



The co-evolution of gossip and friendship in workplace social networks

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ABSTRACT

This study investigates the co-evolution of friendship and gossip in organizations. Two contradicting perspectives are tested. The social capital perspective predicts that friendship causes gossip between employees, defined as informal evaluative talking about absent colleagues. The evolutionary perspective reverses this causality claiming that gossiping facilitates friendship. The data comprises of three observations of a complete organizational network, allowing longitudinal social network analyses. Gossip and friendship are modeled as both explanatory and outcome networks with *RSiena*. Results support the evolutionary perspective in that gossip between two individuals increases the likelihood of their future friendship formation. However, individuals with disproportionately high gossip activity have fewer friends in the network, suggesting that the use of gossiping to attract friends has a limit.

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1. Introduction

Gossip and personal friendship ties are elementary building blocks of informal relations in organizations. These relations are an important quality of formal organizations, as previous research has shown that employees tend to be more cooperative and productive when their formal contacts are accompanied by informal ties (Mehra et al., 2001; Oh et al., 2004; Sparrowe et al., 2001; Sparrowe and Liden, 1997). Being the major channels through which collaborators can obtain information about the trustworthiness of their colleagues, workplace gossip and friendship complement each other in shaping an individual's reputation as a cooperative exchange partner (Burt and Knez, 1996; Burt, 2008). Friends base their positive assessment of each other's trustworthiness on their personal history of successful private exchanges with each other. An indirect way to determine somebody's reputation for being a trustworthy exchange partner is to acquire information through positive or negative workplace gossip: "informal and evaluative talk in an organization about another member of that organization who is not present" (Kurland and Pelled, 2000: 429).

There is much evidence that friendship relations and gossip ties are closely intertwined (Bosson et al., 2006; Burt, 2005; Ellwardt et al., 2012; Grosser et al., 2010; Jaeger et al., 1994; McAndrew et al., 2007; Peters et al., 2009). How exactly they influence each other is less clear. Some portray gossip as an instrument to reinforce an existing friendship relation between sender and receiver (Dunbar, 1996). Gossip about mutual enemies can reinforce existing

friendship relationships (Shaw et al., 2010; Wittek and Wielers, 1998), and instill trust, and confidence (Foster, 2004; Rosnow, 2001). But excessive gossipmongers also were found to have less stable cooperative workplace relations (Wittek et al., 2000), a finding that points towards a more complex, non-linear relation between gossip and interpersonal trust. Others suggest that anyone with an "interest in the maintenance of a norm and the application of sanctions" (Coleman, 1990: 284) will spread gossip about norm violators, because gossiping essentially is costless. Gossiping therefore does neither require a strong tie between sender and recipient, nor will it increase or decrease the likelihood that such a tie will emerge. Still others emphasize the relationship building character of gossiping (Burt, 2008: 11): "Gossip is about creating and maintaining relationships (...) It is not about accurate portrayal of the people and events discussed. It is about connecting the two people sharing a story". Through sharing stories and disclosing private information about their peers, the sender signals intimacy and closeness (Merry, 1984: 276–277). In this view, gossip can be a signaling device, a first step in the trajectory of building a strong personal tie to someone else.

In sum, gossiping is likely to affect the emergence, stability and decay of strong social ties in organizations. The major purpose of the present study is to disentangle the underlying social mechanism. This requires us to theoretically clarify the causal relation between them, and to empirically disentangle the co-evolution of both types of relationships.

Gaining insight into how gossip and friendship ties mutually affect each other contributes to the growing literature on the link between informal networks and cooperation in organizations. The strength of social ties is a major predictor of cooperative investment in social networks (Harrison et al., 2011). Strong informal relations in organizations have long been identified as important

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conditions that may either reinforce or hamper organizational processes as they are laid out in the formal organization chart, and as a result, there is increasing interest in the evolution of these intra-organizational networks. Gossip ties are likely to play a far more prominent role in this process than acknowledged.

In the next section, we further elaborate the theoretical background, and derive two sets of hypotheses from, respectively, social capital and evolutionary reasoning. Section three presents the research design and data of a longitudinal social network study among employees of a Dutch childcare organization. The analytical approach includes multiplex social network analyses, that is, modeling the co-evolution of gossip and friendship networks with *RSiena*. Section four presents the results, and section five concludes.

2. Theory

Two perspectives make predictions about the underlying causal mechanism between gossip and friendship. Despite their congruence in the stated positive relationship between both relationship types, the two perspectives contradict one another in the predicted causality.

2.1. Social capital perspective

Researchers using the social capital perspective have argued that affective relationships stimulate the flow of gossip between employees of an organizational network (Borgatti and Foster, 2003; Burt, 2005; Coleman, 1990), or as put by Merry, that “gossip flourishes in close-knit, highly connected social networks” (Merry, 1984: 277). This is because senders need to be tied to receivers who can be trusted not to reveal the source of the gossip.

A key assumption of the social capital approach to organizations is that being tied to resourceful others can provide access to critical resources and support at the workplace¹ (Brass et al., 2004; Labianca and Brass, 2006; Lin, 2001), as well as constrain one’s action opportunities (Burt, 2005). Individuals evaluate existing and potential new contacts with regard to the potential benefits they may yield. This holds true both for the sender (i.e., ego signaling interest in a friendship relation with alter) and the receiver (i.e., ego receiving signals that alter is interested in a friendship relation) of friendship signals. Friendship in ego-alter dyads is often mutual (Knecht, 2007). However, a friendship “nomination” by ego may not immediately lead to reciprocation with a friendship choice by alter, but involve some intermediate steps in which alter first gathers more information about the trustworthiness of ego. Intensifying one’s relationship with a new contact has opportunity costs for one’s existing network. The time and attention ego invests in the new contact may come at the expense of the time and energy invested in his or her existing contacts.

We posit that individuals who receive a friendship signal from a specific alter will first “reciprocate” with gossip. Ego does not yet know to what degree a specific alter who wants to establish a friendship relation can be trusted to make a sincere effort to become friends. Trust is the willingness to commit to a collaborative effort before knowing how the other person will behave (Burt, 2005). The nature of gossip implies communicating evaluations of third party behavior. Gossip senders approach gossip receivers with

whom they suspect that they interpret the reported behavior similarly, and thus share the gossip senders’ belief (Burt, 2005). This requires interpersonal trust: “when you exchange sensitive information with someone, trust is implicit in the risk you now face that the other person might leak the information” (Burt, 2005: 93). The trust embedded in friendships reduces potential drawbacks of gossip behavior, such as rejection and damage of reputation. At the same time, exploiting an interpersonal trust relation can cause considerable damage, given that such strong ties usually involve large investments in terms of time, resources, and emotions. A useful strategy to limit the potential damage from defection is to start with minor transactions and then gradually expand the exchange (Blau, 1964). Repeated positive experiences eventually manifest in trust. Once a mutual friendship tie is established, gossip can be expected to flourish even more. Sharing gossip with alter helps ego to establish to what degree alter is willing to reveal sensitive information from his own social network, and to assess whether alter will treat sensitive information confidentially: if the gossip returns back to ego, ego knows that alter is not trustworthy.

Given these assumptions, social capital perspective hypothesizes that the multiplexity of gossip and friendship emerges as a result of unreciprocated friendship nominations (of ego) first being reciprocated by gossip (of alter), before they eventually become mutual friendship choices:

Hypothesis 1a. If ego nominates alter as a friend, alter will reciprocate this with gossip behavior over time.

Employees who receive many friendship nominations – and thus are popular in the network – can choose from a wide range of potential friendship ties that they may reciprocate or not. While human beings have a strong need for affiliation and being popular is generally perceived as desirable (Baumeister and Leary, 1995), there is a natural limit, however, with regard to the number of close friendships that one can reciprocate and nourish on a regular basis (Dunbar, 2004). Reciprocating with gossip – a less committed and more sporadic activity – can be a means of nurturing interpersonal trust with others without having to renounce from the benefits of their friendship nominations in the future. Still, the safe environment of a potential friendship can be encouraging to trust others enough to share gossip with them. As a result, individuals who are popular as friends are expected to be particularly likely to gossip:

Hypothesis 1b. The higher the number of friendship choices received by ego, the more likely ego’s gossip activity will increase over time.

Note that whereas **Hypothesis 1a** addressed the dyadic level (multiplex ties between two employees, ego and alter), **Hypothesis 1b** now focuses on the nodal level (ego’s centrality in two different network types).

2.2. Evolutionary perspective

Evolutionary reasoning suggests that friendship is a product, not a precondition, of gossip (Bosson et al., 2006; Dunbar, 2004; Jaeger et al., 1994; Rosnow, 2001). Individuals establish and maintain informal relationships through gossip: providing discrete information on third parties works as a signal of trust and interest in a durable relationship (Bosson et al., 2006). Dunbar, for instance, proposes that gossip has “evolved as a mechanism for bonding large social groups” and that it is “the core of human social relationships” (Dunbar, 2004: 100).

Based on the finding that humans devote a significant amount of their conversation time (up to two thirds) to talking about absent others (Dunbar, 2004), evolutionary psychologists reason that gossip is a vital and effective instrument for individuals to find out about friends and foes in their wider social environment (Barkow,

¹ Social capital results from friendship relations and informal socializing, and was found to affect a large variety of individual or organization level outcomes, e.g. leadership effectiveness and power (Balkundi and Kilduff, 2005), performance of individuals and groups (Mehra et al., 2001; Oh et al., 2004; Sparrowe et al., 2001; Sparrowe and Liden, 1997), job satisfaction (Morrison, 2004), access to information, organizational learning, and innovation (Burt, 1992; Podolny and Baron, 1997), social control and interpersonal conflicts (Lazega and Krackhardt, 2000; Nelson, 1989).

1992; De Backer and Gurven, 2006; Dunbar, 1996, 2004; Emler, 1994; Hess and Hagen, 2006; McAndrew and Milenkovic, 2002; Wilson et al., 2000). Gossiping allows for an examination into the trustworthiness of one's existing contacts as well as potential new ones. It helps to detect free-riders, and to identify potential allies or sources of social support. By reducing the interaction opportunities of free-riders, gossip has a vital function both in the prevention of potential damage and its mitigation.

Gossip can signal a desire to deepen a relationship and thus play an essential role in the formation of new friendships over time in at least two ways. First, gossip was indeed found to be a means for advertising one's qualities as a friend (Dunbar, 2004; Gambetta, 2006; Hess and Hagen, 2006). Before entering a friendship relation with a specific other, disclosing private and secret information about someone else in one's network is a credible signal of faith in the other person, and a potential first step towards building interpersonal trust. The gradual process of relationship forming has also been described by social penetration theory (Altman and Taylor, 1973; VanLear, 1987), which compares an individual's personality to an onion skin, with public, easily accessible layers on the outside and private, hard-to-reach layers in the inside core. Over time individuals disclose increasingly more information from their inside core, however, only if others reciprocate this self-disclosure.

Second, gossiping also signals one's position in the overall social network of the group. The gossip sender can test receivers' reactions to the disclosure of information on third parties. Gossip is a social statement where senders signal that they are closer to the receivers than to the object of gossip (Merry, 1984).² Similarly, the receiver learns whether the sender shares the same friends and mindset. If the receiver has attitudes on third parties similar to the sender, the latter's suitability as a friend will increase in the receiver's perception. Several experimental and survey studies have demonstrated the role of gossip in the formation of friendships. They show that sharing positive information about friends and negative information about disliked others promotes interpersonal closeness (Bosson et al., 2006; McAndrew et al., 2007; McAndrew and Milenkovic, 2002), which is consistent with predictions from balance theory (Heider, 1958).

Compared to immediately entering a friendship relation and making oneself vulnerable to the exploitation of interpersonal trust that comes along with friendship, the risks associated with using gossip as a signaling device before entering a friendship are relatively small. If the receiver reacts negatively to the gossip, this may block the development of a friendship relation with the receiver and eventually result in a bad reputation for the sender as a gossipier, but it will not cause other losses that could result from a breach of trust in a friendship relation. In sum, we expect that individuals are likely to interpret a sender's repeated gossip behavior as a signal of intimacy and a shared mindset, which increases the likelihood that they respond with friendly feelings. Again, we assume that over time also ego is inclined to perceive alter as a friend.

Hypothesis 2a. If ego gossips to alter, alter will reciprocate with friendship over time.

Employees who frequently share gossip possess high information status in the group, meaning that they gather potentially exclusive news that is also of interest to many others in the group. This makes active gossipers particularly attractive as friends. They have a broad overview of what is going on in the group and hence are able to warn about potential frauds or suggest beneficial contacts to others. Therefore, establishing a close relationship with an

active gossipier can be an efficient instrument to monitor the behavior of others beyond one's own circle of influence. The evolutionary perspective implies further that group members interpret the generous sharing of gossip relevant to other members as a signal of commitment to the group (Dunbar, 2004; Ellwardt et al., 2012; Kniffin and Wilson, 2010). This, in turn, enhances the social status of gossip senders. Therefore, we expect that an employee's number of friends increases with the employee's tendency to spread gossip in the group. Note that again, while *Hypothesis 2a* addressed the dyadic level, *Hypothesis 2b* focuses on the nodal level.

Hypothesis 2b. High gossip activity by ego causes an increase in ego's popularity in the friendship network over time.

3. Research design and setting

3.1. Data

Panel data were collected in one site within a medium-sized Dutch non-profit organization at three time points, namely in Spring 2008, Autumn 2008, and Spring 2009. The organization was a major regional child protection institution. These data sets were collected in a site specializing in treating children with special needs, involving problems with their social, psychological, and/or physical functioning. This site employed 45 social workers, behavioral scientists, therapists, medical doctors, and administrative staff. It was an ideal size for this study because there were enough employees for longitudinal network analyses, but it was still small enough to be able to collect data on complete networks using self-administered questionnaires. The site operated rather independently from the organization, with the employees rarely engaging in contact with organizational members outside the site. Within the site, the organization was split into seven teams of two to eight employees, some of which were directly engaged in treating children, while others performed various support functions. None of the teams had formally designated team leaders or supervisors; instead, the teams were all managed centrally by one male manager. Only one of the remaining employees was male, and most were part-time employees.

Due to employee turnover, meaning that some of the 45 employees joined or left the site during the course of our study, the sample size varies between measurement waves. Turnover and non-response was relatively stable across the three waves, with non-response being higher among leaving and joining employees than among employees who stayed in the organization. The exact turnover and response rates are given in *Table 1*. In the first wave 29 out of 34 employees (85.3%) completed the survey. In the second wave 32 out of 37 employees (86.5%), and in the third wave 33 out of 38 employees (86.8%) participated. These response rates provide a solid basis for longitudinal network analyses, as good estimates can be obtained with missing data rates of 20% or less (Ripley et al., 2012: 57). The mean age of the employees was 36.11 ($SD = 11.39$), and on average they had been working in the organization for seven and a half years at the start of the study ($M = 7.62$, $SD = 5.68$).

3.2. Measures

Measures included network data, which captured the relationships between employees. Gossip and friendship relations, which served as co-dependent variables in the analysis, were assessed at three time points with a time lag of six months.

Peer-rated gossip with colleagues. In each of the three measurement waves, we presented respondents with a roster of the names of all employees working at the site. The respondents were asked to indicate from whom they had received gossip during the last three months. Due to the social disdain commonly associated with gossip

² The gossip sender, however, needs to take away the receiver's concern that the sender may also talk about the receiver himself when absent (especially when they are no friends yet).

Table 1
Employee turnover and non-response statistics.

	Wave 1		Wave 2 ^a		Wave 3	
	<i>n</i>	<i>n</i> non-response	<i>n</i>	<i>n</i> non-response	<i>n</i>	<i>n</i> non-response
Employees working in the organization	34	(5)	37	(5)	38	(5)
Employees staying after a wave	29	(3)	32	(3)	n/a	n/a
Employees leaving after a wave	5	(2)	5	(2)	n/a	n/a
Employees joining a wave	n/a	n/a	8	(2)	6	(2)
Total number of respondents <i>N</i>		29		32		33

^a Three employees worked in the organization during wave 1 and 3, but not during wave 2 (e.g., due to maternal leave). Two employees worked in the organization only during wave 2. Twenty-six employees worked in the organization across all waves, of which 20 completed the survey at all waves.

behavior, we refrained from using the term ‘gossip’ in the questionnaire to avoid social desirability bias, which had been found to affect self-reported gossip in earlier studies (Nevo et al., 1994). Instead, we asked whether they engaged in informal, evaluative talking about absent colleagues, which is in line with the definition by Kurland and Pelled’s (2000). As an additional measure to reduce social desirability and self-serving attribution bias, we asked respondents to name the person from whom they had received gossip (which is called a “peer-rated relationship”), rather than asking about self-reported gossip behavior (i.e., to whom they were sending gossip). Based on the gossip question we retrieved a directed, binary adjacency matrix for each measurement wave, where 1 indicated a present gossip relation, and 0 indicated an absent gossip relation.

Friendship. In addition to asking about gossip, respondents were asked to describe their social relationships with every other employee on the following Likert scale: (1) “very difficult,” (2) “difficult,” (3) “neutral,” (4) “friendly,” and (5) “good friend.”³ This directed, valued network captured the quality of the dyadic relationships within the network, as reported by each individual. Providing five answer categories rather than just two (e.g., friendship versus no friendship) made it easier for employees to answer our question on the relationships with every colleague. However, our theoretical approach and the analytical approach described below, required a dichotomized friendship variable. The distribution of the variable had primarily answer codes of 3 and 4. We therefore recoded all of the “friendly” and “good friend” relationships as 1, and the remaining types of relationships as 0 to identify friendships in the network (the term “friendly” is stronger in connotation in Dutch than in English and translates more directly to “friendship-like”). Again, based on the friendship question we retrieved a directed, binary adjacency matrix for each measurement wave, where 1 indicated presence of friendship nomination, and 0 indicated absence. Both friendship and gossip were incorporated as co-dependent network variables in the analysis, meaning that both networks operated as dependent and independent variables.

Controls. We needed to rule out differences in gossiping and friendship formation based simply on proximity and the amount of interaction employees had with one another. This was necessary because employees in our organization were assigned to formal teams and within those teams operated on differing work schedules due to their part-time contracts. Therefore, we controlled for formal team structure and weekly contact frequency in every dyad. In addition to that, several common network configurations and a period dummy served as control variables, which will be detailed in the Analytic Strategy section.

³ The question on relationship quality is roughly translated as follows: “With some colleagues we have a very good relationship. To some we would even confide personal things. With other colleagues, however, we can go along less well. The following question asks about your relationships with your colleagues. How would you describe your relationship with each of the following people?”

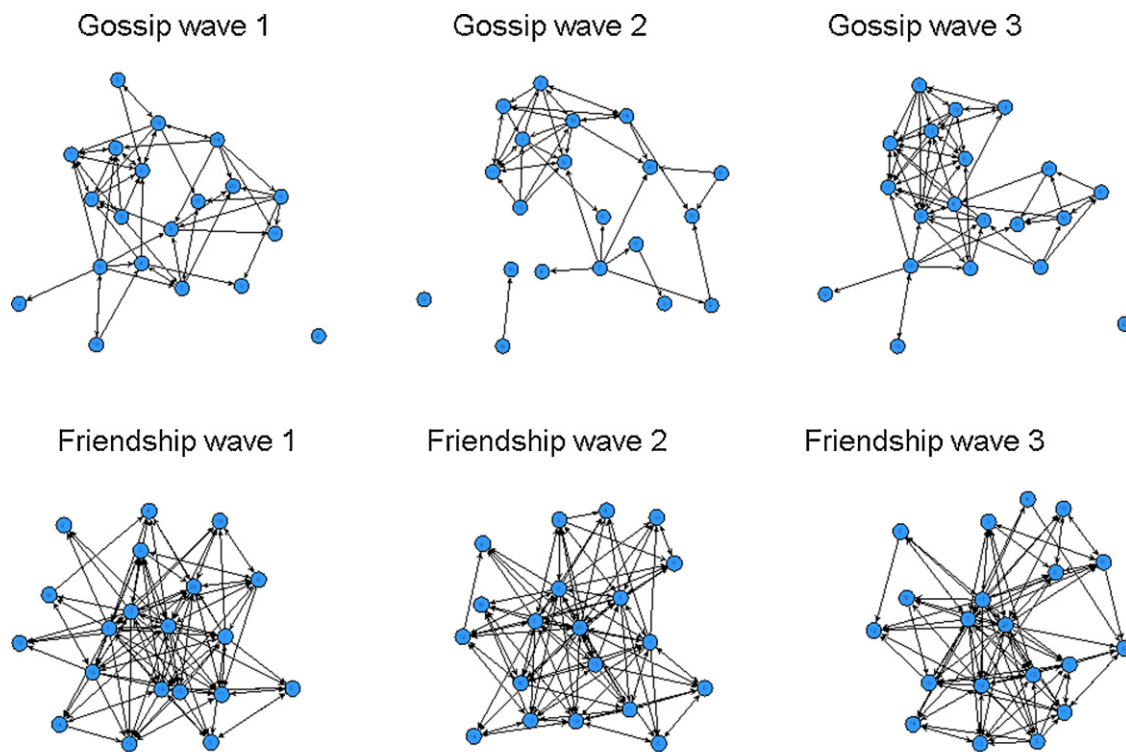
Formal team membership. As described above, the site was organized into seven teams with sizes of between two and eight employees. Prior to the study, the organization provided the data on the formal work teams in this site. Based on this information we created a symmetric, binary matrix on formal team membership, and tested whether being in the same group (i.e., high proximity) led to more gossip or friendship between two employees. Formal team membership was included as a constant dyadic covariate in the analysis.

Contact frequency. Because most respondents were contracted part-time, we needed to control for possible contact frequency. However, the number of contracted hours turned out to be a rather unreliable measure, because for some employees the actual hours worked differed largely from the contracted hours. Furthermore, we were interested in the possible contacts in every dyad. Therefore, we asked each respondent to study a roster of the site members and rate how often they had formal or informal communication with each colleague during the previous three months on a Likert scale that ranged from (1) “never” to (6) “eight or more times per week.” This communication network captured repeated patterns of work-related interaction between employees (Brass and Burkhardt, 1993; Scott and Judge, 2009), so that we could control for the employees’ amount of contact with each other. Contact frequency (in wave one and two) was included as a changing dyadic covariate in the analysis.

3.3. Methods of analysis: SIENA in R (RSiena)

Our hypotheses cover two distinct levels of analysis. On the one hand, we made predictions on the co-evolution of gossip and friendship ties in employee *dyads* (Hypotheses 1a and 2a). On the other hand, we hypothesized on the *nodal level* that the employees’ popularity in the group affects their gossip activity, and vice versa (Hypotheses 1b and 2b). So far, the co-evolution of multiplex relations has not been systematically addressed in the literature on intra-organizational network dynamics in informal groups. Previous research has modeled associations between multiple networks cross-sectionally, e.g. with exponential random graph models (Lomi and Pattison, 2006; Robins and Pattison, 2006), but it has not modeled multiple relations longitudinally (for an exception see Mucha et al., 2010). The complexity of our research questions requires such an approach specifically designed for longitudinal social networks analysis. We use an actor-based approach that models the co-evolution of several social networks and behavioral dynamics.

An actor-based model. To date, researchers have used the program SIENA, shorthand for Simulation Investigation for Empirical Network Analysis, to carry out the statistical estimation of models for repeated measures of social networks. SIENA has been most widely applied in the analysis of friendship networks in schools (Baerveldt et al., 2008; Burk et al., 2007; Dijkstra et al., 2010; Knecht, 2007; Sijtsema et al., 2010), and its growing popularity drives continuous development by social network researchers. The basics of



Note. Network pictures were created with the visualization program Visone 2.5.1. Only actors are represented who had worked in the organization site at all three time points of data collection.

Fig. 1. Gossip and friendship networks at three measurement waves.

the model are detailed in Snijders et al. (2010). In this paper we use a variant of the SIENA model that allows the study of multiplex networks.

Multiplex networks. In our analysis, both gossip network and friendship network serve as explanatory and as outcome variables. We will refer to the testing of several co-dependent (outcome) networks as a multiplex test. While we need a model where we can specify two co-dependent networks to estimate parameters for their co-evolution, the SIENA model traditionally used only allows the specification of a single dependent network. This shortcoming was overcome recently, when the SIENA package (which originally was part of the *Stocnet* software) was extended and implemented into the *R* software (Ripley et al., 2012). This *RSiena* package (which may also be called SIENA 4.0) allows analyzing multiplexity, more specifically whether a change in one co-dependent network causes a change in another co-dependent network. To our knowledge, this study is one of the first to investigate multiplex networks longitudinally.

Analytic strategy. A visual presentation of all effects in our model can be found in Table 2. More information on each effect and its statistical expression can be found in the latest *RSiena* manual (Ripley et al., 2012: 69–70). We proceeded in two hierarchical steps to specify the model. We first modeled control variables only, which can be classified into endogenous network configurations and dyadic covariates. Endogenous configurations are predominant structures in the network that influence changes and therefore require controlling. We controlled for configurations often observed to influence the dynamics of friendship networks (Knecht, 2007): out-degree (representing the tendency to create new ties), reciprocity, transitive triplets (representing the tendency to close triads), and 3-cycles (representing the tendency for generalized reciprocity). Changes in the network are expressed with rate parameters. We used the same control variables for modeling



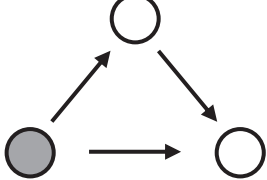
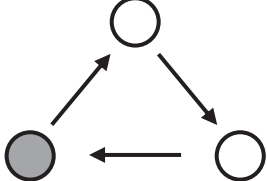


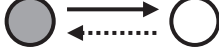
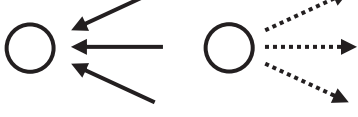
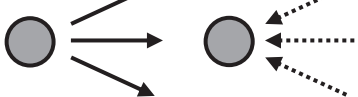
the friendship and the gossip network. The dyadic covariates, i.e. contact frequency and team membership, controlled for exogenous effects on the co-dependent networks. Furthermore, we included a dummy variable to avoid biases in the results due to large differences in change between the two time periods. The dummy was incorporated as a changing actor covariate in the model, with the code 0 for the first time period (between wave one and two), and 1 for the second time period (between wave two and three). Again, this was estimated for both gossip and friendship network. This first, more restricted, model gave an indication of control variables that needed inclusion in the overall model. If they turned out to be robust (which they generally did) in the overall model, we knew that the multiplex parameter estimates testing hypotheses had an effect independent of these control variables.

In the second step, we added multiplex parameters to the estimation to test our hypotheses. On the dyadic level, this included out-degree and reciprocity effects between gossip and friendship ties. On the nodal level, this comprised effects regarding the relationship between gossip activity and friendship popularity.⁴

The model parameters are estimated according to the requirements outlined in the model specification section, using an iterative stochastic approximation algorithm. Estimation was done using the Method of Moments (MoM, Snijders et al., 2007). The first observation is used as a starting point for estimating the network evolution process. Model estimation amounts to the identification of those behavior rules that fit best the observed trajectory of networks. To gain excellent model quality, as recommended by Ripley et al.

⁴ In the second step, we additionally ran models to separate out endowment (i.e., deletion of old ties) and creation (i.e., creation of new ties) effects. However, the data did not yield enough power to generate reliable results on endowment and creation. As a consequence, none of these estimates were significant.

Table 2
Effects in multiple SIENA.

Effect	Explanation	Graphical Presentation
<i>Endogenous network effects</i>		
Out-degree	Ego's tendency to create ties in a certain network	
Reciprocity	Preference for mutual ties between ego and alter in a certain network	
Transitivity	Ego's preference for creating ties with ego's friends' friends; measure for network closure	
3-Cycles	Negative values denote preference for hierarchical ties in the networks. Positive values indicate generalized reciprocity.	
<i>Exogenous network effects (multiplex)</i>		
Dyadic covariate	Ego's tendency to create ties in network A depending on ego's ties in network B	
Out-degree multiplex	Ego's tendency to create ties in network A together with ties in network B	
Reciprocity multiplex	Creating ties in network A by ego (out-degree) is reciprocated with nominations in network B by alter (in-degree)	
Popularity × activity multiplex	Ego's general number of received nominations in network A (in-degree) affects ego's general number of created ties in network B (out-degree)	
Activity × popularity multiplex	Ego's general number of created ties in network A (out-degree) affects ego's general number of received nominations in network B (in-degree)	

Note. Ego is represented with a dark circle, alter is represented with a bright circle. Parts of this table were taken from Sijtsema et al. (2010). Statistical representations for each effect can be found in Ripley et al. (2012: 70).

(2012: 86), all analyses were carried out with 8000 iterations and only used for interpretation when the convergence statistics were between -0.1 and 0.1 for all specified parameters.

4. Results

4.1. Descriptive statistics

In Table 3 descriptive statistics of all analyzed variables are presented. The largest in-between waves change was observed in the gossip network in which employees nominated on average five colleagues in the first wave ($M=4.72$, $SD=3.55$), three to four colleagues in the second wave ($M=3.56$, $SD=3.26$), and seven colleagues in the third wave ($M=6.76$, $SD=4.92$). The difference between the latter two waves was significant in accordance with a Wilcoxon's signed-rank test ($z(26)=-3.00$, $p<0.01$). Employees' friendship choices varied less in-between waves, with ten to twelve friends on average. At all time points, the friendship network was much denser than the gossip network. The networks are illustrated in Fig. 1.

Table 4 provides details on the relationship between the two co-dependent networks, gossip and friendship. The cross tabulation gives an overview of absolute counts and row percentages of employee dyads in which ego and alter were connected with a gossip tie only, a friendship tie only, both gossip and friendship ties, or not connected. In the upper half of the table, we plotted ego's nominations at the beginning of a time period (e.g., as measured in wave one) against ego's nominations at the end of this time period (e.g., as measured in wave two). The dyad counts were summed up for both time periods and contain information on ego's stability in nominating alters. When we look at the diagonal values in the upper half, we see that friendship nominations seemed more stable over time than gossip nominations: a gossip tie only had a likelihood of 17.3% to be observed in a later wave, while a friendship tie only had a much higher likelihood (three times as high) of 51.6%. Because we were interested in multiplex reciprocity, i.e. the responses that ego would cause in alter, we plotted ego's nominations against alter's nominations in the lower half of the table. This enabled causal interpretation of change in dyads during the two time periods.

Table 3
Ties, density, means (M) and standard deviations (SD) of the networks.

Variable	Wave 1 (N=29)				Wave 2 (N=32)				Wave 3 (N=33)			
	Ties	Density	M	SD	Ties	Density	M	SD	Ties	Density	M	SD
Gossip ^a	137	0.14	4.72	3.55	115	0.10	3.56	3.26	217	0.18	6.76	4.92
Friendship ^a	300	0.31	10.34	9.62	348	0.30	11.57	8.83	348	0.29	10.91	9.51
Contact frequency ^{a,b}	n/a	n/a	3.16	0.64	n/a	n/a	2.93	0.60	–	–	–	–
Team membership	146	0.26	4.29	1.85	–	–	–	–	–	–	–	–

^a Statistics calculated based on out-degree. Density was calculated by dividing the number of ties by the number of possible ties. Possible ties are the product of the number of invited people minus missing and the number of invited people minus one.

^b Because contact frequency was measured with an ordinal scale, number of ties and density is not provided for this network. Means of the ordinal scale were first calculated per actor and then used to calculate mean and standard deviation for the whole network.

Chi-squared analyses revealed that in both periods the distribution of the observed dyad counts differed significantly from a random distribution ($\chi^2(9, N=595)=110.20, p<0.001$ and $\chi^2(9, N=695)=174.30, p<0.001$). Note that Chi-square tests only give a quick and approximate impression of the observations, as the network data do not meet the test's assumption of independent observations. SIENA models are more principled. When we ignored cases without response, we observed that ego's gossip ties tended to be reciprocated with friendship nominations, or a combination

of friendship and gossip nominations by alter (in sum 43.75%). In contrast, ego's friendship ties were much less reciprocated with gossip or a combination of both friendship and gossip (in sum 20.69%). There was some indication that gossip produced friendship, whereas friendship produced in comparison little gossip. These insights already delivered slight support for Hypothesis 2a, stating a positive effect of gossip ties on friendship formation. However, an inspection of dyad counts yielded only vague results and was not a strict hypotheses test. For instance, we needed to control

Table 4
Dyad counts and percentages across periods.

		End of period: ego's nominations of alter				Total %
		No tie	Gossip tie only	Friendship tie only	Gossip and friendship tie	
<i>Beginning of period: ego's nominations of alter</i>						
No tie		694	37	103	19	853
		81.36	4.34	12.08	2.23	100.00
Gossip tie only		23	9	5	15	52
		44.23	17.31	9.62	28.85	100.00
Friendship tie only		97	19	175	48	339
		28.61	5.60	51.62	14.16	100.00
Gossip and friendship tie		17	6	28	62	113
		15.04	5.31	24.78	54.87	100.00
		End of period: alter's nominations of ego				Total %
		No tie	Gossip tie only	Friendship tie only	Gossip and friendship tie	
<i>Beginning of period: ego's nominations of alter</i>						
No tie		588	44	151	35	818
		71.88	5.38	18.46	4.28	100.00
Gossip tie only		25	2	11	10	48
		52.08	4.17	22.92	20.83	100.00
Friendship tie only		136	8	117	58	319
		42.63	2.51	36.68	18.18	100.00
Gossip and friendship tie		13	8	37	47	105
		12.38	7.62	35.24	44.76	100.00

Reading example: A gossip tie by ego at the beginning of a period was associated with a friendship tie by alter at the end of a period in 11 out of 48 dyad cases (22.92%). Missing responses are not included in the dyad counts. Ego is represented with a dark circle, alter is represented with a bright circle.

for reciprocity in both gossip and friendship dyads when examining multiplex reciprocity. Therefore, we turn to the multivariate analysis.

4.2. Results from RSiena

Table 5 reports the results from the RSiena models. The social capital perspective (Hypothesis 1a) stated that ego's friendship nominations are reciprocated with gossip behavior by alter in dyads. The results in model two did not support this assumption ($\theta = 0.03$, *ns*). Employees were not more inclined to gossip with colleagues who treated them as friends. Hypothesis 1b predicted an increase in general gossip activity for employees who are popular in the friendship network. For this assumption as well we could not find any support in the data ($\theta = -0.29$, *ns*).

The evolutionary perspective (Hypothesis 2a) reversed the causality of the social capital hypothesis, and suggested that gossiping facilitates friendship formation between employees. In support of this, the significant estimate in model two shows that gossip nominations tended to be reciprocated with friendship nominations in employee dyads ($\theta = 1.64$, $p < 0.001$). Gossiping employees became friends with their gossip partners. Hypothesis 2b predicted positive consequences of gossiping on the group level. According to this hypothesis, an employee's activity in the gossip network would increase the employee's popularity in the friendship network. The results revealed the opposite effect. The negative and significant parameter showed that an increase in degree of gossip caused employees loss of friendship nominations from their colleagues ($\theta = -0.25$, $p < 0.05$). Hence, this hypothesis was rejected. We only found verification for Hypothesis 2a.

The RSiena models contained some more parameters, which we will discuss briefly. The amount of change was modeled by so-called rate parameters for the two time periods (see bottom of table). We also controlled for endogenous configurations in each of the two co-dependent networks, gossip and friendship. These configurations appeared to be comparable: in both networks there was a tendency towards transitivity and generalized reciprocity (indicated by negative 3-cycle parameters) in triangles. However, dyadic reciprocity was stronger in the friendship network than in the gossip network. Furthermore, we controlled for ego's tendency to nominate alters as both gossip partners and friends. The positive and significant parameter suggested that friends were likely being sought out as gossip partners ($\theta = 1.14$, $p < 0.01$).

Finally, our dyadic covariates affected the co-dependent networks: being a member of the same formal team and having frequent contact triggered the formation of both gossip and friendship ties in employee dyads.

4.3. Post hoc analysis

We conducted a number of additional tests to examine the result's robustness and rule out alternative explanations. First, we wanted to know whether subsuming 'friendship relations' (code 4) and 'good friends' (code 5) affected our results, i.e. were results biased due to stronger effects of good friends? Out of 812 possible good friends, there were 30 in wave one, 18 (out of 930) in wave two, and 41 (out of 992) in wave three, which reduced the impact of good friends on the overall results. Second, to be certain, we re-ran the analysis for friendship relations only (code 4), by eliminating good friends (code 5 was set to 0). Overall, the results remained the same with the exception of the effect of gossip activity on friendship popularity (Hypothesis 2b) which was slightly reduced to an only marginally significant effect ($\theta = -0.20$, $SE(\theta) = 0.11$, $p < 0.06$). However, this was not surprising because the popularity measure was less precise once good friends had been excluded from the

analysis. This actually showed that active gossipers were inclined to lose good friends first.

Second, the disappearance of the significant gossip reciprocity effect together with the appearance of a significant friendship effect on gossip (ego's nominations) in the second model raised the question of whether gossip confounded with friendship instead of influencing it. RSiena allows testing for multiplex mutuality. It tests whether the creation of a tie in network A is facilitated by mutual ties in network B. Thus, whether gossiping resulted from mutual friendship, and whether friendship nominations resulted from mutual gossip. Adding these effects in the second model, however, caused the problem of over-specification and multicollinearity. To avoid this problem, we fixed the mutuality effects and ran score tests instead. Score tests indicate whether adding a certain parameter leads to a significant improvement of the model. Score tests revealed that the inclusion of neither multiplex mutuality effect (friendship nomination after mutual gossip: $c = 0.38$, $p = 0.54$; gossip sending after mutual friendship: $c = 1.71$, $p = 0.20$) made a significant contribution to the second model. From this we conclude, that the effect of gossip on friendship (cf. Hypothesis 2a) could not merely be explained by pre-existing reciprocal relationships, but rather that gossip made an independent contribution to the facilitation of friendship (on top of reciprocal friendship relations).

Third, we found that popularity did not increase an actor's likelihood to gossip towards others (Hypothesis 1b). One may also argue that popularity influences an actor's likelihood to receive gossip. For example, gossiping with unpopular employees may impose only limited repercussions. More specifically, gossip senders do not need to worry that unpopular receivers spread the gossip further to friends, and that disagreement with the gossip would damage the sender's reputation. This is because unpopular receivers have a peripheral position in the overall informal network. In an additional test, friendship popularity was not significantly associated with gossip popularity ($\theta = -0.18$, $SE(\theta) = 0.13$).⁵ Hence, being unpopular in the network did not increase an employee's attractiveness as a gossip receiver. Employees may not have picked unpopular colleagues for two reasons. First, these colleagues were poorly embedded in the informal network, and hence know little about others thus being unable to provide senders with extensive feedback on third parties. Second, absence of friendship should not solely be equated with social isolation, as there may be negative relationships present. Affiliating with unpopular receivers through gossiping may reflect back negatively on the sender, so that others may avoid the sender in the future. We now turn to the discussion of the findings.⁶

5. Discussion and conclusion

Organizational network literature has long since emphasized the importance of informal relations at work, as they facilitate interpersonal trust and formal cooperation between employees. Informal relations usually co-occur in multiple forms, and influence

⁵ We also ran an additional test of so-called selection effects. Popularity was operationalized as the number of received friendship nominations, and implemented as an actor covariate in the model part that predicted gossip. Again, the results revealed no significant selection effects for popularity of gossip receivers ($\theta = 0.01$, $SE(\theta) = 0.04$), and gossip senders ($\theta = 0.40$, $SE(\theta) = 0.82$).

⁶ Because tenure in the organization may have affected the likelihood of gossip and friendship between employees, we ran a selection test of tenure. Employees with similar tenure (i.e., more overlap in their employment duration) had an increased likelihood of a gossip relation. There was no such similarity effect in the friendship network. Employees with longer tenure had more friends in the organization. However, these effects did not influence the overall findings of the co-evolution models.

Table 5
Results from R-SIENA on the co-evolution of gossip and friendship.

Parameter	Model 1			Model 2		
	Est.	SE	t-Value ^a	Est.	SE	t-Value ^a
Outcome: gossip network						
Out-degree (density)	−1.94	0.14	−14.27***	−2.34	0.22	−10.64***
Reciprocity	0.78	0.26	3.02**	0.47	0.30	1.58
Transitive triplets	0.50	0.07	7.63***	0.49	0.07	7.40***
3-Cycles	−0.44	0.12	−3.50***	−0.40	0.13	−3.09**
Period	0.59	0.15	4.04***	0.58	0.15	3.80***
Same team membership	0.82	0.18	4.57***	0.64	0.18	3.60***
Contact frequency	0.27	0.06	4.36***	0.17	0.07	2.52*
Friendship (ego)				1.14	0.39	2.95**
Reciprocity friendship (alter)				0.03	0.32	0.10
Friendship popularity on gossip activity				−0.29	0.19	−1.58
Outcome: friendship network						
Out-degree (density)	−1.36	0.10	−13.84***	−1.73	0.16	−10.52***
Reciprocity	1.11	0.19	5.86***	0.78	0.23	3.32***
Transitive triplets	0.15	0.01	11.42***	0.16	0.02	9.46***
3-Cycles	−0.19	0.03	−5.84***	−0.17	0.04	−4.42***
Period	−0.33	0.10	−3.38***	−0.35	0.11	−3.19**
Same team membership	0.57	0.14	3.98***	0.42	0.16	2.60**
Contact frequency	0.28	0.05	5.54***	0.22	0.06	3.65***
Gossip (ego)				0.47	0.39	1.19
Reciprocity gossip (alter)				1.64	0.50	3.30***
Gossip activity on friendship popularity				−0.25	0.11	−2.40*
Network dynamics (changes)						
Gossip rate period 1	11.01	1.79		11.64	1.93	
Gossip rate period 2	11.67	1.99		12.00	2.12	
Friendship rate period 1	15.49	2.31		16.56	3.06	
Friendship rate period 2	14.54	1.97		15.09	2.23	

^a The *t*-values are calculated by dividing the parameter estimate by its standard error. They are not calculated for rate functions because a *t*-test would imply the null hypothesis that no change occurred. Change, however, was evidently measured in our data.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

one another in their dynamics (Brass et al., 2004). The present study examined the co-evolution of two informal relationship types, that is, interpersonal friendships and gossip about absent colleagues. Though previous research showed that the two are related, it has remained unclear whether friendships facilitate gossiping between employees, as implied by social capital perspective (e.g., Burt, 2001); or whether friendships are a product of gossip interactions, as proposed by evolutionary psychologists (e.g., Dunbar, 1996).

Applying the recently developed *RSiena* package (Ripley et al., 2012) to longitudinal social network data, collected in a child care organization during a period of one year, showed that gossip favors the creation of friendship relations, rather than vice versa (Bosson et al., 2006): gossip is often shared between employees who are not friends (yet). This finding is in line with evolutionary arguments, and puts into perspective the widely shared assumption that friendship is a necessary precondition for gossiping. However, contrary to our expectation (H2b), disproportionately active gossipmongers became less, rather than more attractive as friends through time.

High gossip activity may decrease a gossipmonger's attractiveness as a friend for two reasons. First, to the degree that someone becomes known as a gossipmonger, gossip receivers are less inclined to interpret the gossip behavior as a statement of trust and intimacy, but more likely to perceive the gossip as someone who will not treat sensitive personal information confidentially, and therefore are not trustworthy (Emler, 1994). Second, being constantly approached with gossip may raise the concern that the gossip sender also talks about them or their friends to others (Gilmore, 1978). Active gossipers may not be trusted to keep discrete information to themselves but be perceived as easily accessible sources of third-party information. They may be attractive conversation partners because they provide

much knowledge about the social landscape, but receivers will be reluctant to intensify the personal relationship or even become friends.

Several studies showed that active gossipers face the risk of losing the trust of others and being singled out by the group. In a study on an organizational network, Wilson et al. (2000) found that gossiping was perceived as acceptable when it served the group, e.g. it occurred in response to a norm violation, whereas self-serving gossip was judged harshly. Also Jaeger et al. (1994) reported isolation in a friendship network in response to frequent gossiping in their sociometric research on a sorority organization. Moderate gossipers had more close friends than high and low gossipers (Jaeger et al., 1994). However, because the reported study relied on a cross-sectional design, the sequential order of popularity and gossip remained unaddressed. Against the widely assumed linear increase in friendship formation due to gossiping, our findings hint at a curvilinear association similar to the one in Jaeger et al.'s study (1994). From these insights, we conclude that disproportional gossip activities are likely to be sanctioned. Taken everything together, the findings suggest that gossiping leads to an improved relationship with a particular colleague, while the overall effect is greater shunning by the broader network. This means that the group turns away from rigorous gossipers, and their total number of positive relationships decreases.

Our findings suggest that the literature on friendship relations has underestimated the role of gossip as an antecedent. Most current models of friendship formation focus on dyad-level and person-specific characteristics, like homophily (e.g., De Klepper et al., 2010; Knecht, 2007; Zeggelink, 1995), or draw on balance theory (Heider, 1958) to incorporate the broader social environment of the dyad. Gossiping may play a crucial but so far neglected role in these processes. When deciding whether or not to intensify

the relationship with alter, gossip can help individuals to anticipate the structure of alter's network.

More generally, our findings suggest that gossip represents a "sounding device" which helps individuals to explore and monitor their social landscape. Before creating new friendships, gossip assists individuals in learning about the trustworthiness of potential friends before they have met them. The notion of gossip as a sounding device in fact is congruent with both the evolutionary and the social capital perspectives, which differ in the hypothesized sequence with which the two types of relationships co-evolve. However, because friendship relations are more stable than gossip relations, once built, friendships may eventually facilitate gossip.

We conclude by referring to a number of limitations of our study. First, data were collected in an organizational setting existing prior to the study, where informal networks had already been established. Opportunities for future research include experimental studies that pinpoint the co-evolution of friendship and gossip relations by examining empty networks (without any pre-existing relations) as a starting point. Second, future research may benefit from a more systematic investigation of co-evolution in a broader set of organizational contexts: our study was conducted in a non-profit organization in the child care sector, with mainly female pedagogic professionals – and a particularly sociable work environment as our exploratory ethnographic studies had shown. Third, it would have been preferable to distinguish between positive and negative gossip. We would assume both positive effects on dyadic friendship and negative effects on popularity to be stronger for negative than positive gossip. Future research may also address reciprocal gossip relations in more detail. One would expect friendship nominations to ensue from mutual gossip. Interestingly findings from our post hoc analysis did not show this, which weakens the claims made by the evolutionary perspective. Not all of the underlying mechanisms between gossip and friendship may have been captured and unraveled in our study, so that more works needs to be done to fully understand the co-evolution of these two relationship types.

A key finding of our study is that talking about absent colleagues can strengthen informal relationships between employees. Whereas much effort has been put into studying organizational outcomes of interpersonal friendship relations, comparatively little is known about consequences of workplace gossip (for an exception see Wittek et al., 2000). Practitioners commonly attribute negative consequences to gossip (Baker and Jones, 1996; Greengard, 2001). The present findings, however, propose that managers may not need to worry about gossip as much because, first, gossip comes with potential benefits, and second, extreme gossip behavior of individuals may be regulated by the group of employees (Grosser et al., 2012). Future research might benefit from a stronger focus on the effects of gossip, and an assessment of the joint as well as relative impact of gossip, friendship and other types of relations. Informal relations at work may have both detrimental and beneficial individual and organization level outcomes such as social support, cooperation, knowledge sharing, advice giving, well-being, satisfaction, politicking, and performance (Oh et al., 2004; Sparrowe et al., 2001). To fully grasp the antecedents, dynamics, and consequences of "the informal organization", we need a fuller understanding of the co-evolution of multiplex networks. Our findings show that gossip deserves to be part of this research agenda.

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