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Similarity in friendship networks: Selection or influence? The effect of constraining contexts and non-visible individual attributes

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ABSTRACT

Most research on similarity in friendship networks focuses on clearly visible individual attributes (i.e. attitudes and behaviors) in contexts where choices whom to befriend are relatively unconstrained. These studies often reveal that *social selection* rather than *social influence* is the dominant cause of similarity among friends. We argue that in a setting where social collaboration is crucial and friendship choices are more constrained, *influence* might be the main reason for similarity found among friends. In addition, we examined whether social categorization and peer control amplifies the social influence process among friends. Using a stochastic actor-based model for network dynamics, we analyzed a three-wave dataset of first year Royal Netherlands Naval College officer students on friendship formation and military discipline. The data supports our first hypothesis that students adjust their own military discipline to that of their friends. Contrary to our expectations, we did not find support for the idea that individuals adjust their discipline more to friends who are of the same military specialty, and neither more to friends who exert peer control. We elaborate on these findings in the discussion.

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1. Introduction

A well-established finding in social sciences is that people who are friends exhibit a great deal of similarity in attitudes and behaviors (McPherson et al., 2001). The main argument underlying this finding is that friendship relations – characterized as relations in which individuals socially interact and like each other – involve a need for shared mutual understanding, which is expressed in similarities between two people (Byrne, 1971; Granovetter, 1973; Huston and Levinger, 1978; Krackhardt, 1992; Zeggelink, 1995).

As a result of the finding that similarity in friendship relations occurs very often, researchers sought to understand which processes cause similarity in friendship relations. Generally, it is understood that similarities among friends are a result of both social selection and social influence processes (Cohen, 1977; Kandel, 1978). That is, befriended individuals are similar because they *develop* relationships with similar others (i.e. *social selection*), but also because they *become similar* through their relationships with others (i.e. *social influence*). As selection and influence assume opposing causal mechanisms, one can only determine the relative importance of both selection and influence by studying friendship networks and similarities in attitudes and behaviors longitudinally. By considering both changes in attitudes and in behaviors over time, it is possible to empirically separate selection effects from influence effects (Kandel, 1978; Reifman et al., 2006). So-called co-evolution studies that aimed to separate and to determine the relative importance of selection and influence found that selection rather than influence is the most important, or even only, process that leads to similarity in attitudes and behaviors among friends (e.g., Cohen, 1977; Ennett and Bauman, 1994).

Close examination of these studies, however, reveals one important limitation. The friendship networks and types of attitudes and behaviors in these studies are all studied in contexts that are low in organizational constraint. We argue that in a context with stronger organizational constraints – i.e. where individuals are expected to work together to fulfill the requirements of their job – influence will be a stronger predictor of similarities between friends than selection. Thus, our study attempts not just to understand the processes that cause similarities among friends, but also to determine *which contextual conditions* make either selection or influence more likely to be the main underlying mechanism.

The context we examine is the friendship network among a cohort of students at the Royal Netherlands Naval College (in Dutch abbreviated as KIM). We focus on similarity among befriended student officers with respect to compliance with rules and the acceptance of orders and authority, referred to as (military) discipline (Shalit, 1988: pp. 122–123). The KIM-setting suits our purpose because both friendship networks and discipline are developed within the military socialization program at the KIM, and are

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therefore subject to strong organizational constraints. Furthermore, the socialization program at the KIM specifically aims to homogenize officer students to fit the organizational norms and rules, of which discipline is a salient one (van de Aker, 2005). To get a full understanding of the relation between friendship networks and discipline similarity we will use a three-wave network-panel design (Snijders et al., 2007; Steglich et al., 2007).

Furthermore, we will extend the basic idea of friendship influence by arguing that the impact of one's friends also depends on the following two conditions. First, based on social categorization and social identity theory we argue that the influence of friends will be amplified if friends are similar in their membership of social categories (Deaux and Martin, 2003; see Turner et al., 1987 for more details). Second, we use social control theory (Gibbs, 1981; Wittek, 1999) to argue that individuals who are being socially controlled by friends are more likely to comply with these friends than with those friends who control less. By going beyond the basic friendship influence effect we will provide more in-depth understanding of social influence.

2. Theoretical background and hypotheses

Since the studies by Cohen (1977) and Kandel (1978) co-evolution studies have been on the network research agenda (e.g., Jussim and Osgood, 1989; Ennett and Bauman, 1994; Fink and Wild, 1995). Particularly, with the advancement of methods – notably the stochastic actor-based model (Snijders et al., this issue) – and the availability of (national) student panel (web)survey data, longitudinal research on the co-evolution of networks and behaviors has been able to spawn in recent years (Gifford-Smith and Brownell, 2003; Kirke, 2004; McCabe et al., 2005; Reifman et al., 2006; Henry et al., 2007; Hoffman et al., 2007; Mercken et al., 2007). Although these studies made considerable headway in disentangling influence from selection processes, the results in most papers show that selection is the predominant predictor of similarity. Two reasons may explain this consistent finding. Firstly, these studies investigate friendship in a hardly constrained context, such as secondary schools and high schools, and, secondly, they mostly look at *visible* individual behaviors, such as (risky) health behaviors like smoking and drinking.

In the following section we will argue that previous findings cannot be generalized to more constrained contexts (i.e. KIM) and to non-visible attributes (i.e. discipline).

2.1. Organizational constraint: network elasticity

One explanation for the finding that selection is strong in high school health studies can be found in Lazer's (2001) concept of 'network elasticity'. This is the degree to which individuals within a social context have a choice whom to interact with. In a school context network elasticity is high because students have considerable freedom to interact with whomever they like (van de Bunt et al., 1999). However, most other organizations have lower network elasticity as the formal structure largely prescribes with whom individuals have to collaborate and communicate. In other words, individuals are task interdependent (Shrader et al., 1989). Likewise, network elasticity is low in military academies because most of the work that has to be done is carried out in teams in which individuals are highly task interdependent on each other. In addition, military academies are so-called integrative systems. This means that there is a tight coupling of friendship ties and instrumental task-related ties (Ibarra, 1992). In such systems the friendship network tends to be structured by group rather than personal interests, because individual performances are to a high degree the result of the level of effort put into the teamwork. For our case this means that highly disciplined officer students have to deal with less disciplined others in teamwork, and vice versa. This limits their choice for same disciplined friends and increases the chance to meet differently disciplined others. In contrast, students from a regular school can more easily avoid differently disciplined others and have the opportunity to choose similar disciplined students as friends. So we expect that the low level of network elasticity at the KIM may limit the importance of selection effects based on discipline.

2.2. Organizational constraint: investiture versus divestiture socialization

As described above officer students have to work in teams to achieve some target, which necessitates a different type of learning compared to regular students. These differences in learning are reflected in the type of socialization that occurs in school settings compared to that in organizational and particularly military ones. Although both school programs and military academies are built to socialize newcomers to the job market and have many other similarities, they differ at least in one important dimension: the investiture versus divestiture dimension of socialization (Van Maanen and Schein, 1979; Saks and Ashforth, 1997). Schools are more likely to show an investiture socialization process, meaning that schools aim at building skills and attitudes of students without trying to change the personality traits of students. Military academies on the other hand show more divestiture processes which aim to strip away certain personality characteristics and from there to rebuild the individual's self-image based upon new organizational assumptions (Moelker and Richardson, 2002). So, these settings require the internalization of a collective identity, the acceptance of specific norms and values, and therefore involve shaping an individual's personal self-image on dimensions that are important for functioning in this setting (Dutton et al., 1994).

According to Jones (1986) this divestiture process leads to a custodian response by the student, or a so-called conforming orientation. Individuals will easily accept the status quo of norms as they start to consider themselves as custodians of common values. Therefore, they will be more susceptible to social influence in order to maintain common values and to feel socially integrated (Morrison, 2002). In school settings, on the other hand, where friendship is less subject to obligations with respect to norms among students, social influence is not easily accepted and ending a friendship is a simple cure for unwanted social influence (Berndt and Murphy, 2002). Since at the military academy discipline is considered an important common value, and because influence through friendship is acceptable, we expect strong social influence effects in the military setting.

2.3. Type of attribute: visibility

Next to the importance of context, we argue that it is also the nature of the individual attribute that determines whether selection or influence is to be expected. Non-visible individual attributes (like attitudes and opinions) are not likely to be important in the meeting phase of friendship development, because one needs to be acquainted *before* one can determine whether somebody is *similar* in this respect (van Duijn et al., 2003). Extending this argument, visible individual attributes might be more likely to lead to selection, while non-visible individual attributes can be expected to be more susceptible to influence. Evidence can be found in most co-evolution studies (e.g., Cohen, 1977; Ennett and Bauman, 1994 to mention two early studies) that show that selection effects rather than influence effects are found for *visible* individual attributes like smoking and alcohol drinking. Since discipline can be considered a largely non-visible individual attribute (or at least not visible after one or two behavioral incidents), we expect influence mechanisms to be more at work.

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To sum up, a context such as ours characterized by low network elasticity limits the free choice to interact socially with others. In addition, the divestiture nature of the socialization program makes the acceptance of influence on collective attributes like discipline, more effective. Finally, the non-visibility of discipline makes it unlikely that individuals will select friends based on discipline similarity. Combining these three arguments, *we expect social influence to be the more dominant predictor of discipline similarity in friendship networks*, *instead of social selection*.

2.4. Basic social influence

In studying the effects of networks on attitudes and behaviors, network research overwhelmingly relies on general social influence theories, such as social comparison theory (Festinger, 1954), and social information processing theory (Salancik and Pfeffer, 1977). According to these theories individuals have a tendency to compare their own attributes with those of others. Social comparison particularly occurs in new social environments like a freshman year. In their comparisons with others individuals will be influenced and consequently (partly) change their individual attributes such that they become more similar to those others.

Extending this basic social comparison argument, Deutsch and Gerard (1954) proposed a dual process model that distinguishes between normative and informational social influence. Normative social influence refers to one person (called ego) who conforms to another (called alter) because ego wants to meet the positive expectations of alter. In such a case ego changes his attribute (e.g., attitudes or behaviors), because ego *wants* to be like alter. Informational social influence follows from ego's willingness to accept information on a certain individual attribute from alter because it *convinces* ego that changing his[1] individual attribute to alter is advisable; ego is persuaded by factual information given by alter to change his attribute. Clearly, normative and informational social influences are empirically hard to distinguish (cf. Leenders, 1995), because they are heavily intertwined.

In friendship both normative and informational influence coincide. For instance if ego is a friend of alter, ego is socially attracted to alter (Huston and Levinger, 1978) and wants to be similar (i.e. normative social influence). In addition, friends trust each other and trust increases informational credibility (i.e. information social influence; Perloff, 1993). Thus, we treat friendship ties as the pipes through which normative pressure and credible information flows. Accordingly, we expect that the friendship relationship between ego and alter lead to the assimilation of ego's attribute to the attribute of alter(s) (Leenders, 1995). Since individuals have multiple friends in their networks and are potentially influenced by all of them, we have to extend the definition. Following Friedkin's (1995) definition of social influence, we expect that social influence occurs when ego assimilates his attribute to become similar to *all* friends in his network. As a result having more friends increases the level to which someone is influenced. Applied to our study, we expect the following.

H1. Students adjust their level of discipline to become more similar to the level of discipline held by their friends.

2.5. Social influence and social categorization

Many network researchers are aware of distinctions and subtleties in social influence theories (Friedkin, 1995, 1999), yet most hypotheses in network co-evolution research boil down to straightforward friendship-similarity effects. This, however, ignores the vast amount of social psychological influence research (Tajfel, 1978; Turner et al., 1987; see Turner, 1991 for a review). The difference in network influence research and social psychological influence research can best be described by Tajfel's (1978) 'interpersonal–intergroup continuum' (cf. the duality of persons and groups, Breiger, 1974):

> one extreme ... can be described as being "purely" interpersonal and the other as "purely" intergroup. What is meant by "purely" interpersonal is any social encounter between two or more people in which all the interaction that takes place is determined by personal relationships between the individuals and by their respective individual characteristics. The "intergroup" extreme is that in which all of behaviour of two or more individuals towards each other is determined by their membership of different social groups or categories (Tajfel, 1978: p. 43).

Network research is predominantly interpersonally oriented, while social psychological influence research focuses on intergroup processes (Hogg and Terry, 2000). The theoretical core of research on intergroup processes is explained in social identity theory (Tajfel, 1978) and self categorization theory (Turner et al., 1987).[2] The basic premise of these theories is that individuals not only define themselves in terms of individualistic characteristics to differentiate themselves from others, but also in terms of salient social categories (Tajfel and Turner, 1986; Turner et al., 1987). The more salient group membership (i.e. social category) is for the individual, the more he will refer to this group when defining himself (i.e. the process of social identification; see van Knippenberg and Sleebos, 2006), and the more he will be influenced by this membership (Turner et al., 1987). The individual will see himself as more similar to the other members of the social group, will internalize its norms and values and act more in the group's interests (see van Knippenberg, 2000 for a clear elaboration).

Since most natural settings are not either purely intergroup or purely interpersonal, but are rather a mix of these two extremes (Breiger, 1974; Tajfel, 1978; Stets and Burke, 2000; Deaux and Martin, 2003;), social influence research should take into account personal relationships between individuals as well as their group membership. As most social groups and categories are enacted through the interpersonal network and because the process of social identification is mostly induced by the interpersonal network (Deaux and Martin, 2003; Flynn, 2005), we argue that interpersonal influence will be more important. Additively, we argue that the presence of salient social categories has an impact on top of the effect of interpersonal influence. In the current research, we expect students' military processional specialties to be the salient category[3] (Franke, 2000). Hence we posit that specifically having friends in the same military specialty will determine the students' attitudes and behavior because 'the same category effect' will amplify the overall effect of being friends.

H2. Students' adjustment of discipline to the level of discipline held by their friends is more affected by the friends in their network that have the same military specialty.

2.6. Social influence and social control

Many studies of social influence that explore processes which lead to the private acceptance of behaviors or attitudes (Turner,

[1] For reader friendliness we use the male form for an actor, person, individual, or student, but mean the female reference as well.

[2] Identity theory is not discussed in this study, because this focuses on roles and role identities (Burke, 2006; Stryker and Serpe, 1982, 1994). The current study did not include variables that examine either roles or role identities.

[3] Students are very homogenous in race, age, and sex. Also, they all have the same military rank and privileges. Military specialty is in our case the most distinguishing social category and therefore likely to be of importance (Mehra et al., 1998).

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1991) assume that an individual is motivated to accept the attitudes or behavior of others, because he is persuaded by information received from others and/or socially attracted to others. However, an alternative approach has been proposed that explicitly focuses on the disciplinary role of peer members. This line of research starts with the idea that peers directly put pressure on one another leading to coercive compliance rather than voluntary acceptance (Raven and French, 1958; Gibbs, 1981; Turner, 1991). Peer control has been shown to foster group norm conformity and maintenance in organizations (Barker, 1993; Sewell, 1998; Lazega, 2000). This disciplinary role of peer control has been found to be particularly successful in trustworthy relationships, like friendship, because in those situations individuals are more likely to accept others' control efforts (Das and Teng, 1998; Wittek, 1999; Wittek et al., 2003). Therefore, we expect that the role of peer control affects the adjustment of discipline to friends, leading us to formulate our last hypothesis.

H3. Students' adjustment of discipline to the level of discipline held by their friends is more affected by the friends in their network that exert direct peer control.

3. Methods

3.1. Sample

As already described, our study differs from the classic school context. We tested the hypotheses using data collected among first year students of the Royal Netherlands Naval College (KIM); the naval division of the Netherlands Defense Academy. At the KIM, students are trained to become naval officers. In the first year, students' military and personal competences are developed, and they receive their military professional training. The first year program starts with a 4-month first period of *military training* or 'basic officer training', emphasizing mainly the physical and tactical development of the students. In the next 6 months, an important shift is made from military training to *military professional education*. During this second period, students receive their academic education on military science and strategic studies, but also on their chosen military speciality. Personal socialization processes of the students take place during the entire first year and are facilitated by multiple social activities (e.g., sport events, hazing, and galas). Besides, to ensure rapid socialization, the first year program is subjected to a tight and intensive schedule, where students are limited in leisure, space, and privacy (Moelker and Richardson, 2002).

As noted in Section 1 we stress that the KIM is appropriate to examine the effects of influence versus selection on (discipline) similarity in friendship networks. We are aware that research on military socialization showed that similarity among military students is partly due to self-selection by joining the military in the first place (Bachman et al., 2000), yet this only explains that military students are more similar to each other as opposed to larger society. We however explain the similarity *within* one setting, and within our military setting there is enough variation in discipline and change over time to explain for. Furthermore, self-selection explains the similarity of discipline at the time of entrance to the KIM. So it explains similarity among people *who are not friends* (cf. baseline homophily, McPherson et al., 2001). In this study, however, we are especially interested in testing how similarity in friendship arises, and how these friendship ties are established during the first year.

Longitudinal data were collected at three points in time by means of a websurvey (Roelofsma et al., 2005). The websurvey invitation was directed to all first year students ($N = 94$), and included an explanatory letter indicating the purpose of the study, a guarantee of strict confidentiality, and an electronic questionnaire. The first wave was collected during the first period of their training in October 2006 (response rate 100%) directly after the students had been at sea for a 3-week military exercise. The second wave was collected in February 2007 (response rate 83%) in the second week of the second part of their training. The third wave was collected in June 2007 (response rate 75%) at the end of the first year.

3.2. Measurements

Discipline. We based the dependent variable 'discipline' on both Shalit (1988) and a Netherlands Defense Academy statute on 'the attitudes and competences students need to acquire during their education' (van de Aker, 2005). The scale consists of four items on a 5-point Likert scale (from 1 = 'strongly disagree' to 5 = 'strongly agree'): "I carry out orders exactly as I'm told", "I live up to the rules and norms of the academy", "I follow the obligations I impose on myself", and "I display sufficient self-discipline". To overcome bias due to the use of the same scale format in all four items, we added one question with another answering scale (Podsakoff et al., 2003): "If you had to evaluate your level of discipline, what grade would you give yourself?". Three military staff members (i.e. majors), responsible for the education of Netherlands Defense Academy students, assured content validity of the developed items. Statistical reliability of our final five-item scale was satisfactory at wave 1 (Cronbach's $\alpha = .63$), wave 2 ($\alpha = .72$) and wave 3 ($\alpha = .75$).

Friendship relations between students were measured using one roster item (van de Bunt et al., 1999): "Please indicate which of the following definitions characterizes your relationship with the students mentioned below". The response scale consisted of four answering categories: troubled, neutral, friendly and friendship. As we only consider friendship, we extracted the category 'friendship' and formed an friendship matrix in which a cell_{ij} has value '1' if person i considers person j to be a friend, and value '0' if not.

Note that we are interested in the co-evolution of *discipline* and *friendship relations*, which means that these variables are both dependent as well independent variables. For the social influence part *discipline* is the dependent variable and *friendship* the independent variable, while for the selection part it is the other way around.

To test our first hypothesis we specified – based on the discipline and friendship relations data – an effect which we refer to as *total discipline similarity friends*. This effect of social influence takes into account the number of friends as well as the level of discipline of these friends (see formula 28 in the appendix of Snijders et al. in the current issue). A person having more friends is influenced more than someone with few friends, reflecting the importance of additional friends on the amount of influence on one's own attitude.

To test our second hypothesis we specified an effect called *total discipline similarity friends* × *same military specialty*. We extended the same basic formula of *total discipline similarity friends* by using a dyadic covariate – representing 'same military specialty' – as a moderator of the influence of friendship ties. This same military specialty network is a dichotomous symmetric matrix in which a cell is coded '1' if two persons have the same military specialty and '0' if two persons have a different military specialty. At the KIM, five different military specialties exist: Marines, Administrative Services, Electro-technical Services, Technical Services and Nautical Services. This effect reflects the influence on ego due to the discipline of his friends that have the same military specialty as ego.

To test our third hypothesis we specified an effect called *total discipline similarity friends* × *control*. Like with same military specialty, a dyadic covariate representing 'peer control' was used to weigh the basic *total discipline similarity friends* effect. Peer control was measured with one roster item based on Wittek's (1999) concept of direct control: "Please check off the students whom you at least once have asked to change his behavior/attitude the last three

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months". We transposed the control network, to get a matrix in line with our theoretical interest in 'friends who control ego' rather than in 'friends who ego controls'.

Control variables are *age*, *sex*, and *student's competence level*. Based on the peer-rating item "Please grade the following students on their level of competence as future officers", the student's average peer rating was used as a representation of the students' levels of competence. Since students at the KIM are trained in judging others competences and performances, this item should provide a fairly accurate representation of students' competence levels.

Controlling for selection. To overcome misattribution of discipline similarity to social influence instead of selection (Cohen, 1977; Kandel, 1978; Ennett and Bauman, 1994; Snijders et al., 2007), we controlled for discipline homophily, that is the extent to which students make friends with others who have similar levels of discipline. Additionally, we accounted for well-founded selection effects (see van Duijn et al., 2003), namely reciprocity, transitivity, and attribute-based similarity (or homophily) effects of age and sex but also on military specialty. Also for the dichotomous and continuous attributes we added attributed-based out- and indegree effects. Finally, we controlled for the peer control network and for the opportunities to meet among students. The latter one is operationalized as whether two students have their private rooms in the same corridor, or not.

3.3. Analysis

The proposed hypotheses are tested by means of so-called stochastic actor-based models for network dynamics. In this case, a dynamic network consists of actors that gradually change their ties over time, as in our case, friendship ties. The models are especially designed to model networks through time (i.e. network selection), taking into account the network structure (endogenous or structural effects), actor attributes, and dyadic covariates (exogenous effects). Endogenous network selection effects are for instance the tendency to reciprocate ties and the tendency to get engaged in transitive and balanced triplets. Exogenous network selection effects, on the other hand, are those that are related to actor attributes, such as the preference for ties with similar alters ('homophily effect'), or dyadic attributes, such as the occurrence of multiplex ties. Lately the actor-based models have been adapted to simultaneously model social influence processes (i.e. the effect of network structure on individual behavior) and network selection processes as explained above. Individual behaviors can refer to actual behavior (e.g., smoking or delinquency), but also to attitudes (e.g., job satisfaction, organizational commitment, or as in our case discipline) or individual performance measures. The combination of the two processes implies the co-occurrence of two types of dependent variables, change in network ties, and change in actor behavior. Actor-based models are capable to disentangle these two processes, and at the same time to do justice to the dependencies that by definition characterize network data structures. It is important to stress that it is the change in either network ties, or individual behavior that is being modeled (i.e. the difference between the data structure at some time point and subsequent moments). This is done using computer simulation in which the observed data serve as input. A detailed introduction to actor-based models is given in Snijders et al. (this issue). The models are implemented, under the name of SIENA, in the software package StOCNET. For more technical specifications we refer to Snijders (1996, 2005) and Snijders et al. (2007). The analysis results in parameter estimates and standard errors. The precise specification of the most appealing parameters is given in Snijders et al. (this issue), as are examples of how to interpret the outcomes.

4. Results

4.1. Descriptive statistics

Table 1 displays the changes of the dependent variable *discipline* between each two subsequent waves. The 'Down' column represents the number of downward changes in discipline (so less discipline) between two subsequent time points (in decimal units; 1 stands for 0.1 change in discipline), and the 'Up' column represents the number of upward changes in discipline (so more discipline) between two subsequent time points. Notice that the total amount of discipline change is larger from time point 1 to 2, than from time point 2 to 3. This is partly due to the fact that the number of students decreases over time (as a consequence of panel attrition and turnover), but also because norms among students tend to stabilize over time (Friedkin, 1999).

Table 2 reports the changes within the friendship network over time. The sum of the number of ties changing from '0' (no friendship) to '1' (a friendship) ($0 \rightarrow 1$) and '1' to '0' ($1 \rightarrow 0$) between subsequent observations are represented in the column 'Distance'. Again note that there are more ties initiated and broken between the first and second point in time than between the second and third point in time; the same explanation as given above applies here (cf. van de Bunt et al., 1999). The Jaccard coefficient expresses how much change there is between two consecutive moments (within a range from 0 to 1, 1 representing no change). For the two subsequent periods, the Jaccard coefficient are 0.325, and 0.469, respectively. As discussed by Snijders et al. in the current issue a Jaccard coefficient above 0.3 indicates that there is enough stability to justifiably apply actor-based models.

From Table 3 the means and standard deviations of discipline can be read. The mean discipline is slightly declining, which might indicate that students become somewhat less disciplined over time. One explanation could be that the second wave of the data collection took place when students started their second semester, at which point discipline is less enforced by the military staff.

In Table 4 two basic network descriptive statistics are shown, density of the friendship network and average degree (i.e. the sum of indegree and outdegree) per respondent. Again this table suggests a stabilization of friendships over time.

Table 1
Discipline changes in decimal units.

	Discipline		
	Down	Up	Total
From t_1 to t_2	136	76	212
From t_2 to t_3	105	64	169

Table 2
Friendship tie changes.

	Tie change				Distance	Jaccard coefficient
	$0 \rightarrow 0$	$0 \rightarrow 1$	$1 \rightarrow 0$	$1 \rightarrow 1$		
From t_1 to t_2	6263	457	400	413	857	0.325
From t_2 to t_3	5170	129	336	410	465	0.469

Table 3
Means and standard deviations of discipline.

	Observation time		
	t_1	t_2	t_3
Mean	3.6	3.5	3.4
Standard deviation	0.47	0.51	0.58

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Table 4
Densities and degree averages of the friendship network.

	Observation time		
	t_1	t_2	t_3
Density	0.11	0.12	0.08
Average degree	9.97	10.86	7.79

Table 5 reports the descriptive statistics of the variables other than the friendship network and discipline. At the KIM the majority is male, the average age is 21.5 years, student's peer-rated competence is on average 6.3, the majorities in military specialties are the marines and nautical services-officers. The density of the control network is 8.2%.

4.2. Results of SIENA analyses

Table 6 shows the results of two models, the basic co-evolution model in which we assessed the relative importance of selection versus influence, and a model in which all control variables are added to the basic model.

The *selection part* for the basic model shows significant *rate of change* parameters which indicates that there is considerably more change in friendship formation and dissolution between the first and second period (parameter estimate 17.1; $p < 0.01$) than there is between the second and third period (9.32; $p < 0.01$). The *outdegree* parameter is a basic control variable in the actor-based model. The fact that it is significant and negative (−1.06; $p < 0.01$) suggests that individuals are unlikely to make friends with random other individuals. The non-significant *discipline similarity* effect (0.20; $p > 0.05$) indicates that between periods, friendship is equally likely to occur between students with a similar level of discipline, than between students with dissimilar levels of discipline.

The significant *rate of change* parameters in the *influence part* of the basic model indicate that there are only slightly more changes in discipline between time points two and three (22.44; $p < 0.01$) than between time points one and two (19.45; $p < 0.01$). Like the *outdegree* effect in the selection part, the *linear shape* and *quadratic shape* effect are included as controls in the influence part. The *linear shape* effect is to check whether there is a upward drive for individuals to change their level of discipline (cf. Festinger, 1954). The *quadratic shape* is added to test whether the upward drive decreases as the level of discipline increases. This should correct for the difficulty for individuals to obtain the highest value for discipline. Since both *shape* effects are non-significant there is no upward drive in discipline. As expected the effect of *total discipline similarity friends* is positive and significant (0.87; $p < 0.01$). This suggests that students adjust their level of discipline to that of their friends, in such a way that a student that has more friends is also more influenced by the overall level of discipline held by his friends, than a student that has fewer friends. This finding confirms hypothesis 1. Besides, if we compare the significant and positive *total discipline similarity friends* effect in the *influence part* with the non-significant *discipline similarity* effect in the *selection part* we can conclude that as expected social influence is more important than social selection in predicting discipline similarity among friends.

Moving to the controlled model in Table 6, we notice that neither gender, nor age or competence level has a significant effect in the *influence part*, which indicates that none of these variables explain changes in discipline. Moreover, the *total discipline similarity friends* effect in the influence part remained positive and significant (0.77; $p < 0.05$), reconfirming hypothesis 1. Students seem to adjust their discipline to the level of discipline of their friends even when controlling for possible effects of gender, age and competence. The *shape* parameters remained the same as in the basic model.

For the *selection part* we again find a negative *outdegree* effect (−2.40; $p < 0.01$). Additionally, the endogenous reciprocity and transitivity effects are positive and significant (0.99; $p < 0.01$, and 0.10; $p < 0.01$, respectively). This suggests that students prefer to reciprocate friendship ties and are likely to befriend the friends of their friends. Furthermore, as expected most dyadic covariate effects are positive and significant, namely the *same specialty* effect (0.39;

Table 5
Means and standard deviations of the independent variables.

Exogenous variable	Mean/proportion	Standard deviation
Age	21.5	3.36
Sex (prop. of men)	86%	n.a.
Level of competence (range 1–10)	6.3	0.70
Military specialty		n.a.
Marines	35%	
Administrative	8%	
Electro-technical	8%	
Technical	11%	
Nautical	38%	
Control network (density)	8.2%	n.a.

Table 6
Parameter estimates and standard errors for the basic and the controlled co-evolution of friendship and discipline.

	Basic model		Controlled model	
	Par. est.	s.e.	Par. est.	s.e.
Selection: network as outcome				
Rate of change, t_1 to t_2	17.10**	0.97	28.39**	2.23
Rate of change, t_2 to t_3	9.32**	0.56	11.17**	0.95
Outdegree	−1.06**	0.03	−2.40**	0.09
Structural effects				
Reciprocity			0.99**	0.09
Transitive triplets			0.10**	0.01
Dyadic covariates				
Same specialty (centered)			0.39**	0.05
Control tie (centered)			−0.09	0.13
Opportunity			0.20**	0.07
Attribute effects				
Sex				
Alter			−0.21*	0.09
Ego			0.02	0.09
Similarity			0.29**	0.09
Age				
Alter			−0.03**	0.01
Ego			0.004	0.009
Similarity			0.63**	0.13
Competence				
Alter			0.02**	0.004
Ego			−0.02**	0.005
Similarity			0.43	0.23
Discipline				
Alter			−0.03**	0.007
Ego			0.02**	0.006
Similarity	0.20	0.31	0.02	0.34
Influence: discipline as outcome				
Rate of change, t_1 to t_2	19.45**	5.06	18.99**	6.33
Rate of change, t_2 to t_3	22.44**	4.42	22.34**	6.12
Linear shape	−0.04	0.03	−0.04	0.03
Quadratic shape	0.007	0.005	0.006	0.005
Total discipline similarity friends	0.87**	0.32	0.77*	0.30
Attribute effects				
Sex			−0.009	0.07
Age			0.006	0.009
Competence			0.006	0.004

Note: A parameter estimate divided by the standard error gives the t-value for a given effect. For a two-tailed test an absolute t-value higher than 1.96 indicates a significance of $p < 0.05$, and, an absolute t-value above 2.58 indicates a significance of $p < 0.01$. For reader-friendliness we added asterisks for $^{*}p < 0.05$ and $^{**}p < 0.01$.

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Table 7
Parameter estimates and standard errors for predicting discipline.

	Model H2		Model H3	
	Par. est.	s.e.	Par. est.	s.e.
Influence: discipline as outcome				
Rate of change, t_1 to t_2	19.22**	2.98	18.99**	3.37
Rate of change, t_2 to t_3	22.22**	3.34	22.10**	4.62
Linear shape	−0.04	0.03	−0.04	0.03
Quadratic shape	0.006	0.005	0.005	0.0053
Total discipline similarity friends	0.71*	0.31	0.79*	0.30
Total discipline similarity friends × same military specialty	0.44	0.85		
Total discipline similarity friends × control			−1.97	1.54
Attribute effects				
Sex	−0.01	0.07	−0.02	0.07
Age	0.006	0.009	0.007	0.010
Competence	0.006	0.005	0.008	0.005

Note: The selection part is not presented, because the results were the same as in Table 6.
* $p < 0.05$.
** $p < 0.01$.

$p < 0.01$) and the *opportunity* effect (0.20; $p < 0.01$). Students who are of the same military specialty and who occupy a room in the same corridor, and therefore have a higher chance to run into each other are more likely to become friends.

Furthermore, for each dichotomous and continuous attribute we controlled for (i.e. gender, age, competence, and discipline), we added three types of attribute-based effects. A *similarity* effect represents the tendency to choose friends similar with respect to some specific attribute. *Ego* and *alter* effects test, respectively, whether outdegree and indegree are dependent on this specific attributes. We find significant and positive effects for *age similarity* (0.63; $p < 0.01$) and for *sex similarity* (0.29; $p < 0.01$). Thus, students have the tendency to form friendship ties with others of the same sex and about the same age. Again, we do not find a significant selection effect for *discipline similarity* (0.02; $p > 0.05$). Interpreting the alter effects we find negative and significant effects for *sex* (−0.21; $p < 0.05$), *age* (−0.03; $p < 0.01$) and *discipline* (−0.03; $p < 0.01$). This means that men have a lower friendship indegree than women, and that the older a student is the lower his indegree is. It also shows that the more disciplined a student is the lower his indegree is. The *competence alter* effect is positive and significant (0.02; $p < 0.01$) which can be interpreted as follows: the more competent a student is, the higher his indegree in the friendship network is. Moving to the *ego* effects we find a negative and significant *competence* effect (−0.02; $p < 0.01$) and a positive and significant *discipline* effect (0.02; $p < 0.01$). Thus, the more competent a student is, the lower his outdegree is, and the higher a student's discipline level is the higher his outdegree is.

Table 7 presents the results regarding hypotheses 2 and 3. In this table we only show the influence part; we did however control for the complete selection part, but as the results are similar as in Table 6 we omitted them.

Our second hypothesis states that being friends has a more pronounced effect on the adjustment of discipline to the level of his friends if those two friends share a military speciality. This interaction effect between the total discipline similarity of friends and same military specialty is added in *Model H2* (Table 7). As the results show, this interaction effect (in Table 7 referred to as *total discipline similarity friends* × *same military specialty*) is not significant (0.44; $p > 0.05$), while the main *total discipline similarity friends* effect (which does not distinguish between friends according to military specialty) remains significant (0.71; $p < 0.05$). Hence, contrary to what we expected in hypothesis 2, we find that a student's adjustment of his discipline to the discipline held by his friends is *not* more pronounced when these friends are of the same military specialty.

Our final hypothesis (number 3) comprises the influence effect on student's discipline as a result of explicit direct control by his friends. In *Model H3* (Table 7) we tested whether the influence of friends (on individual discipline) is enhanced by peer control between friends. The parameter estimate of this effect, referred to as the *total discipline similarity friends* × *control* effect, does not support our hypothesis (−1.97; $p > 0.05$). On the contrary, since the effect is negative, it hints at the opposite, namely that students are in fact *less* likely to adjust their level of discipline to that of their friends, if those friends explicitly try to influence them. Since the effect is non-significant, however, we have to be very careful in making inferences.

5. Conclusion and discussion

This study examines the relative importance of social selection and social influence processes in a setting that differs from most existing co-evolution studies. We studied the co-evolution of friendship networks and students' levels of discipline at the Royal Netherlands Naval College (in Dutch abbreviated as KIM). This setting also gave us the opportunity to explore extensions of the general social influence mechanism.

Above all, our analysis showed that similarity in discipline among friends is due to influence rather than selection. In other words, befriended naval students are similar in discipline *not* because they *chose* similar friends with respect to discipline. So discipline similarity was not the result of *social selection* processes, but naval students *became similar* in discipline through their friendship relations. Hence, discipline similarity was assumed to be the result of *social influence* processes. As extensively argued in Section 2, social influence processes are likely to occur in settings where, first, there is low network elasticity (i.e. the degree to which persons have a free choice with whom to interact), and second, social influence is acceptable and generally encouraged by the higher echelon in a given setting. So, conditions that limit the freedom of friendship selection but increase the effectiveness or frequency of social influence attempts are important in determining the relative importance of social selection versus social influence. Furthermore, we argued that the type of attribute under examination is important. In short, the less visible an attribute is in the eyes of potential friends, the more likely dyadic similarity is an outcome of social influence through a friendship tie instead of selecting similar friends. Finally, next to social influence, we statistically controlled for often found social selection related effects. Nevertheless, we replicated previous findings such as demographic homophily, network closure (i.e. reciprocity and transitivity) and opportunities to meet. Therefore

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these causes can still be considered to be the baseline for friendship development as is shown in several state of the art special issues about the evolution of social networks (Doreian and Stokman, 1996, 2003; Stokman and Doreian, 2001).

With our findings we hope to stimulate future research to explore the conditions under which either social selection processes or social influence processes are dominant. The field would benefit from future research in several contexts that explores co-evolution processes whilst taking into account – next to the degree of visibility of attributes – two important contextual conditions. Firstly, by assessing how the opportunity and organizational structure determines the network elasticity of a given setting (Shrader et al., 1989; Ibarra, 1992; Lazer, 2001). The larger the number of organizational constraints individuals face, the lower the network elasticity. Secondly, future research should incorporate the type of socialization context of an organization. In our study we considered one important element of socialization, namely the investiture versus divestiture dimension. There are also other socialization dimensions (see Van Maanen and Schein, 1979; Saks and Ashforth, 1997) that may determine how the social influence process, as apposed to the social selection process, works (or works not) in a given setting. Concluding, we expect the scientific debate on the co-evolution of networks and behaviors and/or attitudes to benefit from more comparative research.

5.1. Unexpected findings, limitations and afterthoughts

We were not able to show that individuals' adjustment to friends is enhanced by having friends that are member of the same social category – in this case military specialty (hypothesis 2). The basic argument of this hypothesis is that members of a salient social category are influenced by the leading opinion of that social category (Turner et al., 1987). Individual members will be influenced in such a way that they will internalize the norms and values of the social category they are member of. As we did not find such internalization of discipline (so individuals were not influenced by same military specialty friends), we may conclude that discipline is not a salient norm in the military specialty groups. In other words, discipline may not be within the realm of social influence processes within groups consisting of persons of the same military specialty. However, we did find a significant effect of social categorization/identification as a basis for friendship selection. Individuals tend to befriend those persons that are member of the same military specialty.

We did not find confirmation for the assumed amplifying effect of direct peer control on influence (hypothesis 3). The fact that we found a negative effect, although non-significant, might indicate that to a certain extent people do not like to adjust their behaviors and/or attitudes to that of their friends when they are asked explicitly to do so. Given the overall influence effect this seems to indicate that people adjust their level of discipline unconsciously, so without the pressure of explicit control. There are two issues that we will raise regarding this finding. Firstly, we did not measure how often two friends directly controlled each other, but instead we only know whether they did so at least once. It could well be that only after repeated disapproval of misbehavior with respect to discipline, the amplifying effect is apparent. Secondly, it could be that the type of control considered (i.e. straightforward direct control) explains why we did not find this enhancing effect of peer control. In our survey we measured direct peer control, yet research also discerns more subtle types of indirect control (e.g., gossiping), formal control (e.g., complaining to superiors), and passive control (Wittek, 1999). Exploring these alternative control strategies may shed more light on the enhancing effect of social control on social influence. Despite that we were not able to find support for the effects of social categorization and direct control on social influence in this specific context, we nevertheless hope that this study inspires others to examine other types of control as they might be theoretically valid in other settings.

Finally, we note that discipline similarity among friends is not determined by selection effects partly due to the non-visible nature of discipline. However, research has shown that non-visible attributes do have an effect at later stages of friendship development (see for instance, van Duijn et al., 2003). We would claim, however, that this finding is not counterfactual evidence to our argument, but that this can be explained by what is called the *related attribute hypothesis*, described by Turner (1991: p. 27): "one compares with people who should be similar by virtue of related attributes". This suggests that individuals choose friends on the basis of visible but less salient attributes as a reliable predictor of similarity on more appealing and satisfying, but less visible attributes. We found, for instance, a strong preference for friends of the same military specialty. This specialty is literally marked on the shoulder epaulets of students. The related attribute hypothesis would predict that students choose friends from the same military specialty because they *assume* that these students have the same level of discipline (and other salient characteristics). Elaborating on this hypothesis is an interesting research venue for future research on selection processes.

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References

Bachman, J.G., Freedman-Doan, P., Segal, D.R., 2000. Distinctive military attitudes among US enlistees, 1976–1997: self-selection versus socialization. Armed Forces & Society 26 (4), 561.
Barker, J.R., 1993. Tightening the iron cage—concertive control in self-managing teams. Administrative Science Quarterly 38, 408–437.
Berndt, T.J., Murphy, L.M., 2002. Influences of friends and friendships, myths, truths, and research recommendations. Advances in Child Development and Behavior 30, 275–310.
Breiger, R.L., 1974. Duality of persons and groups. Social Forces 53, 181–190.
Burke, P.J., 2006. Identity change. Social Psychology Quarterly 69, 81–96.
Byrne, D., 1971. The Attraction Paradigm. Academic Press, New York.
Cohen, J.M., 1977. Sources of peer group homogeneity. Sociology of Education 50, 227–241.
Das, T.K., Teng, B.-S., 1998. Between trust and control, developing confidence in partner cooperation in alliances. Academy of Management Review 23, 491–512.
Deaux, K., Martin, D., 2003. Interpersonal networks and social categories: specifying levels of context in identity processes. Social Psychology Quarterly 66, 101–117.
Deutsch, M., Gerard, H.B., 1954. A study of normative and informational social influences upon individual judgement. Journal of Abnormal and Social Psychology 51, 629–636.
Doreian, P., Stokman, F.N., 1996. Evolution of social networks: introduction. Journal of Mathematical Sociology 21, 1–2.
Doreian, P., Stokman, F.N., 2003. Introduction. Journal of Mathematical Sociology 27, 85–87.
Dutton, J.E., Dukerich, J.M., Harquail, C.V., 1994. Organizational images and member identification. Administrative Science Quarterly 39, 239.
Ennett, S.T., Bauman, K.E., 1994. The contribution of influence and selection to adolescent peer group homogeneity, the case of adolescent cigarette smoking. Journal of Personality and Social Psychology 67, 653–663.
Festinger, L., 1954. A theory of social comparison processes. Human Relations 7, 117–140.
Fink, B., Wild, K.-P., 1995. Similarities in leisure interests, effects of selection and socialization in friendship. The Journal of Social Psychology 135, 471–482.
Flynn, F.J., 2005. Identity orientations and forms of social exchange in organizations. Academy of Management Review 30, 737–750.
Franke, V.C., 2000. Duty, honor, country: the social identity of West Point Cadets. Armed Forces & Society 26, 175–202.
Friedkin, N.E., 1995. A Structural Theory of Social Influence. Cambridge University Press, Cambridge.
Friedkin, N.E., 1999. Choice shift and group polarization. American Sociological Review 64, 856–875.
Gibbs, J.P., 1981. Norms, Deviance, and, Social Control—Conceptual Matters. Elsevier, New York.

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Gifford-Smith, M.E., Brownell, C.A., 2003. Childhood peer relationships, social acceptance, friendship, and peer networks. Journal of School Psychology 41, 235–284.
Granovetter, M., 1973. The strength of weak ties. American Sociological Review 78, 1360–1380.
Henry, D.B., Schoeny, M.E., Deptula, D.P., Slavick, J.T., 2007. Peer selection and socialization effects on adolescent intercourse without a condom and attitudes about the costs of sex. Child Development 78, 825–838.
Hoffman, B.R., Monge, P.R., Chou, C.-P., Valente, T.W., 2007. Perceived peer influence and peer selection on adolescent smoking. Addictive Behaviors 32, 1546–1554.
Hogg, M.A., Terry, D.J., 2000. Social identity and self-categorization processes in organizational contexts. Academy of Management Review 25, 121–140.
Huston, T.L., Levinger, G., 1978. Interpersonal-attraction and relationships. Annual Review of Psychology 29, 115–156.
Ibarra, H., 1992. Structural alignments, individual strategies, and managerial action: elements toward a network theory of getting things done. In: Nohria, N., Eccles, R.G. (Eds.), Networks and Organizations: Structure, Form, and Action. Harvard Business School Press, Boston, MA, pp. 165–188.
Jones, G.R., 1986. Socialization tactics, self-efficacy, and newcomers' adjustment to organizations. Academy of Management Journal 29, 262–279.
Jussim, L., Osgood, D.W., 1989. Influence and similarity among friends, an integrative model applied to incarcerated adolescents. Social Psychology Quarterly 52, 98–112.
Kandel, D.B., 1978. Homophily, selection, and socialization in adolescent friendships. American Journal of Sociology 84, 427–436.
Kirke, D.M., 2004. Chain reactions in adolescents' cigarette, alcohol and drug use, similarity through peer influence or the patterning of ties in peer networks? Social Networks 26, 3–28.
Krackhardt, D., 1992. The strength of strong ties: the importance of *Philos* in organizations. In: Nohria, N., Eccles, R.G. (Eds.), Networks and Organizations: Structure, Form, and Action. Harvard Business School Press, Boston, MA, pp. 216–239.
Lazega, E., 2000. Rule enforcement among peers: a lateral control regime. Organization Studies 21, 193–214.
Lazer, D., 2001. The co-evolution of individual and network. Journal of Mathematical Sociology 25, 69–108.
Leenders, R.T.A.J., 1995. Structure and Influence: Statistical Models for the Dynamics of Actor Attributes, Network Structure and Their Interdependence. Thesis Publishers, Amsterdam.
McCabe, S.E., Schulenberg, J.E., Johnston, L.D., O'Malley, P.M., Bachman, J.G., Kloska, D.D., 2005. Selection and socialization effects of fraternities and sororities on US college student substance use, a multi-cohort national longitudinal study. Addiction 100, 512–524.
McPherson, J.M., Smith-Lovin, L., Cook, J.M., 2001. Birds of a feather: homophily in social networks. Annual Review of Sociology 27, 415–444.
Mehra, A., Kilduff, M., Brass, D.J., 1998. At the margins: a distinctiveness approach to the social identity and social networks of underrepresented groups. Academy of Management Journal 41, 441–452.
Mercken, L., Candel, M., Willems, P., de Vries, H., 2007. Disentangling social selection and social influence effects on adolescent smoking, the importance of reciprocity in friendship. Addiction 102, 1483–1492.
Moelker, R., Richardson, R., 2002. Socialisatie op de KMA. In: Richardson, R., Verweij, D., Vogelaar, A., Kuipers, H. (Eds.), Mens en organisatie, de krijgsmacht in verandering. Mets & Schilt, Alphen aan de Rijn.
Morrison, E.W., 2002. Newcomers' relationships: the role of social network ties during socialization. Academy of Management Journal 45 (6), 1149–1160.
Perloff, R.M., 1993. The Dynamics of Persuasion. Lawrence Erlbaum Associates, Hillsdale, NJ.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88, 879–903.
Raven, B.H., French, J.R.P., 1958. Legitimate power, coercive power, and observability in social influence. Sociometry 21, 83–97.
Reifman, A., Watson, W.K., McCourt, A., 2006. Social networks and college drinking, probing processes of social influence and selection. Personality and Social Psychology Bulletin 32, 820–832.
Roelofsma, P.H.M.P., Bottema, C.W., Smeets, J.E.M., 2005. Examine: A Websurvey and Internet Research Tool. SLA Press, Amsterdam.
Saks, A.M., Ashforth, B.E., 1997. Organizational socialization: making sense of the past and the present as a prologue for the future. Journal of Vocational Behavior 51, 234–279.
Salancik, G.R., Pfeffer, J., 1977. An examination of need–satisfaction models of job attitudes. Administrative Science Quarterly 22, 427–456.
Sewell, G., 1998. The discipline of teams: the control of team-based industrial work through electronic and peer surveillance. Administrative Science Quarterly 43, 397–428.
Shalit, B., 1988. The Psychology of Conflict and Combat. Praeger Publishers, New York.
Shrader, C.B., Lincoln, J.R., Hoffman, A.N., 1989. The network structures of organizations: effects of task contingencies and distributional form. Human Relations 42 (1), 43–66.
Snijders, T.A.B., 1996. Stochastic actor-oriented models for network change. Journal of Mathematical Sociology 21, 149–172.
Snijders, T.A.B., 2005. Models for longitudinal data. In: Carrington, P.J., Scott, J., Wasserman, S. (Eds.), Models and Methods in Social Networks Analysis. Cambridge University Press, New York, pp. 215–247.
Snijders, T.A.B., van de Bunt, G.G., Steglich, C.E.G., this issue. Introduction to stochastic actor-based models for network dynamics. Social Networks.
Snijders, T.A.B., Steglich, C.E.G., Schweinberger, M., 2007. Modeling the co-evolution of networks and behavior. In: van Montfort, K., Oud, H., Satorra, A. (Eds.), Longitudinal Models in the Behavioral and Related Sciences. Lawrence Erlbaum, pp. 41–71.
Steglich, C.E.G., Snijders, T.A.B., Pearson, M., 2007. Dynamic networks and behavior: separating selection from influence, Submitted for publication.
Stokman, F.N., Doreian, P., 2001. Introduction. Journal of Mathematical Sociology 25, 1–4.
Stets, J.E., Burke, P.J., 2000. Identity theory and social identity theory. Social Psychology Quarterly 63 (3), 224–237.
Stryker, S., Serpe, R.T., 1982. Commitment, identity salience, and role behavior: a theory and research example. In: Ickes, W., Knowles, E.S. (Eds.), Personality, Roles, and Social Behavior. Springer, New York.
Stryker, S., Serpe, R.T., 1994. Identity salience and psychological centrality: equivalent, overlapping, or complementary concepts? Social Psychology Quarterly 57, 16–35.
Tajfel, H., 1978. Interindividual behaviour and intergroup behavior. In: Tajfel, H. (Ed.), Differentiation Between Social Groups: Studies in the Social Psychology of Intergroup Relations. Academic Press, London, pp. 27–60.
Tajfel, H., Turner, J.C., 1986. The social identity theory of intergroup behaviour. In: Worchel, Austin, W.G. (Eds.), Psychology of Intergroup Relations. Nelson-Hall Publishers, Chicago, pp. 7–24.
Turner, J.C., 1991. Social Influence. Open University Press, Buckingham, UK.
Turner, J.C., Hogg, M.A., Oakes, P.J., Reicher, S.D., Wetherell, M.S., 1987. Rediscovering the Social Group: A Self-categorization Theory. Blackwell, Oxford, UK.
van de Aker, P.J.E.J., 2005. Initieële officiersvorming. Nederlandse Defensie Academie.
van de Bunt, G.G., Duijn, M.A.J., van Snijders, T.A.B., 1999. Friendship networks through time: an actor-oriented dynamic statistical network model. Computational and Mathematical Organization Theory 5, 167–192.
van Duijn, M., Zeggelink, E.P.H., Huisman, M., Stokman, F.N., Wasseur, F.W., 2003. Evolution of sociology freshman into a friendship network. Journal of Mathematical Sociology 27, 153–191.
van Knippenberg, D., 2000. Work motivation and performance: a social identity perspective. Applied Psychology: An International Review 49, 357–371.
van Knippenberg, D., Sleebos, E., 2006. Organizational identification versus organizational commitment: selfdefinition, social exchange, and job attitudes. Journal of Organizational Behavior 27, 571–584.
Van Maanen, J., Schein, E.H., 1979. Towards a theory of organizational socialization. Research in the Sociology of Organizations 1, 209–264.
Wittek, R.P.M., 1999. Interdependence and Informal Control in Organizations. Thela Thesis, Amsterdam.
Wittek, R.P.M., Duijn, M., van Snijders, T.A.B., 2003. Frame decay, informal power, and the escalation of social control in a management team. A relational signaling perspective. Research in the Sociology of Organizations 20.
Zeggelink, E.P.H., 1995. Evolving friendship networks: an individual oriented approach implementing similarity. Social Networks 17, 83–110.

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