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Published in:
Connections

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2004

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Baerveldt, C., Rossem, R. V., Vermande, M., & Weerman, F. (2004). Students' delinquency and correlates with strong and weaker ties: A study of students' networks in Dutch high schools. *Connections*, 26(1), 11.

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Students' delinquency and correlates with strong and weaker ties: A study of students' networks in Dutch high schools

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The goal of the present study was to investigate three issues in the current debate on youth delinquency: (1) Whether the level of delinquency of adolescents is negatively correlated with the quality of her/his personal networks (as stated by the social inability model) or not (as stated by the social ability model); (2) Whether there is homophily in adolescents' networks regarding degree of delinquency; and (3) Whether homophily regarding the degree of delinquency is more pronounced for strong relationships than for weak relationships. A network survey, the Dutch Social Behavior Study, was carried out on 1,317 students (aged 15 to 17 years) in 20 high schools. Students completed a self-report questionnaire about petty crime and nominated fellow students for ten different types of relationships, both positive and negative and varying from weak to strong. Results showed that (1) the quality of the personal networks of delinquents and non-delinquents did not differ over any positive relationship. Delinquents seemed to avoid others a little more than non-delinquents, but were not avoided more; (2) the level of delinquency of students involved in positive relationships was correlated. This was caused partially by sex segregation; and (3) Homophily in weak-tie networks was not smaller than in strong-tie networks.

INTRODUCTION

Since Sarnecki (1990) published his descriptive study on delinquent networks in Sweden, network research on delinquent behavior gradually has gained popularity (see, for instance, Aseltine, 1995; Baerveldt & Snijders, 1994; Baron & Tindall, 1993; Dishion, Andrews, & Crosby, 1995; Fletcher, Darling, Steinberg, & Dornbusch, 1995; Gilmore, Hawkins, Day, & Catalano, 1992; Haynie, 2001, 2002; Houtzager & Baerveldt, 1999; Poulin, Dishion, & Haas, 1999). Nevertheless, the number of network studies in this field is still small. Network analysis, however, could contribute substantially to the ongoing criminological debate about the significance of adolescents' social relationships for delinquent behavior. For instance, opinions differ about the causal direction of the relationship between having delinquent friends and one's own delinquent behavior, about the social mechanisms

involved, and about the quality of delinquents' social relationships (see, e.g. Matsueda & Anderson, 1998; Reed & Rose, 1998; Weerman, 2004). In this paper, we use a network approach to shed light on three issues that are discussed in the criminological debate about social relationships and delinquent behavior of adolescents.

The first of these three issues refers to the delinquent's (in)ability to maintain social relationships. Some authors assume that delinquent adolescents have insufficient social skills to maintain strong relationships with their peers while others argue that delinquent adolescents do not have less skills than non-delinquents. These perspectives have been labelled the "social inability" model and the "social ability" model by Hansell and Watriowski (1981). Both viewpoints are also present in classical criminological theories, such as Hirschi's (1969) social control theory, and Sutherland's differential association theory (Sutherland, 1947; Sutherland & Cressey, 1974). According to Hirschi, delinquent behavior is possible when the bond to society is weakened or broken. Strong social bonds with conventional people and institutions prevent delinquent behavior. Delinquents never developed such bonds, and according to Hirschi, they are unable to develop strong attachments to their peers. Although Hirschi (1969) recognized that delinquent adolescents often report friendships with each other, he stated that these relationships are superficial and of poor quality. The mutual bonds of delinquents are explained through selection: these adolescents have chosen each other because of their similarity in attitudes and behavior, but that does not imply that these relationships are strong and influential. According to Sutherland's differential association theory, delinquent behavior is learned through social interaction within intimate personal groups. Criminal norms, values and know-how are passed on through normal socialization processes. People who have more associations with delinquent others are more likely to become delinquent themselves. Social relationships with delinquent peers therefore precede delinquent behavior, and the quality of these relationships does not necessarily differ from that of non-delinquent adolescents. Although various criminologists have tried to build theoretical bridges between both models, (for example, see Reed & Rose, 1998; Thornberry, Krohn, Lizotte, & Chard Wierschem, 1993; Vitaro, Tremblay, Kerr, Pagani, & Bukowski, 1997) the discussion so far has mainly been determined by the supposed theoretical incompatibility of the two models (Gilmore et al., 1992).

The second issue concerns similarity or homophily with respect to the level of delinquency. As noted before, from both the social inability model and the social ability model it can be predicted that the level of delinquency of related adolescents is correlated. Apart from the question which processes cause the homophily (e.g., selection processes as stated by the inability model or influence processes as stated by the ability model), the debate in criminology concentrates on the reliability of many results with respect to homophily. Some (e.g., Aseltine, 1995; Kandel, 1996) suggest that methodological flaws may lead to overestimation of homophily.

The third issue relates to the kind of relationships that are important for the explanation of delinquent behavior. Theorists in this field use very general and vague terms to define which kind of relationships play a role, they use terms like "delinquent peers" (Akers, 1973), "delinquent friends" (Hirschi, 1969) or "intimate personal groups" (Sutherland, 1947). This has led to a wide variety of empirical operationalizations of social relationships between adolescents. In many cases questions are used about "one's peers" or "your friends," but sometimes respondents are asked to think of their five best friends. In some cases respondents are questioned about their schoolmates or their best friends in school, whereas in other cases research is focused on gang or group membership. It is unclear which kinds of relationships are most relevant for delinquent behavior among adolescents. Especially strong and weak ties (relationships) between adolescents may play different roles with regard to delinquency (see, e.g., Warr, 2002).

Most criminologists emphasize the importance of close relationships, and this is also the case for some well-known classical criminological theories. According to Sutherlands' differential association theory, criminal definitions and techniques are learned in "intimate personal groups". He also explicitly states that associations which are more intense than others (and also associations that are more frequent, longer-lasting and older) have more significance than associations that are less intense. These assumptions would mean that the similarity in behavior is strongest for adolescents with strong mutual ties, whereas the similarity in behavior should be weaker for adolescents with weaker ties. In the logic of Hirschi's social control theory, stronger social bonds with relevant conventional others are more protective than weak relationships. As described before, Hirschi did not expect delinquents to have strong bonds with other delinquents. Therefore, social networks would consist of clusters of delinquents with weak relationships, and of non-delinquents with weak and strong mutual relationships, and only few and weak relationships between the clusters. As a consequence, one would expect similarity in weak-tie networks, but it remains unclear what the consequences are for the similarity in strong tie-networks.

However, not all criminologists assume that close, intimate relationships between adolescents are most significant for delinquent behavior. In his recent book, Warr (2002) describes a large number of possible mechanisms for peer influence, adding to those described in the existing criminological theories. All these mechanisms are assumed to operate especially during adolescence when peers and belonging to peer groups are central to the life of youths. The most important mechanisms through which adolescents conform to other law breaking adolescents or through which their own delinquent behavior is magnified, are fear of ridicule, the desire to show loyalty and the desire to maintain status. Other mechanisms mentioned by Warr are the diffusion of responsibility in groups, pressures to maintain consensus in the groups or to gain acceptance by the group, groups as means for protection and groups as source of potential co-offenders. Most of these mechanisms might be more relevant for larger collectivities of adolescents with relatively weak relationships, and for some of these mechanisms it is hard to imagine how they could operate in intimate dyads or triads of close friends. For some of these mechanisms, Warr explicitly offers empirical support for the notion that peer influences occur in larger collectivities rather than within close intimate friendships. This implies that similarity in behavior might be stronger for relatively weak ties than for strong mutual ties between adolescents.

Consequences for networks

The above debates lead us to formulate three research questions about the relation between delinquency and social relationships:

- Q1 Is the delinquency level of adolescents negatively correlated with the quality of her/his personal networks or not?
- Q2 Is there homophily regarding degree of delinquency in adolescents' networks, i.e., do positively related adolescents have similar levels of delinquency?
- Q3 Is homophily regarding the degree of delinquency more pronounced for strong relationships than for weak relationships?'

Non-network criminological research has not been decisive on the quality of relationships of delinquents compared to non-delinquents. A small number of non-network studies have been conducted on this topic. Giordiano et al. (1986) investigated a large number of friendship characteristics, and concluded that delinquent and non-delinquent adolescents were similar rather than different in their social relationships. The most important difference was that delinquents reported more conflicts and disagreements. No differences were found between delinquents and non-delinquents in stability and frequency of their contacts, and more important, there were no differences in trust,

caring and self-confirmation. Delinquent respondents even reported a slightly higher level of loyalty and self-disclosure. Claes and Simard (1992) reported no differences between incarcerated delinquent adolescents and non-delinquents in trust and communication, and also in a measure of intimacy (based on items about self-disclosure, empathy, sharing, affection and loyalty). They did find important differences with regard to conflict, however, and they mentioned that delinquents reported more feelings of being different than others, being ganged up, ridiculed and rejected by their group. Marcus (1996), who reviewed a number of relevant studies, reached an opposite conclusion than that of Giordano et al.: According to him the available research suggest substantial differences between delinquents and non-delinquents. However, Marcus also relied on research about personal characteristics of delinquents (like higher levels of aggressiveness and impulsivity) to reach this conclusion. The results of direct research on the friendships of delinquents may be well interpreted in a different way. Moreover, in all of the relevant studies, the quality of personal relationships is measured only by the adolescent's response. This implies that the data contain perceptions about the quality of relationships rather than direct measures of actual quality. The present study investigates entire students' networks in order to avoid these drawbacks.

With regard to the second question, it is generally accepted in criminology that delinquents have relationships mainly with other delinquents (Bender & Lösel, 1997; Elliot, Huizinga, & Ageton, 1985; Jussim & Osgood, 1989; Ploeger, 1997; Reed & Rose, 1998; Thornberry, Lizotte, Krohn, Farnworth, & Jang, 1994; Vitaro et al., 1997), but there is debate about the strength of this correlation. It is general practice to ask respondents to give information about their own behavior as well as that of their friends (Brownfield & Sorenson, 1993; Bruinsma, 1992; Frauenglass, Routh, Pantin, & Mason, 1997; Gardner & Shoemaker, 1989; Gilmore et al., 1992; Hayes, 1997; Heimer, 1997; Hundleby & Mercer, 1987; Kandel & Davies, 1991; Kandel, 1996; Keenan, Loeber, Zhang, & Stouthamer Loeber, 1995; McCarthy, 1996; Mears, Ploeger, & Warr, 1998; Ploeger, 1997; Reed & Rose, 1998; Warr, 1993; Warr & Stafford, 1990; White, Johnson, & Garrison, 1985), but this practice has been strongly criticized (Aseltine, 1995; Haynie, 2001; Jussim & Osgood, 1989; Kandel, 1996; Reed & Rose, 1998). According to the critics, people tend to homogenize the images of themselves and of their social environment. With respect to delinquency, this tendency may be strong because it is socially less desirable behavior and exact information about such hidden behavior of others is not always available. For example, we should expect non-delinquents not to admit readily that they have delinquent friends. The result is that the similarity between the delinquent behavior of the respondent and his friends is overestimated. According to critics such as Aseltine (1995) and Kandel (1996), social network research produces more reliable estimates of the similarity between the behavior of respondent and peers. The present study analyses this similarity using network data from 20 high schools.

Up until now the third question has not received much attention in empirical research. This parallels the theoretical vagueness in the criminological literature: it is unclear what kind of relationships are involved, and how theories relate to more specific relationships such as social support, participating in common activities, communication, and specific power relationships. In almost all empirical research in criminology, concepts such as "peers" and "friendship" are not defined. It is often left to the respondents how to interpret the relationships. This was for instance the case in the influential National Youth Survey in the United States, from which data are used in many criminological studies (i.e., Agnew, 1991; Elliot et al., 1985; Elliott & Menard, 1996; Haynie, 2001; Matsueda & Anderson, 1998; Reed & Rose, 1998). The problem is that adolescents can interpret the concept of friendship in many different ways. The criteria for friendship differ, for instance, between boys and girls (Houtzager & Baerveldt, 1999). However, some criminological studies are available comparing different kinds of relationships. For instance, some studies addressed the difference between having delinquent friends and being member of a delinquent gang (Battin, Hill, & Abbott, 1998; Morash, 1983). A few

criminological studies are available in which the interactive effects of friendship variables on delinquency are investigated (Agnew, 1991; Warr, 1993). These studies indicate that stronger relationships (as reported by respondents) and more time spent with friends lead to a stronger effect of these friends on one's own delinquent behavior. The social network approach offers many advantages above traditional research to answer the third question. It enables the researcher to distinguish between different kinds of relationships and to identify stronger and weaker ties. The use of these possibilities in the study of deviant behavior has been extremely rare thus far. One study on drug and alcohol use is available in which network methods are used to distinguish between friends and best friends (Urberg, Degirmencioglu, & Pilgrim, 1997). This study suggests that in general similarity was slightly stronger for best friends than for other friends, except for getting drunk. Social network studies with regard to delinquent behavior only presented either friendship networks or best friendship-networks but never both at the same time. Consequently, correlations of delinquency of positively related people are never compared between different tie networks. In the present network study several stronger and weaker relationships are studied and compared.

METHODS

Study design

This study was part of the Dutch Social Behavior Study (DSBS, see Baerveldt, 2000; Houtzager & Baerveldt, 1999). The main data source for the DSBS was a two-wave survey in classrooms in Dutch urban high schools. In this article we only report about the second wave, comprising data from 20 schools. All students in the fourth grade of the intermediate educational level (MAVO) of these schools were selected, resulting in a sample of 1,317 students between the ages of 15 and 17 years. A network consisted of all the 4th grade MAVO students within a school and ranged from 41 to 102 students. The sample was equally divided between boys (49.5%) and girls (50.5%). One third of the students had at least one parent who was born outside the Netherlands, mainly in Surinam, Morocco, Turkey, or the Dutch Antilles.

The project elaborated on an earlier study by the first author (Baerveldt, 1992; Baerveldt & Snijders, 1994) on similar students, in which the items on delinquency and personal backgrounds and one network item (best friends) had already been tested. The procedure –the students completed the questionnaire during a one-hour session– was repeated. After introducing the researchers, the teacher left the classroom. The researchers emphasized privacy, and answered any questions. They also completed a process paper about the way the class behaved during the session (time used for completion; number of questions; problems with students). Class behavior did not appear to be correlated with the mean class scores on key variables (delinquency, networks). Most students reported to enjoy answering the questions, wrote a personal story at the end, and no disruptions were reported.

Measures

Delinquency. Delinquency was measured by a self-report questionnaire that had been used and tested in an earlier study (Baerveldt, 1992). The respondents were asked how many times they had committed 23 minor offences, such as shoplifting, petty theft, vandalism, and unarmed fights over the last twelve months (see Table 2). The total number of offences was used as a scale; it had sufficient internal consistency (Cronbach's Alpha = .91) and was sufficiently one-dimensional (Eigenvalues factor analysis 8.6, 1.5, ...).

Social relationships. The existence of different types of relationships was measured by the social network items in the questionnaire. All the network items focused exclusively on relationships with

other students in the same grade. The procedure was as follows: each student was given a personal code and a code list for fellow students in the same year. The students gave their own identification code on the form. For the network items the respondents were instructed to complete the codes for other involved students for each item (up to a maximum of twelve codes).

The network items concerned ten types of relationships or ties (see Table 3). Relationship (t1) was a negative relationship: "With whom do you absolutely not want to associate?" while (t2) represented a functional relationship for misconduct: "With whom do you do things that are not allowed, like bullying or playing truant?". In descending order of frequency were: (t3) "Who are your best friends?"; (t4) practical support given: "Which students do you help with practical problems such as doing homework, organizing a party, or completing a difficult form?"; (t5) practical support received: "Which students help you ..."; (t6) emotional support given: "Which students do you help when they are depressed, for example, after the end of a love affair or when they have a conflict with other people?"; (t7) emotional support received: "Which students help you ..."; (t8) "Who do you compare your school results with first?"; (t9) "Who do you also see outside school?". Finally (t10) was "With whom do you talk about personal problems?". The frequency of the relationships can be used as a proxy for their strength, assuming that the stronger a relationship is the less frequent it will occur.

Students sometimes nominated alters who were not at school during the survey, because they had switched schools, were sick or playing truant. When these alters were excluded, the number of nominations dropped by about 10%. In the analyses we used only the relationships with alters who also filled in the questionnaire.

The support items were formulated both in terms of receiving and giving, which facilitates checking the reliability by comparing the scores of the responses from egos and alters. Table 1 shows that about 80% of the support relationships received by an ego was also reported as being given by an alter, and vice versa. If egos reported no received support, the chance that alters reported support given was less than 1%. We therefore concluded that the reliability of the items was satisfactory.

Table 1. Reliability of Social Support Items: Comparison of Scores of Ego and Alter

<i>Practical support</i>		Ego indicates that he/she receives practical support from alter		
		No	Yes	Total
Alter indicates that he/she gives practical support to ego	No	44,138 (99.1%)	271 (16.4%)	44,409 (96.2%)
	Yes	381 (0.8%)	1,381 (83.6%)	1,762 (3.8%)
	Total	44,519 (100%)	1,652 (100%)	46,171 (100%)
<i>Emotional support</i>		Ego indicates that he/she receives emotional support from alter		
		No	Yes	Total
Alter indicates that he/she gives emotional support to ego	No	44,586 (99.7%)	314 (22.0%)	44,900 (97.2%)
	Yes	156 (0.3%)	1,115 (78.0%)	1,271 (2.8%)
	Total	44,742 (100%)	1,429 (100%)	46,171 (100%)

Control variables. Each adolescent answered some additional questions about his or her sex, age, acculturation and the relative importance of school friends versus friends outside school. Acculturation was measured by a scale of four items regarding the use of the Dutch language and Dutch media at home (Van Hemert, Baerveldt, & Vermande, 2001).

Indicators of the quality of the personal network. The personal network characteristics can be divided up in three sets: size, structure, and homophily (see Table 4). These network characteristics were calculated for each of the relationships. The Utrecht Network Analysis Program was used to calculate these variables. As indicators of the size of ego's network we used the outdegree (Out), indegree (In) and total degree (Deg) for each of the relationships, as well as ego's connectedness (Con). Connectedness was calculated as the proportion of the actors in the network that ego could reach, directly or indirectly. For positive relationships, the size of the personal network might be viewed as an indicator of its quality. This is especially the case for strong relationships. It should be noted that connectedness is meaningless for the avoidance relationship (t1).

The structure of one's personal network is measured by several indicators. Reciprocity was operationalized as both the number of reciprocal relationships (Rec1) and the number or reciprocal relationships as proportion of the outdegree (Rec2). It is often used as an indicator of the quality of positive social relationships. Transitivity (Tra) was operationalized as the proportion of transitive triads ego was involved in. Note that we consider to be transitive only those triads in which ego closes the transitive structure. For instance, a triad in which ego → alter 1, alter 1 → alter 2, and ego → alter 2 is considered transitive, but one in which alter 1 → ego, ego → alter 2, and alter 1 → alter 2 is not.¹ Transitivity is used as an indicator of network quality in balance theory. Segmentation (Seg) pertains to the extent that short (length=1) and long path distances (length³ 4) dominate the network and that medium path distances are relatively rare (Baerveldt & Snijders, 1994). However, while the original segmentation measure was calculated over the entire network, we here calculated it at the individual level. The segmentation of a personal network is a quality indicator because it indicates whether the ego is member of a close group. Further, we also looked at the structure of the ego-network of the student. We included both the density and reciprocity of the relationships among those alters who were nominated by ego or who nominated ego as indicators of the closure of the group to which ego belongs (Den and RecL, respectively).

Homophily in the personal network (Hom) regarding delinquency was measured using the following index (H):

$$H_i = \frac{\frac{1}{n_N - 1} \sum_{j \in \{A_N\}} (x_j - x_i)^2 - \frac{1}{n_L - 1} \sum_{j \in \{A_L\}} (x_j - x_i)^2}{\frac{1}{n - 2} \sum_{j \neq i} (x_j - x_i)^2}$$

where H_i is the score on the homophily index for i (ego), x_i the delinquency score for ego and the x_j -s those for the alters; $\{A_L\}$ is the set of alters with whom ego has relationships (receiving or sending), n_L the number of alters in this set, while $\{A_N\}$ and n_N refer to those alters with whom one has no relationships, and n is the size of the network. This homophily index measures to what extent those persons ego has relationships with are more like ego in terms of delinquency compared to those whom ego has no relationships with. A zero score on the homophily index indicates the absence of homophily for ego, while a positive score indicates that one has relationships with alters who are

¹ Using the Hummell and Sodeur (1987) labeling of triads, following triads are considered transitive: P11, P15, P22, P29, P33, and P36.

more similar to ego than those without relationships with ego. A negative score indicates a tendency towards heterophily. Note that the maximum and minimum values for H are not $+1$ and -1 , but $(n-2)/(n_N-1)$ and $-(n-2)/(n_L-1)$, respectively. The homophily of a personal network is a quality indicator because it indicates whether the ego is member of a homogenous group.

ANALYSIS

In the analysis one needs to distinguish between positive and negative relationships. As social network analysis developed with positive relationships in mind, we need to consider whether all network parameters are equally meaningful for positive and negative relationships. For instance, transitivity in positive relationships is consistent with the balance model, in negative relationships it is not: an enemy of an enemy should be an ally, not an enemy. Likewise connectedness and segmentation have little meaning for negative relationships. One cannot expect the presence of chains of negative relationships.

Table 2. Delinquency among MAVO-4 Students in 20 Dutch High Schools

<i>Offence</i>	<i>Percentage that have committed this offence at least once in the past year</i>	
	<i>Girls</i>	<i>Boys</i>
Shoplifting	31.5	48.6
Changing price tags	29.4	37.2
Dodging fare	48.2	60.4
Bought stolen articles (receiving)	22.5	48.4
Stole things from school	25.9	43.1
Stole money from home	23.0	21.9
Stole money from students	1.0	5.9
Stole a coat from student	0.0	2.4
Burglary	2.9	18.7
Stole bikes	6.7	28.0
Stole mopeds	0.2	9.3
Stole something else	6.1	14.4
Graffiti	25.7	37.4
Vandalism on public transport	7.3	18.1
Vandalism on the street in public	8.6	35.4
Started a fire	14.6	46.3
Damaged a bike	11.5	38.6
Damaged a car	9.0	28.5
Damaged something at school	10.9	27.6
Broke a window	6.7	33.1
Broke something else	2.9	7.7
Kicked or hit someone	22.1	46.1
Threatened someone with a knife/other weapon	4.4	14.4

For the analysis we relied mainly on correlational analysis as we made no assumptions about the causal relationship between delinquency and social relationships. The data used here do not allow us to distinguish between selection and influence processes. Each of the network characteristics was correlated for each of the relationships with the respondent's delinquency score. In a first phase we controlled only for school, later on we added other control variables to check whether observed correlations were not due to differences in the relational patterns and delinquency rates of various groups. The control variables included were: age, sex, importance of friends outside school, ethnicity and acculturation. To test for overall homophily regarding delinquency (question 2 and 3) we also ran a spatial correlation analysis for each school over each of the relationships (see the Results section).

RESULTS

Delinquency. 86.7% of the students had committed at least one minor offence in the past twelve months, although most offences were very light (see Table 2 for an overview). Moreover, the delinquency rate of MAVO students in urban schools is known to be relatively high. As expected (see the Introduction), petty crimes were reported more often by boys than by girls ($t=13.76$, $df=1312$, $p<.001$). The boys' delinquency score was about 2.5 times that of girls.

Peer relationships. With regard to the network items, we observed that the percentage of students who nominated at least one alter varied from 29.9% for misbehaving together, to 66.7% for discussing personal problems, to 88.8% for best friends. These frequencies show that students are not secretive about their relationships. This was also illustrated by the fact that 63.2% of the students reported having at least one fellow student whom they avoid. The frequencies of the positive items roughly reflect the scarcity and emotional value of the relationships, which partly validated this set of items. Table 3 shows that the frequencies of the weak relationships (t3 thru t5) were higher than of the stronger ones (t6 thru t10). However, the order of frequencies for boys is slightly different than for girls. As Table 3 shows, girls had more social support relationships and intimate friendships, but boys nominated more "best friends". This indicates that boys and girls have different kinds of networks. Boys also nominated more alters with whom they got into mischief, which is in line with the finding that they commit many more offences. We could not find any significant differences between boys and girls as regards avoidance relationships.

Table 3. Mean Number of Peers Nominated by MAVO-4 Students for Ten Types of Relationships

	Type of relationship	Girls	Boys	Total	$T_{girls,boys}$ ($df = 1312$)
t1	(Neg. relationship) ego avoids alter	2.62	2.38	2.50	1.41
t2	Ego misbehaves with alter	0.44	0.73	0.59	-4.28**
t3	Ego calls alter his/her best friend	3.27	4.00	3.64	-4.80**
t4	Ego gives practical support to alter	2.80	2.26	2.53	3.90**
t5	Ego receives practical support from alter	2.90	2.36	2.63	3.87**
t6	Ego gives emotional support to alter	2.67	1.64	2.16	8.43**
t7	Ego receives emotional support from alter	2.36	1.45	1.91	8.51**
t8	Ego first compares marks with alter	1.81	1.78	1.79	0.31
t9	Ego also has contact with alter outside school	1.73	1.84	1.79	-1.26
t10	Ego discusses intimate affairs with alter	1.71	1.04	1.38	8.28**

* $p<.01$, ** $p<.001$; two-tailed.

The relative importance of friends in and outside school. For most students their friends at school really matter. 1,296 out of 1,317 students answered the question "Which friends are more important: friends at school or outside school?". For 61.7% of the students both friends are equally important and for 10.1% friends at school were more important. However, for 28.2% of the students, friends outside school were more important. The students who stated that their friends outside school were more important committed more offences than those for whom friends outside school were less important ($t=2.96$, $df=1242$, $p<0.01$). In addition, they also nominated significantly fewer fellow students for items about positive social relationships (t varies between 3.70 and 5.66, $df=1,294$, $p<.001$). This is why we had to take the possible effects of these differences into account in our analysis and interpretation of these aspects.

Delinquency and the quality of personal networks (Q1). From the inability model it may be expected that delinquency is negatively correlated with the quality of personal networks (question 1). As said before, we studied three different aspects of network quality: the size, the structure and the homophily within the personal network. We correlated delinquency with those network characteristics. Hirschi(1969) and other adherents of the model, generally state, or implicitly assume, that these correlations are independent of background variables. Also, some of these variables: namely sex, age, ethnicity, acculturation, and the importance of school friends, are correlated with delinquency or with network quality or both. We controlled the correlations for all these variables, because, while delinquency generally does not differ much between these types of schools, networks do (Baerveldt, 1992). In Table 4, the partial correlations are shown.²

Table 4. Partial Correlations of Delinquency with Network Quality Indicators over Ten Types of Relationships for MAVO-4 Students, controlled for School, Sex, Age, Ethnicity, Acculturation and the Importance of School Friends (significant ($p < .01$) correlations in **bold**).

Type of relationship	Network characteristic*										
	Size				Structure				Hom		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
t1 (Neg. relationship) ego avoids alter	.20	.01	.12	.12	.08	.12	.15	-.15	-.03	-.05	.08
t2 Ego misbehaves with alter	.26	.19	.20	.24	.25	.30	.18	-.16	.10	--	-.00
t3 Ego calls alter his/her best friend	.01	.08	.03	-.06	.07	-.01	.03	.06	.03	.00	-.00
t4 Ego gives practical support to alter	.07	-.02	.04	-.03	.03	.05	.05	.02	.03	-.02	.00
t5 Ego receives practical support from alter	.07	-.02	.05	-.03	.04	.07	.01	-.02	.02	-.02	-.01
t6 Ego gives emotional support to alter	.05	.04	.07	-.04	.05	.06	.03	-.00	.00	.06	.01
t7 Ego receives emotional support from alter	.06	.04	.07	-.03	.01	.06	.02	.01	.01	.02	.04
t8 Ego first compares marks with alter	.01	.00	.02	-.06	.01	.02	.03	.04	.03	.02	.04
t9 Ego also has contact with alter outside school	.10	.11	.11	.03	.06	.07	.03	-.06	-.04	-.01	.03
t10 Ego discusses intimate subjects with alter	.05	.04	.03	-.01	.05	.09	-.00	.02	-.03	-.03	-.01

* See text for explanation of the abbreviations. -- cannot be computed

According to the inability model (more) delinquent adolescents can be expected to have fewer relationships with their peers than less delinquent ones. The correlations in columns 1 to 4 of Table 4 do not support this prediction. For positive types of relationships the correlations between the level of delinquency of the respondent and the size of his/her network are not significant. The only significant correlations, regarding (t9) (contact also outside school) are in the wrong direction. Significant, but positive, correlations were found between delinquency level and the network size indicators for misbehaving with alters (t2), indicating that delinquency often occurs within a group context. Worth noticing is also that delinquent students tend to have larger avoidance (t1) networks

² As a matter of fact, controlling did hardly change the results.

than non-delinquent ones. However, this difference seems entirely due to the outdegree and not to the indegree. In other words, delinquent students are not more avoided at school, but tend to avoid more of their classmates than non-delinquent students. All in all, our findings with respect to size are at odds with the inability model.

According to the inability model we can also expect that the structural quality of the personal network of delinquent students is poorer than of non-delinquent ones. Again the results provide no support for this prediction (see Table 4, columns 5-10). For the more positive relationships (t3-t10) no significant association was found between the structural quality of the relationships and the level of delinquency. Only regarding the avoidance (t1) and misbehaving together (t2) relationships did we find significant correlations with delinquency. The results in Table 4 do show that reciprocity of avoidance relationships is somewhat stronger for delinquent students. This means that for delinquent student, the chance that they avoid alters who are avoiding them, is larger. The significant correlations between delinquency level and the other structural quality indicators for avoidance relationships are more difficult to interpret. Note, however that these effects might be to some extent effects of the delinquent's larger outdegree for avoidance relationships. The results for misbehaving together relationships point to the existence of groups that engage in delinquent behavior. Such finding is more supportive of the ability rather than of the inability model.

The results in Table 4 (column 11) indicate that the homophily of the personal networks with respect to delinquency did not vary with the level of delinquency for any of the relationships. Thus, delinquent students are not part of groups which are more heterogeneous with respect to delinquency than non delinquent students.

In sum, our results did not support the inability model, and are much more in line with the ability model.

Peer relationships and similarity regarding petty crime (Q2 & Q3). We used spatial correlation coefficients for testing the similarity of delinquency rates of related students (question 2). A spatial correlation of a quality V over a relationship R indicates how far the scores on V of egos in a network correspond with those of the alters to which they are connected through a relationship R, in comparison with the scores of individuals not related to each other. The literature (Cliff & Ord, 1973; Sprenger & Stokman, 1989) offers two possible measures: Geary's C and Moran's I. Our analysis showed that the differences between both measures were minimal for our data, and we will only present Moran's I here. In case of homophily, Moran's I is expected to be positive for positive social relationships, and negative for the avoidance relationship (t1).³ Moran's I is independent of the mean and variance of delinquent behavior, the size of the network (the number of students) or the density of the network (the mean number of relationships per student) and it is possible to test the statistical significance. Our analyses showed that it makes hardly any difference whether spatial correlations were calculated according to the asymmetric (directed) variant or not, or whether strong or weak criteria for symmetry were used. For the sake of comparability of Moran's I with regard to the different types of social relationships, we will only present the results of the directed variant in the tables.

³ A positive I over relationship R does not always indicate that the behavior of adolescents with a relationship R is more similar than the behavior of adolescents without this type of relationship. According to the statistical model, there is a positive connection when Moran's I > $-1/(N-1)$, in which N represents the number of students per network. N varies in this study between 41 and 102, so that there is a positive relationship connection if I > $-.025$, even with the smallest network (N=41). In our study Moran's I was never significant if $-.10 < I < .10$. This implies that when Moran's I is significant, the value of I indicates whether it concerns a positive or negative connection.

Because Moran's I applies to a single network, it was calculated separately for each school. Since 20 schools were involved in the study, 20 spatial correlations were calculated for each of the ten types of relationships. The relatively high standard deviation of the spatial correlations between positive social relationships and petty crime indicate that they differ substantially from school to school. However, the correlations are generally positive, and for most schools significant ($p < .01$). All mean correlations above .10 are significant. Table 5 shows the mean of Moran's I over all schools. We placed the avoidance relationship (t1) and misbehaving together (t2) at the top of the table. Below we placed the positive relationships (t3 thru t10). The arrangement of these relationships corresponds with their frequency: the least frequent relationships are listed at the bottom. These are also the relationships that may be assumed to be the closest or strongest (Houtzager & Baerveldt, 1999).

Table 5. Mean Spatial Correlations (Moran's I) and Standard Deviations of Sex and Delinquency over Ten Types of Relationships for Dutch MAVO-4 Students (N = 20 Schools; significant ($p < .01$) correlations in **bold**).

	Type of Relationship	Spatial correlation of Sex		Spatial correlation of Delinquency		Spatial correlation of Delinquency controlled for Importance of school friends		Spatial correlation of Delinquency controlled for Importance of school friends and Sex	
		(1)	(2)	(3)	(4)				
		<i>m</i>	<i>sd</i>	<i>m</i>	<i>sd</i>	<i>m</i>	<i>sd</i>	<i>m</i>	<i>sd</i>
t1	(Neg. relationship) ego avoids alter	0.25	(.13)	-0.09	(.15)	-0.01	(.16)	-0.11	(.16)
t2	Ego misbehaves with alter	0.66	(.20)	0.61	(.40)	0.54	(.47)	0.42	(.42)
t3	Ego calls alter his/her best friend	0.64	(.14)	0.24	(.10)	0.23	(.12)	0.15	(.13)
t4	Ego gives practical support to alter	0.63	(.13)	0.23	(.11)	0.21	(.13)	0.14	(.12)
t5	Ego receives practical support from alter	0.62	(.13)	0.24	(.11)	0.22	(.12)	0.15	(.13)
t6	Ego gives emotional support to alter	0.63	(.16)	0.20	(.14)	0.19	(.15)	0.11	(.13)
t7	Ego receives emotional support from alter	0.63	(.15)	0.19	(.12)	0.18	(.12)	0.11	(.14)
t8	Ego first compares marks with alter	0.70	(.12)	0.29	(.15)	0.25	(.18)	0.19	(.16)
t9	Ego also has contact with alter outside school	0.66	(.13)	0.30	(.16)	0.28	(.19)	0.22	(.20)
t10	Ego discusses intimate subjects with alter	0.70	(.17)	0.22	(.15)	0.20	(.17)	0.14	(.17)

Table 5 shows the means of the spatial correlations of relationships with four different variables. Column 2 shows the mean correlations with delinquency. We found the highest spatial correlation for delinquent behavior over the misbehaving (t2) relationship. This was not a surprise, as both types of behavior are closely related and may well overlap. The mean spatial correlation over avoiding is about zero, indicating that students who differ with respect to delinquency do not avoid each other more than those with similar delinquency scores. The mean spatial correlations with positive relationships are positive. This means that the delinquency scores of students with a positive

relationship are more similar to each other than between students without this type of relationship. The pattern that might be expected from the inability model was that the correlations would be higher for stronger relationships (question 3). However, this was not supported by the results. There may even be a slight tendency towards the opposite: the stronger the relationship, the lower the spatial correlation for petty crime tends to be.

As already stated, some students think that their friends outside school are more important than their friends at school. We have already considered why it is necessary to control the spatial correlation for the impact of the importance of school friends. Following Leenders (1995), first, a bivariate regression analysis of the importance of school friends on delinquent behavior was carried out. The residual terms of this regression equation can be used as a delinquency score corrected for the importance of school friends. Secondly, the spatial correlation for these residual terms was calculated and the results are reported in column 3 of Table 5. The table shows that controlling for the importance of school friends hardly changes the results. The mean spatial correlations in column 3 are slightly lower than in column 2, but the picture remains the same.

One of the most consistent findings in criminological research is that boys commit offences much more frequently than girls. This was also the case in this study: the boys' delinquency score was about 2.5 times higher than that of girls. In addition, boys and girls had different patterns of relationships (an overview is given by Benenson, Apostoleris, & Parnass, 1998; , and Rubin, Bukowski, & Parker, 1998). For example, we saw that boys nominated more "best friends", but that girls nominated intimate friends at least 1.5 times more often than boys. This is sufficient reason to control for sex differences. An investigation into the sex homogeneity of the networks reinforced this conclusion. The first column in Table 5 shows the mean spatial correlation coefficients for sex over the various social relationships. The mean spatial correlations for sex over avoidance relationships (t1) were positive, which implies that students avoided alters of the same sex more than alters of the other sex. The spatial correlations for sex over the positive social relationships are positive. In addition, they are much stronger than the correlations for petty crime. This means that the networks of MAVO-4 students are quite sex-homogeneous. However, we cannot reproduce the slight tendency noticeable in columns 2 and 3, that is to say, the weaker the correlations, the closer the relationships. Sex homogeneity seems quite strong and stable for all positive relations.

If sex can have such a great influence on the network, it seems advisable to investigate what remains of the connection between social relationships and delinquent behavior after controlling for sex (question 2). This control was carried out in the same way as for column 3: by calculating the spatial correlations with the residual terms from the regression of delinquent behavior on sex and the importance of school friends. Column 4 shows the results. The mean spatial correlations of petty crime over positive social relationships usually remain positive, but they are substantively lower than they were before controlling for sex and importance of school friends. This means that at least part of the similarity in delinquent behavior of related students can be explained by observed sex differences in delinquency combined with the sex homogeneity of social relationships.

CONCLUSIONS

Results showed that (1) the quality of the personal networks of delinquents and non-delinquents did not differ over any positive relationship. Delinquents seemed to avoid others a little more than non-delinquents, but were not avoided more; (2) the level of delinquency of students involved in positive relationships was correlated. This was caused partially by sex segregation; and (3) Homophily in weak-tie networks was not smaller than in strong tie-networks.

DISCUSSION

Most criminologists assume that in adolescence friends tend to display similar levels of delinquent behavior. However, research in which adolescents give information about the behavior of their friends ("perceived delinquency") has been severely criticized on methodological grounds. Various critics prefer research using social networks. Using social network data it is possible to measure the delinquent behavior of adolescents independently of that of their peers. In addition, the quality of the relationships and both strong and weak relationships can be included in the analysis, as was shown by the present study.

The results of this study are explicitly limited to petty crime since other processes may play a role in serious, persistent crime. According to our expectations, adolescents who maintained positive relationships with each other often had corresponding delinquency scores. The spatial correlations for delinquent behavior were substantial but weaker than the spatial correlations for sex. This suggests that associations established in mainstream research overestimate the reality (as also argued by Kandel, 1996).

Nevertheless, the finding that the spatial correlation coefficients vary substantially over the schools is an important qualifier. This indicates that it makes a considerable difference to which network adolescents belong: in one network the similarity in behavior is apparently stronger than in another. This also suggests that the strength of selection and/or influence differs between networks, even when nodes and ties are of the same type. We think that further research and development of theories in this context would be desirable (see also Haynie, 2001).

Contrary to expectations, we did not find that the similarity in delinquent behavior between ego and alter was larger for stronger than for weaker relationships. It is unclear what this means for the inability model because, according to that model, delinquents can't maintain strong ties. However, it contradicts the ideas of most ability model adherents. For instance the differential association theory states that social learning of delinquent behavior takes place in small, tight-knit groups. In other words, our findings contradicted important assumptions of both models. It seems that strong and close relationships may be less important in explaining minor delinquency than many criminologists assume. Perhaps the development of criminological theories should focus more on the strength of weak ties (see, e.g., Warr, 2002) or on the role of social capital.

We studied the association between delinquency and several indicators (size, structure and homophily) of network quality. The indicators for positive relationships were not negatively correlated with students' delinquency, most correlations were even positive. Some indicators of the avoidance relationship correlated positively with delinquency, others were negative or zero. The positive correlations were all based on outdegree measures. While delinquents were not avoided more by other students, they seemed to be more selective themselves. All in all the differences are small, which does not correspond with the inability model.

The existence of similar delinquent behavior among adolescent friends might be explained by two different processes: influence (according the ability model) and selection (according the inability model). When adolescents influence each other's level of delinquency, the level of delinquent behavior of adolescents who already have a social relationship with each other converges. When the delinquency level is a criterion for social selection, relationships develop between adolescents who have a more or less similar level of delinquent behavior. Because we analyzed cross-sectional data, we cannot discriminate between influence and selection; longitudinal research is required for firm conclusions about influence and selection.

Nevertheless, our cross-sectional analysis gives some clues about the strength of influence and selection processes. Our findings indicate that selection and influence processes are probably weaker than suggested in the literature. After controlling the spatial correlation for sex, we got some idea of the upper limits for influence and selection processes. When the spatial correlation was controlled for sex, the coefficients decreased substantially. By controlling for sex, one accounts for both the strong tendency towards sex homophily in the sample and for differences in delinquency levels for boys and girls. As boys tend to be more delinquent than girls, and relationships are overwhelmingly within-sex, this inflates the spatial correlation for delinquency. Because the networks are practically separated in boys' and girls' networks, delinquency based selection and influence processes operate generally within these single-sex networks. Therefore, the controlled spatial correlations are a better indication of the (maximum) strength of delinquency based influence and selection than the original ones. The fact that the raw and adjusted spatial correlations differ substantially, indicates that much similarity regarding delinquency can be attributed to sex homophily: boys interact with boys, girls with girls. To summarize, controlling for sex makes clear that delinquency based selection and influence processes are substantially less powerful than uncontrolled similarity indices suggest.

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