted among Hungarian secondary school students (7 schools, 40 classes, N_1=1313). The research was conducted under the

project *'Wired into Each Other: Network Dynamics of Adolescents in the Light of Status Competition, School Performance, Exclusion and Integration'*. The main aim of the project was to examine the dynamics of students' social relations, and the associations between the individuals' characteristics and their actual or perceived position in the hierarchy of the class. The research started in the autumn of 2010 among all 9th-grade students enrolled in the selected schools (mean age = 15.1 years). Then, data were collected in the spring of 2011, 2012, and 2013.

We present descriptive statistics for gossip and reputation networks of the forty classes that participated in all of the first three waves of the study. The co-evolution of gossip and reputation among adolescents is illustrated by the longitudinal social network analysis of seven grammar school classes.

Measures

Malicious gossip. The survey measured negative gossip by self-reports on the item *"Of whom do you say bad things to your friends?"* using a full network roster of the class. Students were thus able to nominate as many students they gossip about as they wanted. For descriptive purposes, both the incoming and outgoing nominations (known as indegree and outdegree in social network analysis) were calculated for each student. These measures show how often students are nominated by their classmates and how often they nominate their classmates.

For each class an adjacency matrix was created. In this matrix, dyads in which student *i* (the sender) nominated student *j* as the *target* of negative gossip were coded as 1 and dyads where there were no nominations from *i* to *j* were coded as 0. This matrix was used as a dependent variable.

Reputational status. Reputational status was measured as dyadic peer nominations on the full network roster items *"Who do you look up to?"* and *"Who do you disdain?"* Based on these

questions, we created two networks for each class (the respect and the disdain network), and calculated the same measures as for the gossip network.

Descriptive statistics

Table 1 presents descriptive statistics on the gossip, disdain, and respect networks. On average, students were nominated by less than one classmate as targets of negative gossip. Only six percent of the nominations were reciprocated, and only a few nominations remained stable between the successive waves (represented by the low Jaccard-indices, which measure the proportion of stable nominations compared to existing nominations). On average, the disdain and respect networks were denser and more frequently reciprocated than the gossip network.

[insert Table 1 here]

Individual-level correlations between indegrees and outdegrees (the sum of incoming and outgoing nominations, respectively) in the gossip, disdain, and respect networks show a moderate positive correlation between being disdained and being the object of negative gossip (Wave 1: 0.42, Wave 2: 0.58, Wave 3: 0.59, $p < 0.001$). In contrast, there is a weak negative correlation between being respected and being the object of negative gossip (Wave 1: -0.07, $p < 0.05$, Wave 2: -0.13, $p < 0.001$, Wave 3: -0.11, $p < 0.001$). Whereas sending negative gossip is not significantly associated with being respected, there is a significant but weak positive correlation between sending gossip and being disdained (Wave 1: 0.06, $p < 0.05$, Wave 2: 0.09, $p < 0.01$, Wave 3: 0.06, $p < 0.05$).

Based on these associations low reputation is more strongly associated with being the object of negative gossip than high reputational status. We are, however, unable to differentiate between two mechanisms: whether students gossip about disdained classmates, or whether students disdain

15

classmates who are targets of negative gossip. To disentangle these two mechanisms we estimated stochastic actor-based models.

Results of the empirical analysis

We modelled the co-evolution of reputational status and self-reported gossip with stochastic actor-based models (Snijders et al., 2010). We estimated these models using RSiena (Ripley, Snijders, Boda, Vörös, & Preciado, 2015). We specified SABM's to estimate the effects of network processes and individual characteristics on the creation and maintenance of ties in each network. In our model, we simultaneously estimated gossip and disdain, and gossip and respect tie formation as dependent networks. We also included the cross-network effects between the two dependent networks. First, we analysed each class separately, and then we undertook meta-analyses. We used the Fisher-tests for the meta-analysis to evaluate whether estimated parameter values were significantly different from zero across the classrooms.

We included several network effects in both the gossip and reputation models as controls to demonstrate the interplay between gossip and reputation networks. Mathematical formulas for the parameters and a detailed description of stochastic actor-based models can be found in Ripley et al. (2015). We did not find any significant cross-network effects in the co-evolution model of gossip and respect. Therefore, only the results for the co-evolution of gossip and disdain are presented in Table 2.

The models are reported for each class separately, and a Fisher-type combination of *p*-values is also presented. A significant right-sided *p*-value can be seen as evidence that some networks have a positive parameter value, whereas a significant left-sided *p*-value shows that some networks have a negative parameter value (Ripley et al., 2015).

16

[insert Table 2 here]

The cross-network effects model how the gossip and reputation networks co-evolve. Based on the meta-analysis, two of these effects are statistically significant. On the one hand, the positive effect of gossip on reputation indicates that if a student is gossiping about a classmate, he or she will also disdain this classmate over time (combination of right one-sided p-values: χ^2=24.21, d.f. = 8, p = 0.002). On the other hand, the positive effect of reputation on gossip suggests that if a student disdains a classmate, he or she will also gossip about this classmate over time (combination of right one-sided p-values: χ^2= 38.15, d.f. = 14, p < 0.001). We also examined whether higher number of incoming gossip nominations lead to higher number of incoming disdain nominations and vice versa, but this effects were not significant based on the meta-analysis and were therefore left out from the final model.

Besides these cross-network effects, we find several significant structural parameters in the meta-analysis of the gossip and disdain networks. The negative outdegree parameters in each network reflect the low density of the nominations. The positive reciprocity parameters show that students have a tendency to reciprocate gossip and disdain nominations. The positive indegree popularity parameters imply that students who have a high number of incoming nominations attract even more incoming nominations. The positive outdegree activity parameters in each network reflect that students who send many outgoing nominations will send even more nominations towards others. The negative truncated outdegree parameters in each network show the positive tendency of students to have zero outgoing nominations. Furthermore, the same gender effects show that students are likely to nominate same-gender peers in the gossip networks but not in the disdain networks. Moreover, boys are more likely to receive disdain nominations than girls.

Implications of the findings

The network of gossip target nominations is relatively sparse and it is only weakly correlated negatively with respect. This explains why we do not find significant (negative) effects in our co-evolution models of malicious gossip and respect. In line with Dunbar (1996, 2004) it could very well be that also among adolescents most informal communication can be characterized as gossip, but due to its sensitive character it is not reported in the questionnaire. Moreover, it could also be that underreporting is not random. Extrovert individuals may report more gossip activity, while strategic users might also be more strategic in withdrawing this information in a survey.

Correlations between indegrees in the gossip and disdain networks show a significant moderate positive association between being the object of negative gossip and being looked down by the classmates. In the longitudinal social network analysis we found support that malicious gossip significantly undermines the reputation of the target: if a student is gossiping about a classmate, he or she will also disdain this classmate over time. It was also found that looking down on somebody increases the chance of sending negative gossip about the person. We did not find, however, evidence that incoming nominations in gossip would increase incoming nominations in the disdain network beyond the above mentioned dyadic relations in the stochastic actor-based models.

Our results illustrate that endogenous network processes play a significant role in gossip and reputation. There was a significant dispersion in the distribution of incoming and outgoing nominations and most adolescents did not nominate any gossip targets. Stochastic actor-based models showed that students were likely to reciprocate nominations, and were more likely to nominate same-gender peers in the gossip and respect networks than cross-gender peers.

Discussion

Summary

Gossip is an important social activity already at a young age. In line with majority of the literature, we defined gossip as an evaluative talk between a sender and a receiver about a third person (target) who is not present. By reviewing the literature, we identified several functions, explanations, and consequences of negative gossip particularly that are relevant in the school context. Previous studies suggest that malicious gossip indeed can have multiple functions and explanations. It can serve to create social bonding between the sender and the receiver; it can constitute an informal sanction against the target; it can be used as a form of social exclusion or relational aggression; it can be a gendered activity; and it can be a tool of competition for informal status and reputation – or the consequence of status inequality. After this review, we speculated that for the question of who is gossiping about whom in negative terms probably the last dimension of status and reputation is the most important among adolescents. Hence, our empirical illustration aimed at the investigation of determinants of how negative gossip is interrelated with reputational concerns.

Our review highlighted that previous literature unequally considered these functions of gossip among adolescents. While the enjoyment of ridicule and laughter on others have been studied and there is a rich literature on relational aggression, bullying, ostracism, and their relationship to informal status, the group beneficial effects of malicious gossip are less investigated in the school context. Our empirical illustration was also the first we are aware of that utilized stochastic actor-based models for the analysis of the interrelation between gossip and reputation in adolescent classroom communities.

Future directions

Gossip is a pervasive social phenomenon among adolescents (McDonald, 2011). We illustrated with an empirical example that gossip has an impact on the reputational hierarchy among adolescence and at the same time disdain of a third person increases the likelihood that he or she is picked for malicious gossip. Relatively little is known, however, about the empirical relationship between gossip and the development and maintenance of group beneficial norms among adolescents. As the intimacy barrier is difficult to cross for any researcher, more observational studies are necessary to test which functions of gossip are prevalent at the age of adolescence. Observational and survey methods together could help us to develop a deeper understanding of the complex interrelation and development of gossip, informal social status, and social norms; which together endow individuals with elementary competencies for later adult life.

References

Adler, P. A., & Adler, P. (1995). Dynamics of Inclusion and Exclusion in Preadolescent Cliques. *Social Psychology Quarterly*, *58*(3), 145. https://doi.org/10.2307/2787039

Arbona, C., Jackson, R. H., McCoy, A., & Blakely, C. (1999). Ethnic Identity as a Predictor of Attitudes of Adolescents Toward Fighting. *The Journal of Early Adolescence*, *19*(3), 323–340. https://doi.org/10.1177/0272431699019003002

Archer, J. (2004). Sex Differences in Aggression in Real-World Settings: A Meta-Analytic Review. *Review of General Psychology*, *8*(4), 291–322. https://doi.org/10.1037/1089-2680.8.4.291

Besnier, N. (2009). *Gossip and the Everyday Production of Politics*. Honolulu: U Hawai'i Press.

Billig, M. (2005). *Laughter and Ridicule: Towards a Social Critique of Humour* (1 edition). London ; Thousand Oaks: SAGE Publications Ltd.

Björkqvist, K. (1994). Sex differences in physical, verbal, and indirect aggression: A review of recent research. *Sex Roles*, *30*(3–4), 177–188. https://doi.org/10.1007/BF01420988

Björkqvist, K., Lagerspetz, K. M. J., & Kaukiainen, A. (1992). Do girls manipulate and boys fight? developmental trends in regard to direct and indirect aggression. *Aggressive Behavior*, *18*(2), 117–127. https://doi.org/10.1002/1098-2337(1992)18:2<117::AID-AB2480180205>3.0.CO;2-3

Bliege Bird, R., & Smith, E. A. (2005). Signaling Theory, Strategic Interaction, and Symbolic Capital. *Current Anthropology*, *46*(2), 221–248. https://doi.org/10.1086/427115

Bowles, S., & Gintis, H. (2004). The evolution of strong reciprocity: cooperation in heterogeneous populations. *Theoretical Population Biology*, *65*(1), 17–28. https://doi.org/10.1016/j.tpb.2003.07.001

Burt, R. S., & Knez, M. (1995). Kinds of Third-Party Effects on Trust. *Rationality and Society*, *7*(3), 255–292. https://doi.org/10.1177/1043463195007003003

Card, N. A., Stucky, B. D., Sawalani, G. M., & Little, T. D. (2008). Direct and Indirect Aggression During Childhood and Adolescence: A Meta-Analytic Review of Gender Differences, Intercorrelations, and Relations to Maladjustment. *Child Development*, *79*(5), 1185–1229. https://doi.org/10.1111/j.1467-8624.2008.01184.x

Cillessen, A. H. N., & Mayeux, L. (2004). From Censure to Reinforcement: Developmental Changes in the Association between Aggression and Social Status. *Child Development*, *75*(1), 147–163. https://doi.org/10.1111/j.1467-8624.2004.00660.x

Coleman, J. S. (1960). The Adolescent Subculture and Academic Achievement. *American Journal of Sociology*, *65*(4), 337–347.

Coleman, J. S. (1961). *The Adolescent Society. The Social Life of the Teenager and its Impact on Education* (Free Press). New York.

Cook, K. S., Hegtvedt, K. A., & Yamagishi, T. (1988). Structural Inequality, Legitimation, and Reactions to Inequity in Exchange Networks. In M. Webster & M. Foschi (Eds.), *Status Generalization: New Theory and Research*. Stanford, CA: Stanford Univerisyt Press.

Corsaro, W. A., & Eder, D. (1990). Children's Peer Cultures. *Annual Review of Sociology*, *16*(1), 197–220. https://doi.org/10.1146/annurev.so.16.080190.001213

Crick, N. R. (1995). Relational aggression: The role of intent attributions, feelings of distress, and provocation type. *Development and Psychopathology*, *7*(02), 313–322. https://doi.org/10.1017/S0954579400006520

de Bruyn, E. H., Cillessen, A. H. N., & Wissink, I. B. (2010). Associations of Peer Acceptance and Perceived Popularity With Bullying and Victimization in Early Adolescence. *The Journal of Early Adolescence*, *30*(4), 543–566. https://doi.org/10.1177/0272431609340517

Dijkstra, J. K., Berger, C., & Lindenberg, S. (2011). Do physical and relational aggression explain adolescents' friendship selection? The competing roles of network characteristics, gender, and social status. *Aggressive Behavior*, *37*(5), 417–429. https://doi.org/10.1002/ab.20402

Dunbar, R. (1996). Grooming, Gossip and the Evolution of Language. Cambridge, MA: Harvard University Press.

Dunbar, R. (2004). Gossip in evolutionary perspective. *Review of General Psychology*, *8*(2), 100–110. https://doi.org/http://dx.doi.org/10.1037/1089-2680.8.2.100

Eagly, A. H., & Steffen, V. J. (1986). Gender and aggressive behavior: a meta-analytic review of the social psychological literature. *Psychological Bulletin*, *100*(3), 309–330. https://doi.org/10.1037/0033-2909.100.3.309

Eckert, P. (1990). Cooperative competition in adolescent "girl talk". *Discourse Processes*, *13*, 91–122. https://doi.org/10.1080/01638539009544748

Eder, D. (1985). The Cycle of Popularity: Interpersonal Relations Among Female Adolescents. *Sociology of Education*, *58*(3), 154. https://doi.org/10.2307/2112416

Eder, D. (1991). The Role of Teasing in Adolescent Peer Group Culture. *Sociological Studies of Child Development*, (4), 181–197.

Eder, D., & Enke, J. L. (1991). The Structure of Gossip: Opportunities and Constraints on Collective Expression among Adolescents. *American Sociological Review*, *56*(4), 494. https://doi.org/10.2307/2096270

Ellwardt, L. (2011). *Gossip in Organizations. A Social Network Study*. Groningen: ICS Dissertation Series.

Ellwardt, L., Labianca, G. (Joe), & Wittek, R. (2012). Who are the objects of positive and negative gossip at work? *Social Networks*, *34*(2), 193–205. https://doi.org/10.1016/j.socnet.2011.11.003

Espelage, D. L., Green, H. D., & Wasserman, S. (2007). Statistical analysis of friendship patterns and bullying behaviors among youth. *New Directions for Child and Adolescent Development*, *2007*(118), 61–75. https://doi.org/10.1002/cd.201

Espelage, D. L., & Swearer, S. M. (2003). Research on School Bullying and Victimization: What Have We Learned and Where Do We Go from Here? *School Psychology Review*, *32*(3), 365–383.

Faris, R., & Ennett, S. (2012). Adolescent aggression: The role of peer group status motives, peer aggression, and group characteristics. *Social Networks*, *34*(4), 371–378. https://doi.org/10.1016/j.socnet.2010.06.003

Faris, R., & Felmlee, D. (2011). Status Struggles: Network Centrality and Gender Segregation in Same- and Cross-Gender Aggression. *American Sociological Review*, *76*(1), 48–73. https://doi.org/10.1177/0003122410396196

Faris, R., & Felmlee, D. (2014). Casualties of Social Combat School Networks of Peer Victimization and Their Consequences. *American Sociological Review*, *79*(2), 228–257. https://doi.org/10.1177/0003122414524573

Fave, L. R. D. (1980). The Meek Shall Not Inherit the Earth: Self-Evaluation and the Legitimacy of Stratification. *American Sociological Review*, *45*(6), 955. https://doi.org/10.2307/2094912

Fehr, E., & Gächter, S. (2002). Altruistic punishment in humans. *Nature*, *415*(6868), 137–140. https://doi.org/10.1038/415137a

Feinberg, M., Willer, R., & Schultz, M. (2014). Gossip and Ostracism Promote Cooperation in Groups. *Psychological Science*, *25*(3), 656–664. https://doi.org/10.1177/0956797613510184

Gemmill, G. (1989). The Dynamics of Scapegoating in Small Groups. *Small Group Research*, *20*(4), 406–418. https://doi.org/10.1177/104649648902000402

Gest, S. D., Davidson, A. J., Rulison, K. L., Moody, J., & Welsh, J. A. (2007). Features of groups and status hierarchies in girls' and boys' early adolescent peer networks. *New Directions for Child and Adolescent Development*, *2007*(118), 43–60. https://doi.org/10.1002/cd.200

Gest, S. D., Graham-Bermann, S. A., & Hartup, W. W. (2001). Peer Experience: Common and Unique Features of Number of Friendships, Social Network Centrality, and Sociometric Status. *Social Development*, *10*(1), 23–40. https://doi.org/10.1111/1467-9507.00146

Giardini, F., & Vilone, D. (2016). Gossip Quantity and Network Structure Can Counterbalance Errors in Transmission and Promote the Evolution of Cooperation. *ArXiv: 1606.01711 [Physics.Soc-Ph]*.

Gibson, D. R. (2003). Participation Shifts: Order and Differentiation in Group Conversation. *Social Forces*, *81*(4), 1335–1380. https://doi.org/10.1353/sof.2003.0055

Gintis, H., Smith, E. A., & Bowles, S. (2001). Costly Signaling and Cooperation. *Journal of Theoretical Biology*, *213*(1), 103–119. https://doi.org/10.1006/jtbi.2001.2406

Gluckman, M. (1963). Gossip and Scandal. *Current Anthropology*, *4*, 307–315.

Gottman, J. M., & Mettetal, G. (1986). Speculations about social and affective development: Friendship and acquaintanceship through adolescence. In *Conversations of friends: Speculations on affective development* (Vol. xvi, pp. 192–237). New York, NY, US: Cambridge University Press.

Gould, R. V. (2002). The Origins of Status Hierarchies: A Formal Theory and Empirical Test. *American Journal of Sociology*, *107*(5), 1143–1178. https://doi.org/10.1086/341744

Hartup, W. W. (1993). Adolescents and their friends. *New Directions for Child and Adolescent Development*, *1993*(60), 3–22. https://doi.org/10.1002/cd.23219936003

Houghton, S. J., Nathan, E., & Taylor, M. (2012). To Bully or Not to Bully, That Is Not the Question: Western Australian Early Adolescents' in Search of a Reputation. *Journal of Adolescent Research*, *27*(4), 498–522. https://doi.org/10.1177/0743558411432638

Huitsing, G., Snijders, T. A. B., Van Duijn, M. A. J., & Veenstra, R. (2014). Victims, bullies, and their defenders: a longitudinal study of the coevolution of positive and negative networks.

Development and Psychopathology, *26*(3), 645–659.

https://doi.org/10.1017/S0954579414000297

Huitsing, G., Veenstra, R., Sainio, M., & Salmivalli, C. (2012). "It must be me" or "It could be

them?": The impact of the social network position of bullies and victims on victims'

adjustment. *Social Networks*, *34*(4), 379–386.

https://doi.org/10.1016/j.socnet.2010.07.002

Jessor, R., Donovan, J. E., & Costa, F. M. (1994). *Beyond Adolescence: Problem Behaviour and*

Young Adult Development (Revised ed. edition). Cambridge: Cambridge University Press.

Juvonen, J., Graham, S., & Schuster, M. A. (2003). Bullying Among Young Adolescents: The

Strong, the Weak, and the Troubled. *Pediatrics*, *112*(6), 1231–1237.

Katz, I., Glass, D. C., & Cohen, S. (1973). Ambivalence, guilt, and the scapegoating of minority

group victims. *Journal of Experimental Social Psychology*, *9*(5), 423–436.

https://doi.org/10.1016/S0022-1031(73)80006-X

Kreager, D. A., & Staff, J. (2009). The Sexual Double Standard and Adolescent Peer Acceptance.

Social Psychology Quarterly, *72*(2), 143–164.

https://doi.org/10.1177/019027250907200205

Lagerspetz, K. M. J., Björkqvist, K., & Peltonen, T. (1988). Is indirect aggression typical of

females? gender differences in aggressiveness in 11- to 12-year-old children. *Aggressive*

Behavior, *14*(6), 403–414. https://doi.org/10.1002/1098-2337(1988)14:6<403::AID-

AB2480140602>3.0.CO;2-D

Lareau, A. (2011). *Unequal Childhoods: Class, Race, and Family Life, 2nd Edition with an*

Update a Decade Later (2 edition). Berkeley: University of California Press.

Little, T. D., Henrich, C. C., Jones, S. M., & Hawley, P. H. (2003). Disentangling the 'whys'

from the 'whats' of aggressive behaviour. *International Journal of Behavioral

Development*, *27*(2), 122. https://doi.org/10.1080/01650250244000128

McDonald, K. L. (2011). Gossip. In R. J. R. Levesque (Ed.), *Encyclopedia of Adolescence* (pp.

1196–1200). New York: Springer. Retrieved from

http://www.springer.com/gp/book/9781441916945

Merton, R. K. (1968). *Social Theory and Social Structure*. New York: Free Press.

Moody, J., Brynildsen, W. D., Osgood, D. W., Feinberg, M. E., & Gest, S. (2011). Popularity

trajectories and substance use in early adolescence. *Social Networks*, *33*(2), 101–112.

https://doi.org/10.1016/j.socnet.2010.10.001

Morreall, J. (1983). *Taking Laughter Seriously*. Albany: State University of New York Press.

Mouttapa, M., Valente, T., Gallaher, P., Rohrbach, L. A., & Unger, J. B. (2004). Social network

predictors of bullying and victimization. *Adolescence*, *39*(154), 315–335.

Olweus, D. (1993). *Bullying at School: What We Know and What We Can Do*. Oxford: Wiley.

Ouwerkerk, J. W., Kerr, N. L., Gallucci, M., & Van Lange, P. A. M. (2005). Avoiding the social

death penalty: Ostracism and cooperation in social dilemmas. In K. D. Williams, J. P.

Forgas, & W. V. Hippel (Eds.), *The Social Outcast: Ostracism, Social Exclusion,

Rejection, and Bullying* (1 edition, pp. 321–332). New York: Psychology Press.

Pál, J., Stadtfeld, C., Grow, A., & Takács, K. (2016). Status Perceptions Matter: Understanding

Disliking Among Adolescents. *Journal of Research on Adolescence*, *26*(4), 805–818.

https://doi.org/10.1111/jora.12231

Pharo, H., Gross, J., Richardson, R., & Hayne, H. (2011). Age-related changes in the effect of

ostracism. *Social Influence*, *6*, 22–38. https://doi.org/10.1080/15534510.2010.525852

Proyer, R. T., Meier, L. E., Platt, T., & Ruch, W. (2013). Dealing with laughter and ridicule in

adolescence: relations with bullying and emotional responses. *Social Psychology of*

Education, *16*(3), 399–420. https://doi.org/10.1007/s11218-013-9221-y

Rambaran, J. A., Dijkstra, J. K., Munniksma, A., & Cillessen, A. H. N. (2015). The development

of adolescents' friendships and antipathies: A longitudinal multivariate network test of

balance theory. *Social Networks*, *43*, 162–176.

https://doi.org/10.1016/j.socnet.2015.05.003

Rauwolf, P., Mitchell, D., & Bryson, J. J. (2015). Value homophily benefits cooperation but

motivates employing incorrect social information. *Journal of Theoretical Biology*, *367*,

246–261. https://doi.org/10.1016/j.jtbi.2014.11.023

Ripley, R. M., Snijders, T. A. B., Boda, Z., Vörös, A., & Preciado, P. (2015). Manual for SIENA

version 4.0. Oxford: University of Oxford, Department of Statistics; Nuffield College.

Rodkin, P. C., & Berger, C. (2008). Who bullies whom? Social status asymmetries by victim

gender. *International Journal of Behavioral Development*, *32*(6), 473–485.

https://doi.org/10.1177/0165025408093667

Rutland, A., Nesdale, D., & Brown, C. S. (Eds.). (2017). *The Wiley Handbook of Group*

Processes in Children and Adolescents (1 edition). Sothern Gate, Chichester, West

Sussex, UK: Wiley-Blackwell.

Salmivalli, C., Huttunen, A., & Lagerspetz, K. M. J. (1997). Peer networks and bullying in

schools. *Scandinavian Journal of Psychology*, *38*(4), 305–312.

https://doi.org/10.1111/1467-9450.00040

Salmivalli, C., Kärnä, A., & Poskiparta, E. (2010). From peer putdowns to peer support: A

theoretical model and how it translated into a national anti-bullying program. In S. R.

Jimerson, S. M. Swearer, & D. L. Espelage (Eds.), *Handbook of bullying in schools: An*

international perspective (pp. 441–454). New York, NY, US: Routledge/Taylor & Francis Group.

Salmivalli, C., Lagerspetz, K., Björkqvist, K., Österman, K., & Kaukialnen, A. (1996). Bullying as a Group Process: Participant Roles and Their Relations to Social Status Within the Group. *Aggressive Behavior*, *22*(1), 1–15. https://doi.org/10.1002/(SICI)1098-2337(1996)22:1<1::AID-AB1>3.0.CO;2-T

Sentse, M., Dijkstra, J. K., Salmivalli, C., & Cillessen, A. H. N. (2013). The Dynamics of Friendships and Victimization in Adolescence: A Longitudinal Social Network Perspective. *Aggressive Behavior*, *39*(3), 229–238. https://doi.org/10.1002/ab.21469

Sijtsema, J. J., Ojanen, T., Veenstra, R., Lindenberg, S., Hawley, P. H., & Little, T. D. (2010). Forms and Functions of Aggression in Adolescent Friendship Selection and Influence: A Longitudinal Social Network Analysis. *Social Development*, *19*(3), 515–534. https://doi.org/10.1111/j.1467-9507.2009.00566.x

Sijtsema, J. J., Veenstra, R., Lindenberg, S., & Salmivalli, C. (2009). Empirical test of bullies' status goals: assessing direct goals, aggression, and prestige. *Aggressive Behavior*, *35*(1), 57–67. https://doi.org/10.1002/ab.20282

Smart Richman, L., & Leary, M. R. (2009). Reactions to discrimination, stigmatization, ostracism, and other forms of interpersonal rejection: A multimotive model. *Psychological Review*, *116*(2), 365–383. https://doi.org/10.1037/a0015250

Smith, E. A. (2010). Communication and collective action: language and the evolution of human cooperation. *Evolution and Human Behavior*, *31*(4), 231–245. https://doi.org/10.1016/j.evolhumbehav.2010.03.001

Smith, E. R. (2014). Evil Acts and Malicious Gossip: A Multiagent Model of the Effects of Gossip in Socially Distributed Person Perception. *Personality and Social Psychology Review*, *18*(4), 311–325. https://doi.org/10.1177/1088868314530515

Smith, E. R., & Collins, E. C. (2009). Contextualizing person perception: Distributed social cognition. *Psychological Review*, *116*(2), 343–364. https://doi.org/10.1037/a0015072

Snijders, T. A. B., van de Bunt, G. G., & Steglich, C. E. G. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks*, *32*(1), 44–60. https://doi.org/10.1016/j.socnet.2009.02.004

Sommerfeld, R. D., Krambeck, H.-J., Semmann, D., & Milinski, M. (2007). Gossip as an alternative for direct observation in games of indirect reciprocity. *Proceedings of the National Academy of Sciences*, *104*(44), 17435–17440. https://doi.org/10.1073/pnas.0704598104

Stolte, J. F. (1983). The Legitimation of Structural Inequality: Reformulation and Test of the Self-Evaluation Argument. *American Sociological Review*, *48*(3), 331. https://doi.org/10.2307/2095226

Vaidyanathan, B., Khalsa, S., & Ecklund, E. H. (2016). Gossip as Social Control: Informal Sanctions on Ethical Violations in Scientific Workplaces. *Social Problems*, *63*(4), 554–572. https://doi.org/10.1093/socpro/spw022

van de Bunt, G. G., Wittek, R. P. M., & de Klepper, M. C. (2005). The Evolution of Intra-Organizational Trust Networks: The Case of a German Paper Factory: An Empirical Test of Six Trust Mechanisms. *International Sociology*, *20*(3), 339–369. https://doi.org/10.1177/0268580905055480

Veenstra, R., Dijkstra, J. K., & Kreager, D. A. (2017). Pathways, networks, and norms: A sociological perspective on peer research. In W. M. Bukowski, B. Laursen, & K. H.

Rubin (Eds.), *Handbook of Peer Interactions, Relationships, and Groups*. New York, NY: Guilford.

Veenstra, R., Dijkstra, J. K., Steglich, C., & Van Zalk, M. H. W. (2013). Network-Behavior Dynamics. *Journal of Research on Adolescence*, *23*(3), 399–412. https://doi.org/10.1111/jora.12070

Veenstra, R., Huitsing, G., Dijkstra, J. K., & Lindenberg, S. (2010). Friday on My Mind: The Relation of Partying With Antisocial Behavior of Early Adolescents. The TRAILS Study: PARTYING, POPULARITY, AND ANTISOCIAL BEHAVIOR. *Journal of Research on Adolescence*, *20*(2), 420–431. https://doi.org/10.1111/j.1532-7795.2010.00647.x

Veenstra, R., Lindenberg, S., Munniksma, A., & Dijkstra, J. K. (2010). The complex relation between bullying, victimization, acceptance, and rejection: giving special attention to status, affection, and sex differences. *Child Development*, *81*(2), 480–486. https://doi.org/10.1111/j.1467-8624.2009.01411.x

Wargo Aikins, J., Collibee, C., & Cunningham, J. (2015). Gossiping to the Top: Observed Differences in Popular Adolescents Gossip. *The Journal of Early Adolescence*. https://doi.org/10.1177/0272431615617291

Wesselmann, E. D., Williams, K. D., & Hales, A. H. (2013). Vicarious ostracism. *Frontiers in Human Neuroscience*, *7*. https://doi.org/10.3389/fnhum.2013.00153

Williams, K. D. (2002). *Ostracism: The Power of Silence* (1 edition). New York London: The Guilford Press.

Wittek, R., & Wielers, R. (1998). Gossip in Organizations. *Computational & Mathematical Organization Theory*, *4*(2), 189–204. https://doi.org/10.1023/A:1009636325582

Wooten, D. B. (2006). From Labeling Possessions to Possessing Labels: Ridicule and

    Socialization among Adolescents. *Journal of Consumer Research*, *33*(2), 188–198.

    https://doi.org/10.1086/506300

Wu, J., Balliet, D., & Van Lange, P. A. M. (2016). Gossip Versus Punishment: The Efficiency of

    Reputation to Promote and Maintain Cooperation. *Scientific Reports*, *6*(1).

    https://doi.org/10.1038/srep23919

Xie, H., Cairns, B. D., & Cairns, R. B. (2005). The Development of Aggressive Behaviors

    Among Girls: Measurement Issues, Social Functions, and Differential Trajectories. In D.

    J. Pepler, K. C. Madsen, C. Webster, & K. S. Levene (Eds.), *The development and*

    treatment of girlhood aggression (pp. 105–136). Mahwah, NJ, US: Lawrence Erlbaum

    Associates Publishers.

Xie, H., Farmer, T. W., & Cairns, B. D. (2003). Different forms of aggression among inner-city

    African–American children: Gender, configurations, and school social networks. *Journal*

    of School Psychology, *41*(5), 355–375. https://doi.org/10.1016/S0022-4405(03)00086-4

Table 1. Descriptive statistics about the gossip, disdain, and respect networks

Network	mean	sd	min	max
Gossip networks				
Indegree w1	0.69	1.3	0	9
Indegree w2	0.93	1.53	0	10
Indegree w3	1.04	1.7	0	8
Density	0.03	0.02	0.01	0.09
Reciprocity	0.06	0.09	0	0.24
Jaccard coefficient w1-w2	0.1	0.04	0.04	0.16
Jaccard coefficient w2-w3	0.12	0.06	0.04	0.19
Disdain networks				
Indegree w1	1.46	1.65	0	12
Indegree w2	1.35	1.7	0	16
Indegree w3	1.41	1.83	0	13
Density	0.05	0.03	0	0.15
Reciprocity	0.08	0.09	0	0.38
Jaccard coefficient w1-w2	0.08	0.07	0	0.29
Jaccard coefficient w2-w3	0.08	0.07	0	0.25
Respect networks				
Indegree w1	1.58	1.67	0	15
Indegree w2	1.52	1.87	0	16
Indegree w3	1.6	1.89	0	14
Density	0.05	0.03	0.01	0.15
Reciprocity	0.14	0.1	0	0.52
Jaccard coefficient w1-w2	0.15	0.08	0.01	0.34
Jaccard coefficient w2-w3	0.12	0.09	0	0.3

Table 2. Stochastic actor-based models for the co-evolution of gossip and disdain for seven classes

	Class 1		Class 2		Class 3		Class 4		Class 5		Class 6		Class 7		Right-sided Fisher	Left-sided Fisher	classes
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE			
Gossip																	
outdegree (density)	-3.64***	1.02	-5.82***	1.01	1.73	2.51	-0.97	1.23	2.06	1.86	-3.41***	0.49	-0.94	1.21	0.899	< 0.001	7
reciprocity	0.80†	0.44	0.13	0.68	N.A.	N.A.	-0.13	0.74	1.37**	0.42	0.33	0.25	-0.45	0.85	0.003	0.939	6
indegree - popularity	0.65*	0.28	0.73*	0.34	0.4	0.66	0.83***	0.19	0.28	0.47	0.67***	0.14	0.79***	0.19	< 0.001	1.000	7
outdegree - activity	0.32	0.21	0.74**	0.27	-1.88	1.23	-0.56	0.44	-1.60*	0.8	0.33***	0.1	-0.64	0.45	0.002	0.061	7
truncated outdegree	-2.71***	0.76	N.A.	N.A.	-6.09***	1.76	-4.87***	1.1	-6.52***	1.46	-2.26***	0.54	-4.49***	1.11	1.000	< 0.001	6
boy alter	0.17	0.28	-0.49	0.51	-0.55	0.39	0.12	0.2	-0.06	0.23	0.02	0.18	0.38†	0.2	0.363	0.535	7
boy ego	-0.04	0.27	0.92†	0.53	-0.17	0.48	-0.47*	0.23	0.03	0.21	0.23	0.18	-0.13	0.19	0.360	0.337	7
same gender	0.42	0.3	1.32*	0.54	0.64†	0.38	0.45*	0.22	0.2	0.22	0.26	0.2	0.38†	0.22	< 0.001	1.000	7
Time dummy: ego	-0.76	1.21	0.02	1.68	-1.2	2.3	-1.07	1.05	2.5	1.84	0.12	0.75	1.26	1.13	0.478	0.622	7
Time dummy: ego x indegree - popularity	0.62	0.61	-0.11	0.69	0.77	1.35	0.08	0.37	-0.56	0.94	0.13	0.29	-0.32	0.39	0.568	0.744	7
Tima dummy: ego x outdegree - activity	-0.11	0.23	0.06	0.57	-0.04	0.82	0.68†	0.41	-0.95	0.73	-0.06	0.12	-0.53	0.45	0.694	0.290	7
Disdain																	
outdegree (density)	-1.99**	0.75	-4.37***	0.74	-2.13**	0.74	-3.47***	0.95	-2.59*	1.25	-3.02***	0.57	-2.77***	0.77	1.000	< 0.001	7
reciprocity	0.24	0.47	0.94*	0.37	0.02	0.7	0.24	0.4	1.16**	0.38	0.92***	0.22	N.A.	N.A.	< 0.001	0.997	6
indegree - popularity	0.59**	0.21	0.44	0.38	0.36	0.38	0.52*	0.21	0.01	0.75	0.74***	0.12	0.2	0.44	< 0.001	0.999	7
outdegree - activity	-0.01	0.22	0.64***	0.11	0.22†	0.12	0.36†	0.19	0.40***	0.11	0.27†	0.14	0.35*	0.16	< 0.001	1.000	7
truncated outdegree	-3.27***	0.77	N.A.	N.A.	-3.81***	0.68	-3.08***	0.83	-3.09***	0.67	-2.61***	0.75	-3.40***	0.68	1.000	< 0.001	6
boy alter	-0.29	0.19	0.29	0.3	-0.26	0.21	0.23	0.21	-0.04	0.22	-0.43	0.27	0.93**	0.29	0.047	0.199	7
boy ego	-0.02	0.17	0.15	0.31	-0.06	0.15	0.45	0.4	0.03	0.21	-0.12	0.29	0.01	0.25	0.579	0.806	7
same gender	-0.12	0.2	0.54†	0.31	0.08	0.2	0.15	0.22	-0.29	0.21	-0.3	0.27	0.37	0.29	0.259	0.522	7
Time dummy: ego	0.49	1.01	1.50	1.28	1.42	1.29	-0.44	1.14	-3.11	2.45	0.33	0.71	-0.08	1.23	0.366	0.744	7
Time dummy: ego x indegree - popularity	-0.67	0.42	-0.94	0.76	-1.30†	0.73	-0.43	0.4	1.73	1.51	0.32	0.23	0.23	0.75	0.612	0.079	7
Time dummy: ego x outdegree - activity	0.29	0.28	-0.16	0.21	0.19	0.19	0.32	0.22	0.13	0.14	-0.14	0.15	-0.16	0.19	0.227	0.686	7
Cross-network effects																	
gossip → disdain	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.35*	-1.63	2.09	-1.4	0.80†	-0.46	1.3	-1.02	0.002	1.000	4
disdain → gossip	2.08*	1.03	2.03**	0.65	2.38†	1.4	-0.51	1.02	0.47	0.5	0.27	0.28	0.47	0.89	< 0.001	0.996	7

Notes: † p < 0.1; * p < 0.05; ** p < 0.01; *** p < 0.001. Rate functions were estimated but are not presented in the table.