

# Revisiting Selection and Influence: An Inquiry into the Friendship Networks of High School Students and Their Association with Delinquency<sup>1</sup>

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*Les criminologues ont tendance à croire que les amis adoptent des comportements délinquants relativement similaires. Toutefois, on ne comprend pas bien la raison de cette similarité. On ne sait pas si elle provient d'une sélection ou d'un processus d'influence. Dans l'article, on explore ce sujet à l'aide de données longitudinales sur les réseaux d'amitiés entre étudiants et les comportements délinquants observés dans seize écoles secondaires hollandaises (n = 859). Aux fins d'analyse, on s'est servi de SIENA, une technique permettant l'analyse simultanée de la dynamique des réseaux et des comportements. Selon une méta-analyse, l'influence est un processus général qui ne varie pas d'une école à l'autre, tandis que la sélection a joué un rôle dans seulement 4 des 16 écoles.*

*Mots clés : délinquance, adolescence, sélection, influence, réseaux d'amitié*

*Criminologists tend to assume that friends are fairly similar in their delinquent behaviours. However, the process leading to this similarity is not fully understood. It is not clear whether similarity in delinquent behaviour among friends is the result of a selection- or of an influence process. In this article, we investigate this issue using longitudinal data on students' friendship networks and their delinquent behaviour in 16 Dutch high schools (n = 859). For the analysis, we made use of SIENA, a technique for the simultaneous analysis of the dynamics of both networks and behaviour. A meta-analysis showed influence to be a general process without variation over the schools, while selection played a role in only 4 of the 16 schools.*

*Keywords: delinquency, adolescence, selection, influence, friendship networks*

## I. Introduction

Most criminologists agree that delinquents prefer relationships with other delinquents (e.g., Aseltine 1995; Baerveldt and Snijders 1994; Baerveldt, Van Rossem, and Vermande 2003; Baron and Tindall 1993; Bender and Lösel 1997; Dishion, Andrews, and Crosby 1995; Elliot, Huizinga, and Ageton 1985; Fisher and Bauman 1988; Fletcher, Darling, Steinberg, and Dornbusch 1995; Gilmore, Hawkins, Day, and Catalano 1992; Haynie 2001; Jussim and Osgood 1989; Marcus 1996; Ploeger 1997; Poulin, Dishion, and Haas 1999; Reed and Rose 1998; Thornberry, Lizotte, Krohn, Farnworth, and Jang 1994; Vitaro, Tremblay, Kerr, Pagani, and Bukowski 1997). However, while there is certainly more similarity among friends than among non-friends regarding delinquent behaviour, the nature of the underlying mechanism for this similarity remains an open question. Some authors argue that the similarity is primarily the result of selection processes (Hirschi 1969). According to this view, delinquents choose other delinquents as friends, while non-delinquents prefer other non-delinquents. Others argue that it is mainly the result of influence processes (e.g., Sutherland and Cressey 1974). This latter perspective implies that people adapt their behaviour to that of their friends. Someone who has more delinquent than non-delinquent friends is more likely to become delinquent him- or herself. Although there is some evidence (e.g., Matsueda and Anderson 1998) that selection and influence are simultaneous processes, most authors see selection and influence processes as mutually exclusive.

Until recently, most studies on selection and influence processes were hampered by three important limitations on measurement, study design, and methods of analysis. First, many studies measured peer delinquency indirectly; that is, respondents were asked to give information about their own behaviour as well as that of their friends (Brownfield and Sorenson 1993; Bruinsma 1992; Frauenglass, Routh, Pantin, and Mason 1997; Gardner and Shoemaker 1989; Gilmore et al. 1992; Hayes 1997; Heimer 1997; Hundleby and Mercer 1987; Keenan, Loeber, Zhang, and Stouthamer-Loeber 1995; McCarthy 1996; Mears, Ploeger, and Warr 1998; Ploeger 1997; Reed and Rose 1998; Warr 1993; Warr and Stafford 1990; White, Johnson, and Garrison 1985). This approach has been criticized (Aseltine 1995; Kandel 1996), as people tend to exaggerate the similarity in behaviour between themselves and their friends. As a result, the association between the delinquent behaviour of respondents and that of their friends may be

overestimated (Weerman and Smeenk 2005). Second, studying selection or socialization processes requires longitudinal data, which are quite rare (Baerveldt et al. 2003; Haynie 2001; Knecht 2008). Cross-sectional data do not allow distinguishing between influence and selection processes. Third, until recently, one lacked the appropriate advanced techniques to analyse nested data such as students within classes or friends within networks of individuals. Multilevel techniques, which can account for interdependencies in the relationships of students nested in classes or schools, have only come into widespread use in the past decade (Snijders and Bosker 1999). In addition, the techniques necessary to analyse the processes of influence and selection simultaneously were developed just recently. Before that, most analyses of selection and influence accounted only for one side of the process and neglected the other. Fortunately, there have been important innovations recently (see Snijders 2001 and below, for a description of simulation investigation for empirical network analysis [SIENA]).

This article contributes to our understanding of selection and influence processes, while attempting to address the limitations mentioned above. The study on which it is based used direct measurements of friendship networks and of delinquency (measured at two points in time) and a newly developed technique for longitudinal network analysis (SIENA).

The remainder of the article is organized as follows. In section 2, we discuss some important studies on networks and delinquent behaviour. In section 3, we focus on the explanation for the similarity in delinquency levels among friends; that is, on selection and influence processes. Our data, our measurements, and the analytical model applied are outlined in section 4. Section 5 presents our results; and, in the last section, section 6, we conclude and discuss our findings.

## **2. Social networks and delinquency**

The importance of relationships for delinquent behaviour has long been recognized in the criminological literature. As early as the 1930s, Shaw and McKay (1931) observed that more than 80% of delinquent youths who were caught by the police acted, not alone, but together with others. Additionally, early criminological theories acknowledged the importance of the environment as opposed to personality characteristics for explaining delinquent behaviour

(Sutherland 1947). Some early criminological theories also acknowledged that social relations were more important than personality characteristics for explaining delinquency (e.g., Sutherland 1947). Despite these early studies stressing the importance of social relations, many studies focused either on the personality of the offender or on contextual characteristics, such as neighbourhood or school composition, while the effects of social relationships were not considered systematically (Birbeck and LaFree 1993). Over the last two decades, the number of studies examining the effects of social relations on delinquent behaviour has grown substantially (Haynie 2001). Haynie's research showed that the association between a respondent's delinquent behaviour and that of his or her peers is stronger than that of most other factors investigated (Birbeck and LaFree 1993: 1014). Further, the effects of socio-demographic characteristics decrease substantially when one controls for friendship relations (Sampson and Groves 1989).

### **3. Two explanations: Selection and influence**

As mentioned earlier, two possible causes for similarities in the delinquent behaviour of friends suggested in the criminological literature are influence and selection.<sup>2</sup>

The idea that people prefer similar others as friends – or, to put it differently, that homophily is a fundamental principle of social structure – can be traced at least back to the work of Lazarsfeld and Merton (1954), who discuss value- and status homophily as principles for the selection of others. According to Homans (1954/1974) people select similar others because those who are similar in socio-demographic background characteristics, in attitudes, and in behaviour understand each other better. This makes relationships with similar others relatively more rewarding and stable. Later, this argument was augmented by a supply-side argument (Blau 1978; Feld 1981; Verbrugge 1977) – the selection of friends is contingent upon the social composition of the pool of available others. The composition of such a pool is anything but random and it structures choices among possible friends. Within a school, the others available to become network members tend to have much more homogeneous background characteristics (socio-economic status, ethnicity, religion, locality, and so forth) than in society at large. As schools tend to be more homogenous in composition, the chances of meeting are considerably higher for two students with similar background characteristics

than for two students with distinct backgrounds. Feld (1981) has noted that shared *foci* (social settings that structure a person's actions and interactions) increase the likelihood of similarity in behaviour (for an overview of the literature, see Feld 1981; McPherson, Smith-Lovin, and Cook 2001). Hence, homophily with respect to delinquency may be a result not only of preference but also of the opportunity to meet – the “supply” of similar other persons. In fact, for many types of relationships and forms of behaviour, *assortative pairing* is corroborated by social research (Kalmijn and Flap 2001).

In criminology, Glueck and Glueck (1950) were among the first to introduce the principle of selection as a basis for (delinquent) associations. However, Glueck and Glueck never explicitly state that delinquency itself is the selection criterion. Reasons for selection might be the popularity or the status of the other person or some other feature rather than his or her delinquent behaviour. Studies of organized and gang-related crime introduced delinquency as a selection criterion in its own right: Individuals involve themselves in relationships to commit delinquent acts together (Venkatesh 1997). Social control theory (Hirschi 1969) also predicts that delinquents will preferentially select other delinquents for friends. Their poor social integration and general social disability prevents them from establishing strong and stable relationships, and delinquents associate with one another because of external threats or for lack of better alternatives. As a consequence, their relationships are weak, emotionally lacking, and superficial; or, as described by Hirschi (1969), “cold and brittle” (141; see also Hansell and Wiatrowski 1981, on the *social ability* model).

The contrasting idea that behaviour is influenced by social relationships can be traced back to Durkheim's (1897/1951) argument that all types of behaviour are influenced by social norms. Norm conformity is enforced through membership and integration in social groups. The more someone is integrated, the more she or he complies with the existing norm of the group in question. Hence, the degree of integration in, for example, church, family, schools, or voluntary organizations is crucial for explaining an individual's behaviour. Later, the arguments of Durkheim were extended by the assertion that norms can differ among intermediate groups and that, in general, all behaviour is affected by these norms. Criminologists were thinking along similar lines, yet regarded social influence more as a consequence of a learning process that occurs most easily through close and strong relationships (see the overview of Giordano, Cernkovich, and Pugh 1986). Differential association theory states that delinquent behaviour

is learned through social interaction within a group of friends, where delinquent standards, values, and know-how are passed on (Sutherland and Cressey 1974). Social relationships with delinquent peers, therefore, precede delinquent behaviour. An important shift here is that not only is pro-social behaviour learned through group membership and social relations; anti-social behaviour is, as well.

There is ample research on both mechanisms of homophily with respect to peer delinquency, yet the evidence is mixed. Slightly more studies seem to confirm the importance of selection processes (Elliott and Menard 1996; Knecht 2008; Reed and Rountree 1997; Snijders and Baerveldt 2003; Thornberry et al. 1994). Yet there are also studies stressing the importance of influence processes. For example, Aseltine (1995: 104) states that, “[F]or the most part, empirical tests of these competing theories have lent greater support to theories of peer influence.” Moreover, in psychology, the classic research on influence processes (Moscovici 1985; Sherif, Sherif, and Nebergall 1982) or social learning (Bandura 1977) further emphasizes the importance of influence processes.

These inconsistent findings can, to some extent, be attributed to methodological and statistical problems as well as to differences in sampling, measurement, and analysis. As mentioned above, research into selection and influence was confronted with a number of considerable obstacles. This, of course, does not mean that no earlier attempts were made to compare influence and selection processes systematically. For instance, Kandel (1978) used an elegant and simple solution in her study of selection and influence processes in delinquent behaviour among adolescents. She clearly formulated which network pattern could be expected to emerge under the assumptions of selection and influence, respectively. Next, she compared these expected patterns with those observed and found that the importance of selection and influence processes depends on the type of delinquency. Marijuana use is more affected by influence processes, while participation in minor delinquent acts involves more selection processes. Kandel (1978: 436) suggested that similarity in more strategic individual behaviour – like the use of marijuana in the United States in the 1970s – can be explained through selection processes rather than influence processes. Yet, as indicated above, due to a lack of appropriate statistical tools, Kandel was not able to take the nested structure of the data into account: students are nested within classes or schools and part of the variation in individual behaviour may be attributable to differences among schools. Furthermore, she could not establish

effects of one mechanism while controlling for the other; that is, estimations of influence effects were not controlled for selection and vice versa. In other words, she was not able to account for both processes simultaneously.

Our present study builds upon the discussion and the different findings on selection and influence processes and aims to contribute to answering the question of which of these processes is the more important one. We do not formulate specific hypotheses as to whether selection or influence processes are dominant or whether they can be combined. Rather, we explore our data with a newly developed method and attempt to figure out reliably which process is dominant.

## **4. Methods**

### ***Measurements***

Our data stem from the Dutch Social Behaviour study (DSBS) (Houtzager and Baerveldt 1999). This study sampled third-grade students from an intermediate track (MAVO) in secondary schools in urban areas in the Netherlands.<sup>3</sup> These schools are known to include a substantial number of adolescents at risk. Dutch high schools are quite homogeneous regarding education and organization. Any differences between schools can be attributed mainly to their location (urban/rural), the social background of the students, and the educational tracks offered. Differences between tracks are usually more important for educational outcomes and social behaviour than differences between schools. The students studied here are all from the MAVO track, a technical/vocational track that provides access to non-university higher education. Students within this track spend at least half their classroom hours together. There are no structural barriers hindering the formation of friendships with other MAVO students. Consequently, every student has ample opportunities to select friends from within the same track.

The DSBS study included a two-wave survey in classrooms. The first wave took place in 22 Dutch urban high schools in 1994/1995. All students in third grade were included in the sample. The sample consisted of 1,528 students aged between 13 and 18 years. One year later, 19 out of the 22 schools of the first wave participated again in the second wave (in 1996). A total of 990 students in 19 schools completed the survey in both waves, constituting the sample discussed in

this article. (Consequently, students who dropped out between the measurements were excluded.) The number of participating students per school varied from 34 to 129. In both waves, the sample was fairly evenly divided between girls (48%) and boys (52%). The majority (90%) of the students were born in the Netherlands. One third had at least one parent who was born outside the Netherlands, mainly in Surinam, Morocco, Turkey, or the Dutch Antilles. Because of the small number, in the sample, of migrants of any particular non-Dutch ethnicity, we only differentiated between *Dutch* and *non-Dutch* ethnicity in the analyses. Ethnicity was defined by origin of the parents. The networks of three schools could not be analysed because there were too few changes between the two points of measurement in friendships or in delinquency for a SIENA analysis to be feasible. The effective sample, therefore, consisted of 859 students in 16 schools.

The measurements used in DSBS had already been tested and used for an earlier study (Baerveldt and Snijders 1994). A strict protocol was followed for collecting the data. Teachers introduced the project and the researchers and then left the classroom. The researchers emphasized confidential treatment of all responses and took ample time to answer questions from the students. They also completed a process protocol about class behaviour during the session (time needed for completing the questionnaire; number and kind of questions asked; problems mentioned; etc.). This type of behaviour did not appear to be correlated with the mean class scores on key variables (delinquency, friendship networks). Most students reported that they enjoyed answering the questionnaire.

Different types of relationships were measured by standardized social network nomination questions. All the network items focused exclusively on relationships with other students in the same grade and the same school, yet not necessarily in the same class. In this article, we focus on *friendship relations* among the students, determined by the question, "Who do you consider to be your best friends?" Students were allowed to mention up to 12 persons within their grade at school. The literature suggests different measurements of friendship ties, depending on whether ties are acknowledged by the nominating student, by the nominated student, or by both. Our analyses showed no substantial differences in outcomes. Therefore, we only present friendship ties as measured by the responses of the nominating student.

Regarding *delinquency*, the respondents were asked how many times they had committed any of 23 possible offences, such as fare dodging,

shoplifting, petty theft, vandalism, and fighting unarmed (giving a punch) over the previous 12 months (see Table 2). The list was explicitly meant to measure minor delinquency related to adolescence (Moffitt 1993; 1994). The total number of offences resulted in a one-dimensional scale with good internal cohesion (Cronbach's  $\alpha = 0.87$  for wave 1 and 0.91 for wave 2). This result implies that there was no difference between the different types of offences: those who committed petty offences were also more likely to commit more serious ones and vice versa. The constructed delinquency scale consists of the sum score of committed offences. Note that we did not ask the students about the delinquent behaviour of their friends; students only rated their own delinquency.

Measurement of the other characteristics was quite straightforward: *sex* is a dichotomous variable, coded 1 for girls and 2 for boys, and the *ethnicity* variable distinguishes between students of Dutch origin (coded 0) and those of another ethnic origin (coded 1). Further, in order to control for the *importance of the school setting*, the students were asked to rate the relative importance of their friends at school as against those outside school (a 3-point scale).

### **Analytic strategy**

As mentioned above, much of the previous research suffers from the lack of proper statistical tools for the study of longitudinal data. Recently, SIENA was developed for that purpose: the analysis of simultaneous changes in network structure and behaviour (Snijders 2001; Snijders, Steglich, and Schweinberger 2007; Steglich, Snijders, and West 2006). In order to model the processes of selection and influence simultaneously, SIENA makes a number of assumptions: First, the observations at the different discrete points in time are the result of an underlying continuous time process, a Markov process with a continuous time parameter (Holland and Leinhardt 1977). This implies that the observed change between two points of measurement is the result of many unobserved changes between the two measurements and that, because it is a Markov process, only the current state determines the next state. Second, it is assumed that all actors act independently from each other. Third, the changes an actor makes in her or his relationships – for example, breaking off, maintaining, starting a new one – and the changes an actor makes in her or his behaviour are conditionally independent from each other. Hence the co-evolution of networks and behaviour is separated into two processes, a network change process (selection) and a behaviour change

process (influence). These processes are linked, but changes in an individual's network do not necessarily imply a change in behaviour as well. Fourth, it is assumed that someone can only make a single change at a time; that is, starting a new tie, breaking off another.

Because SIENA takes into account both the existing network configuration and the actors' behaviour, it can analyse selection and influence simultaneously in one model. It does so by modelling the possible paths of change in networks and behaviour between the measurement points. Note that this allows SIENA to discriminate between selection and influence and assess the probabilities of both processes. SIENA tests the effects of similarity of delinquency levels on the probability that new friendships will develop (selection) and the effects of the existence of friendships on adjustment of delinquency levels (influence). In addition, SIENA allows controlling for other conditions, like the effect of gender similarity on friendship formation or of gender on delinquency. Below, in Table 4, an example of the SIENA results is provided for one single school.

## 5. Results

Before estimating SIENA models, we will first describe some important findings. Table 1 shows that only about 9% of the students mentioned no friends at the time of the first interview and about 8% at the second assessment. On average, the number of friends had slightly but significantly increased from the first to the second assessment one year later (from about 3.9 (*SD* 2.9) to 4.1 (*SD* 3.0);  $t = -2.082$ ,  $df = 858$ ,  $p = 0.038$ ). Girls mentioned fewer friends than boys at both assessments. Girls mentioned 3.6 (*SD* 2.6) and 3.7 (*SD* 2.6) friends on average at waves 1 and 2, respectively; while boys mentioned 4.2 (*SD* 3.1) and 4.5 (*SD* 3.3) friends. The difference in number of friends between girls and boys was significant at both assessments (for wave 1:  $F = 10.876$ ;

**Table 1: Distributions (%) of 859 high school students according to the number of friends at two points of measurement (1995 and 1996)**

Number of friends	Wave 1—1995 (%)	Wave 2—1996 (%)
0	9.2	7.9
1–2	26.0	25.9
3–4	35.0	30.9
5–6	13.9	18.4
More than 6	15.9	16.9
<b>Average number of friends per student (<i>s.d.</i>)</b>	<b>3.90 (2.93)</b>	<b>4.12 (3.01)</b>

$df = 1/854$ ,  $p < 0.001$ ; and for wave 2:  $F = 18.514$ ;  $df = 1/854$ ,  $p < 0.001$ ). The number of friends did not differ by ethnicity.

During the one-year interval between the two assessments, the composition of many friendship networks changed drastically (results not shown in a table). Only 41% of the friends nominated in the first wave were still nominated as friends one year later. Note that, for most students, their friends within school did matter a lot: in wave two, the question was posed as to which friends were more important – friends outside school or friends at school. For more than 70% of the students, friends at school were either equally or more important, while for somewhat less than 30%, friends outside school were said to matter more.

Table 2 shows the percentages of students who had committed certain offences during the previous year. At first sight, these percentages are rather high, but one needs to bear in mind that many minor offences are included in the list. The offences with the highest incidence rate are fare dodging and shoplifting. Interviews in a pilot study indicated that shoplifting often referred to goods worth less than five euros. However, even taking this into account, the students' delinquency rates remained high.

In general, the Netherlands ranks as average among European countries with respect to overall crime rates but quite high when petty crime is considered (Research and Documentation Centre (WODC) 2003; Smit 2000). Yet we explain the high crime rates in our sample with reference to the fact that the educational track these students were enrolled in is known to include many adolescents at risk, in particular in the larger cities. And, our data were collected in cities rather than in rural areas, which again accounts for rates higher than average. Kassenberg (2002), using some of the same delinquency items for students from the same age group in a more representative sample of Dutch schools and tracks, reported lower but still substantial rates (124) for offences like fare dodging (31%), graffiti (28%), fighting unarmed (22%), and shoplifting (18%). We conclude that the delinquency scores presented here can be used for comparisons involving students in this type of school and track but cannot be generalized to the overall Dutch secondary-school student population.

We compared the delinquency rates across all respondents (including those who did not commit any offence). In both assessments, girls committed, on average, significantly fewer offences than boys

**Table 2: Percentages among 859 high school students who committed offences of specified types, during the last year, at two points of measurement (1995 and 1996)**

Type of offence	% committed at least once, 1995	% committed at least once, 1996
Shop lifting	40.3	41.3
Changing price tags in shops	32.2	33.8
Dodging fares	48.7	52.5
Buying goods that are stolen	26.0	35.3
Theft at school	35.3	34.6
Theft at home (money)	21.5	22.2
Money theft from other student	3.1	3.7
Jacket/coat theft from other student	0.3	1.4
Burglary in house or shop	6.3	11.4
Theft of a bike	12.2	17.8
Theft of a motor bike	2.9	4.8
Other theft	12.9	10.0
Graffiti	30.7	31.8
Vandalism in public transport	12.1	12.5
Vandalism on the street	20.5	22.4
Setting a fire	32.4	29.5
Damaging a bike	25.0	25.1
Damaging a car	18.0	19.6
Vandalism at school	24.6	19.3
Smashing a window	20.6	20.7
Miscellaneous vandalism	6.6	5.4
Fighting (unarmed)	35.5	34.6
Threatening with weapon	8.8	9.0
<b>Any of the above</b>	<b>88.6</b>	<b>88.8</b>

(wave 1, girls average = 5.3 (*SD* 5.9), boys average = 11.0 (*SD* 10.2);  $df=1/854$ ,  $F=97.343$ ,  $p<0.001$ ; wave 2, girls average = 5.3, (*SD* 6.6), boys average = 12.7 (*SD* 12.2); ( $df=1/854$ ,  $F=122.956$ ,  $p<0.001$ ). The delinquency rate did not differ with the ethnic origin of the students. A test for an association between ethnicity and committing at least one offence also was non-significant.

In Table 3, the students are divided into two categories: students with a delinquency score higher than 20 (maximum score 60) and students with a lower score. The table shows the probability that a student would select a delinquent or a non-delinquent as a friend, depending on her or his own delinquency status. Following Wasserman and Faust (1994), we calculated the probabilities by dividing the observed number of relations between two students by the

**Table 3: The probability of friendship nominations (%) among and between delinquent and non-delinquent high school students in 16 schools, in two waves (1995 and 1996)**

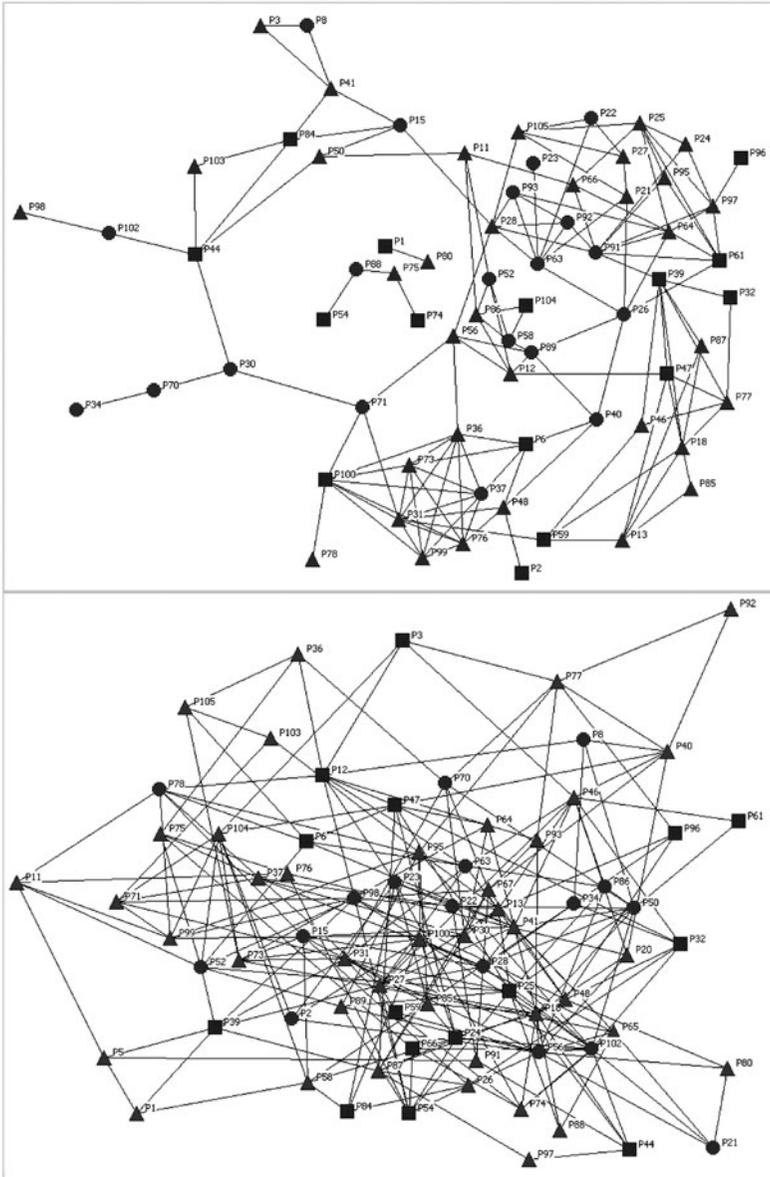
<b>Nominators</b>	<b>Nomination of non-delinquents</b>	<b>Nomination of delinquents</b>
<b>1995</b>		
Non-delinquents	2.8	2.8
Delinquents	2.6	9.2
<b>1996</b>		
Non-delinquents	3.6	3.3
Delinquents	2.6	5.7

number of possible relations. Note, that the number of possible relations in a network of  $n$  students is relatively large, namely  $(0.5 \times n) \times (n - 1)$ . Consequently, the number of all possible relations in all networks combined is also large. The probabilities in Table 3 were calculated by dividing the observed number of relations of a given kind by the number of possible relations of that kind. For instance, in the 1996 assessment, the non-delinquent respondents (over all 16 schools) could have nominated their delinquent fellow students 6,320 times as friends. Actually, they only nominated them 207 times. Thus, the probability of non-delinquent students' having a delinquent student as friend was  $207/6,320 = 3.3\%$ .

Table 3 further shows that non-delinquent students did not take the delinquency status of the other into account when establishing friendship relations, but that delinquent students did: They preferred friendships with other delinquent students. For instance, the probability, in 1995, that delinquent students would nominate other delinquent students as friends was 9.2% (49/534), while the probability that they would nominate non-delinquents was only 2.6% (120/4,611). In contrast, non-delinquent students did not take into account the delinquency status of their fellow students: they had equal probabilities of nominating non-delinquent and delinquent fellow students. In 1996, the probability of delinquent students' selecting delinquent friends decreased to 5.7.

As already explained, the analysis of delinquency-related selection and influence processes includes the simultaneous assessment of changes in both delinquent behaviour and friendships. In this study, the level of delinquent behaviour is given by the number of delinquent acts over the past year. Figure 1 illustrates how remarkably a social

**Figure 1: Students' friendship networks and delinquency in one school, in wave 1 (upper half of the figure) and in wave 2 (lower half of the figure). Squares indicate no delinquency or a low delinquency level, triangles indicate a medium delinquency level, and circles indicate a high delinquency level. Picture refers to school no. 23 in the data; see also Table 4**



**Table 4: Results of SIENA analysis of one school network (example)**

Parameter (SIENA models variables)	Estimate	Standard Error	t-value	
<b>Panel A: Selection</b>				
Network rate	1.989	0.223	4.434	**
Outdegree	-2.702	0.244	11.073	**
Reciprocity	2.263	0.242	9.351	**
Transitivity	0.616	0.089	6.921	**
Sex ego	-0.191	0.268	0.712	
Importance school friends	-0.026	0.199	0.235	
Delinquency ego	-0.029	0.123	0.243	
Sex similarity	0.381	0.194	1.964	+
Ethnic similarity	0.316	0.265	1.192	
Delinquency similarity	0.728	0.999	0.728	
<b>Panel B: Influence</b>				
Delinquency rate	0.746	0.2477	3.020	*
Delinquency tendency	-0.094	0.143	0.657	
Delinquency: effect of sex	0.410	0.330	1.231	
Delinquency of friends	1.666	0.822	2.026	+

\*\* $p < 0.001$ ; \* $p < 0.01$ ; + $p < 0.05$

network could change between the two assessments. It is based on a single school and includes all friendship nominations among the students. The students' delinquency levels are indicated by the symbols used for the nodes. (Squares indicate no delinquency or a low delinquency level, triangles indicate a medium delinquency level, and circles indicate a high delinquency level.) The figure was made in Netdraw (Borgatti 2002) and is based on multidimensional scaling in Ucinet VI (Borgatti, Everett, and Freeman 2002). It shows substantial changes in the network between the two points of assessment. The network as a whole became much more differentiated, with separated cliques in the middle. Also, other sub-groups became much more distinct. And, importantly, it also seems that – at least, in this school – the delinquent students became more closely linked over time, as they formed more direct friendship relations among themselves, were grouped closer together, and formed more distinct groups.

As an example, we present the results of a SIENA analysis for one school network in Table 4. Note that these results apply only to this single network and not to all 16 networks (see the summary Table 5 and text below). Panel A results pertain to the selection process, and panel B to the influence process. In panel A, the coefficients in the *estimate* column indicate the size of the effect on changes in the friendship network, while in panel B they indicate effects on the change in

**Table 5: Summary of results of MLWIN Meta analysis of SIENA results (n = 16 schools, 859 students)**

Parameter (SIENA models variables)	Estimate	Standard Error	t-value	
<b>Panel A: Selection</b>				
Network rate	1.535	0.106	14.481	**
Outdegree	-2.710	0.286	9.475	**
Reciprocity	2.032	0.111	18.306	**
Transitivity	0.510	0.025	20.040	**
Sex ego	-0.047	0.115	0.408	
Importance school friends	-0.061	0.063	0.968	
Delinquency ego	0.020	0.144	0.138	
Sex similarity	0.548	0.099	5.535	**
Ethnic similarity	0.021	0.061	0.344	
Delinquency similarity	0.847	0.368	2.301	+
<b>Panel B: Influence</b>				
Delinquency rate	0.386	0.070	5.510	**
Delinquency tendency	-0.057	0.055	1.036	
Delinquency: effect of sex	0.260	0.093	2.795	*
Delinquency of friends	0.495	0.204	2.426	*

\*\* $p < 0.001$ ; \* $p < 0.01$ ; + $p < 0.05$

delinquency levels. The coefficient of *delinquency similarity* at the bottom of panel A indicates whether similarity in delinquency levels had an effect on nominating someone as a friend. In this school, the delinquency-based selection processes did not play a significant role ( $t = b/se = 0.728/0.999 = 0.728$ , *ns*). In panel B, the coefficient of *delinquency of friends* indicates whether there was an influence effect with respect to the delinquency levels of friends. As we can see, the effect here was clearly significant ( $t = 1.666/0.822 = 2.026$ ,  $p < 0.05$ ).

The other significant coefficients in Table 4, panel A, refer to the control variables. The first four parameters capture general network dynamics. The values of these parameters all fall within the expected range. The *network rate* parameter captures the rate of change in the network and is positive, indicating that there was some change in the networks. The effect of *outdegree* is negative, indicating that the mean number of friendships compared with the number of possible friendships was low, which is consistent with the results in Table 3. Friendships are sparse relationships, and individuals do not associate with many others. The positive and significant *reciprocity* coefficient indicates that, in cases where a student nominated another student as a friend, that fellow student generally also nominated her or

him as a friend. This also implies that friendships are, in general, mutually acknowledged. The coefficient for *transitivity* indicates that there was a tendency to consider the friends of friends as one's own friends (Heider 1946; Holland and Leinhardt 1977). Besides these four general network indicators, three indicators of the main effect of a student's characteristics (sex, the importance of school friends compared to friends outside school, and delinquency level) on the likelihood of nominating someone as a friend are presented, none of which were significant for this network. To capture the selection processes, we included three indices for similarity in the model. The coefficient of *sex similarity* captures the degree to which individuals chose others of the same sex as friends. Surprisingly, this coefficient is not significant for this network. The coefficient of *ethnic similarity* can be interpreted in the same way: it indicates whether native Dutch students had a tendency to prefer other native Dutch students and non-Dutch to select other non-Dutch students. Again, this coefficient was not relevant in this school. Finally, and as already mentioned, we estimated the degree to which delinquents chose each other for friends, as indicated by the coefficient of delinquency similarity, which is not significant.

The first three coefficients in panel B, again, refer to control variables. The *delinquency rate* parameter is positive, which is in line with the expectations because it indicates that there was a change in delinquency over time. The *delinquency tendency* parameter indicates whether there was a rise in delinquency levels between waves 1 and 2. The coefficient is not significant, meaning that after controlling for all other variables no increase in delinquency levels was observed for this school. Finally, in this school, also no effect of *gender on delinquency* was observed. In this school, boys seem not to have been more delinquent than girls. Importantly, and as mentioned above, the delinquency of friends is significant, indicating that students adapted their delinquency towards the delinquency of their friends.

Again, it needs to be emphasized that the results discussed here pertain only to a single school and do not necessarily apply to the other schools in the sample. Furthermore, in an analysis across all schools, effects that fail to reach significance in a single school may become significant. To analyse all schools together, we applied a meta-analysis using MLwiN (Rasbash, Browne, Healey, Cameron, and Charlton 2005) to pool the results for the various schools (Snijders and Baerveldt 2003).<sup>4</sup> The results are shown in Table 5.

Again the coefficient for delinquency similarity captures the selection process. The result here shows that on average, over the 16 schools, the effect of delinquency similarity on friendship relations was significant ( $t = 2.301$ ), and hence, there is evidence of an overall selection effect. However, further inspection of the results shows that the delinquency similarity coefficient was significant for only 4 of the 16 schools, indicating that, in these schools, friends were, indeed, selected according to delinquency level. The effects were quite strong in these schools. The random component for this coefficient is significant, which indicates a substantial variation in the selection effects across the schools studied. Consequently, the degree to which selection processes played a role varied between schools. The influence process is again captured by the coefficient for delinquency of friends at the bottom of panel B. The coefficient is positive (0.495) and significant ( $t = 0.495 / 0.204 = 2.426$ ). Moreover, the random component is not significant, which indicates that the influence effect did not vary substantially over the schools. Influence effects seem to be more general than selection effects regarding delinquency. With regard to the control variables, the results in Table 5 confirm the earlier findings on the effects of the structural controls (outdegree, reciprocity, transitivity). The gender of the respondent, the importance of school friends, and the delinquency level of the respondent did not have an effect on the selection of friends. The fact that we did not find an effect of delinquency on friendship selection contradicts the disability thesis (Hirschi 1969) that delinquents have fewer relationships. Note that the lack of effect on delinquency level contradicts the disability thesis that delinquents have fewer relationships (Hirschi 1969). There are important differences from the effects for the one school discussed in Table 4: Across all schools, the effect of gender similarity on the selection of friends was significant and also, across all schools, boys in general tended to be more delinquent than girls.

## 6. Conclusion and discussion

That friends tend to display similar levels of delinquency is well known in the literature. This similarity can be the result of a selection process in which students choose friends with similar delinquency levels, as is predicted by the inability model, which assumes that delinquents are unable to maintain strong friendship relations and thus resort to making friends with other delinquents. The more general homophily model, which asserts that people prefer to associate with others who are like themselves (Hansell and Wiatrowski 1981),

also predicts such a selection process. Yet similarity in behaviour can also be the result of an influence process in which friends influence each other's behaviour. This is predicted by, among others, differential association theory and subcultural theory (Heimer 1997) but is consistent with more general socialization and social-learning theories (Bandura 1977). We investigated both processes using two assessments (1995 and 1996) of the friendship networks of 859 students in 16 Dutch high schools and their delinquency in the past year. We found that the average delinquency rate of these students was rather high, which can be explained by the nature of the schools selected: urban MAVO schools (i.e., technical/vocational high schools). It is important to note, however, that the measure for delinquency included many minor offences. Further, we found, as was to be expected, that boys commit more offences than girls. Ethnicity, on the contrary, had no effect on the delinquency levels of either or on friendship choices.

For the simultaneous analysis of selection and influence processes, we used SIENA. Influence processes were observed in all schools, and there was no substantial variation in its effect across the schools. We also found evidence for the selection effect. However, the effect varied significantly across schools. In effect, selection was observed in only four schools. These results actually indicate that influence and selection processes can be active at the same time. However, while influence seems to be a general phenomenon in all networks, the occurrence or strength of selection seems to depend on the network and school context. It is a task for future research to examine what school or network characteristics affect selection processes with respect to delinquency.

A criticism of our approach is that we only analysed friendships among students within a given school. Of course, friendship relations outside school can be at least as important for adolescents' behaviour as those within school. However, the majority of the students stated that friendships at school were at least equally or even more important to them, and there was no significant effect on school friendships of the stated importance of school friends. Also, while SIENA has proven to be a useful analytic tool for this kind of question, not all assumptions it makes are necessarily realistic: SIENA assumes that actors act independently from each other; that is, that they do not coordinate their actions. Consequently, collective action is ignored. This means that a SIENA analysis – although it improves on existing techniques – may not fully model group phenomena, like co-offending, sub-group power, or the effect of collective norms. Further, SIENA does not

model history of friendships. Long-term experiences with one another among friends are ignored, as it is based on a-historical Markov processes. While these limitations do not invalidate our findings, they are important considerations for future research, in general, but also regarding influence and selection processes.

To put it in a nutshell, we found that social influence is a general process, while selection depends on certain, still unknown, school or network characteristics. Given our results, we suggest that these processes play a different role according to the type of delinquency as well as to the type of actors. Probably, influence processes are more important for the limited delinquency of adolescence, while selection processes gain importance for lifetime, persistent delinquency. Neither process excludes the other. According to Moffitt (1993; 1994), lifetime, persistent delinquency indicates serious individual problems, including an inability to cope with social relationships, but most delinquency is limited to adolescence and represents a rather normal episode in someone's life. Only the few adolescents who are persistent delinquents will be unable to maintain intimate relationships. The majority of high school students, who are involved only in minor delinquency, will tend to have normal social relationships (Sampson and Laub 1990). There are definitely some indications that, while those in the prison population often lack social skills, adolescence-limited delinquency is not negatively correlated with the quality of personal networks (Baerveldt, Van Rossem, Vermande, and Weerman 2004; Claes and Simard, 1992; Giordano et al. 1986). As a consequence, similarity with respect to persistent delinquency may be caused by selection, while similarity with respect to adolescence-limited delinquency may be caused by influence processes (Hayes 1997). This may also explain why we found influence processes to be a general phenomenon in all schools, while the importance of selection processes differed significantly as between schools: adolescent delinquency is usually a normal aspect of development and relatively few adolescents get involved with persistent delinquency.

This study has shown that disentangling selection and influence processes leads to a more precise specification of when each of the two processes occurs. It also leads to further, relevant questions on the conditions under which that kind of mechanism becomes effective. In view of our results, future research should inquire more deeply into the characteristics of contexts such as schools – as well as neighbourhoods and voluntary organizations – where selection and

influence processes take place and study their role in the evolution of networks and delinquent behaviour.

## Notes

1. The authors thank Tom Snijders, Christian Steglich, and Marijtje van Duijn for their comments on and help with the analysis. We are also grateful to four anonymous reviewers and the editorial board of *CJCCJ* for their valuable comments.
2. Sometimes, the selection process is referred to as opportunity; see Haynie and Osgood (2005). Clearly, selection processes assume that there is the *opportunity* to select particular others. Yet we keep using the term *selection*, because it is more common. Besides, we do not argue that differences in opportunities do not explain differences in selection behaviour at all.
3. The first grade in the Dutch school system is the first year of secondary education. Students are about 12 years when they enter this grade. They are 14–15 years of age when they enter third grade.
4. Note that meta analysis is a well-known technique in prevention studies (e.g., Lipsey, 1995).

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