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A Multilevel Analysis of Neighbourhood Contextual Effects on Serious Juvenile Offending*

The Role of Subcultural Values and Social Disorganization

Dietrich Oberwittler
Max Planck Institute for Foreign and International Criminal Law, Freiburg, Germany

ABSTRACT

The extent and nature of contextual effects on juvenile offending are frequent subjects of current research, mainly in the USA. After a short literature review, this paper presents empirical results of a new study which hints at the existence of neighbourhood contextual effects on serious offending by adolescents. The study is based on three types of cross-sectional data on 61 neighbourhoods in two German cities and a rural area: a self-report survey of students aged about 13 to 16, a separate survey of residents in the survey neighbourhoods, and census and administrative data on the same neighbourhoods. Multilevel analysis is applied to identify and explain the neighbourhood-level variance of self-reported serious juvenile offending. Hypotheses from both main traditions of theoretical reasoning about contextual effects on juvenile delinquency – subcultural and disorganization theories – are supported by the empirical findings. The spatial concentration of adolescents with attitudes typical of delinquent subcultures increases the likelihood of serious offending net of relevant individual predictors, whereas the social capital of neighbourhoods (as measured by the independent survey of residents) reduces it. Methodological problems of applying multilevel analysis to delinquency research are discussed.

* A note by the author will be published in issue 1(4) of this journal, qualifying the interpretation of certain statistics in this article.

KEY WORDS

Juvenile Delinquency / Neighbourhood Contextual Effects / Ecology / Multilevel Analysis / Social Disorganization / Subculture.

Current research on neighbourhood contextual effects

Within the growing field of research on communities and crime, the topic of neighbourhood contextual effects on child and adolescent delinquency has received special attention in recent years. Although the idea that neighbourhoods may have collective properties exerting an influence on their residents' behaviour independently of individual factors is far from new in criminological theory, empirical research on ecological contextual effects has been very sparse until recently (Bottoms and Wiles 1997; Sampson et al. 2002; Wikström 1998). Strong correlations between structural disadvantage and offender rates are a well-established fact in classic studies, such as Shaw and McKay's (1969) on Chicago, as well as in more recent studies on Stockholm, Basel (Eisner 1997; Eisner and Wikström 1999; Wikström 1991) or Montreal (Ouimet 2000). However, the use of aggregated data on community characteristics and offender rates, in most cases derived from official police records, has been criticized as inappropriate to substantiate the hypothesis of neighbourhood contextual effects for several reasons (for a still excellent review, see Bursik 1988).

First, and most importantly, aggregate data analysis cannot be made to disentangle contextual from compositional effects: high offender rates in certain neighbourhoods may be owing merely to a high proportion of individuals with delinquent inclinations residing in these areas. Second, a correlation between structural conditions (such as the level of poverty) and crime does not show which particular social mechanisms lead adolescents to offend more often in disadvantaged neighbourhoods than in other ecological contexts. For example, the claim of classic social disorganization theory that insufficient informal control over adolescents is a major factor mediating the effect of structural conditions on delinquency was not substantiated by Shaw and McKay, and was empirically tested for the first time only decades later by Sampson and Groves (1989). Nor is the lack of informal control the only conceivable mediating factor that would explain contextual effects; for example, Shaw and McKay (1969) themselves stressed the role of subcultural associations and transmissions among adolescent peers. A third point of criticism highlights the questionable validity of police-recorded measures of juvenile delinquency. If the practice of police recording and the victims' decision to inform the police are biased against lower-class or ethnic minority offenders, who frequently live in

deprived neighbourhoods, official crime data will overestimate the link between poverty and delinquency at both individual and aggregate levels (Cohen and Land 1984; Junger-Tas and Marshall 1999; Karstedt-Henke and Crassmöller 1991).

From these criticisms, it is possible to derive some basic principles of quantitative research into ecological contextual effects on juvenile delinquency: it should be based on survey data on self-reported offending and the relevant *individual* factors regarded as possible causes of offending, and it should also include data measuring the social processes at the *neighbourhood level* that are thought to mediate the association between structural conditions and behavioural outcomes. One reason research following these lines has evolved rapidly in recent years – apart from criminologists' intrinsic interest – is the availability of multilevel modelling software that makes it possible to integrate the individual- and aggregate-level perspective on delinquency causation by simultaneously estimating regression equations on both levels without violating important statistical assumptions of conventional multiple regression models (Bryk and Raudenbush 1992; Raudenbush and Bryk 2002; Snijders and Bosker 1999). Thus it becomes possible, in principle, to estimate the contextual effects of neighbourhoods (or schools) on adolescents' behaviour net of individual influences, which may also vary between contexts.

Theoretical reasoning about the possible causal mechanisms of contextual effects on the individual behaviour of children and adolescents has also grown rapidly over the past few years, blending old and new concepts and developing more sophisticated hypotheses. Triggered by William Julius Wilson's (1987) seminal book *The Truly Disadvantaged*, which linked different phenomena such as teenage pregnancy and school dropout to the growing concentration of poverty and unemployment in the American inner-city ghettos, much of this research is directed towards behavioural outcomes related to delinquency, such as psychological stress, sexual behaviour and educational and labour market achievement (Duncan and Brooks-Gunn 1997; Leventhal and Brooks-Gunn 2000; Sampson et al. 2002). 'Social capital' has emerged as the key concept in this research and as a kind of catch-all phrase for different mechanisms thought to be responsible for the aggravation of social evils in deprived neighbourhoods (Furstenberg and Hughes 1995; Portes 1998). In the Social Science Citation Index, articles with 'neighbourhood' and 'social capital' in the title have more than doubled from around 40 to 100 per year during the past few years (Sampson et al. 2002: 444). Yet, although there is a general consensus that *concentrated disadvantage* is at the root of adverse contextual influences, there is less consensus and still less empirical knowledge about the

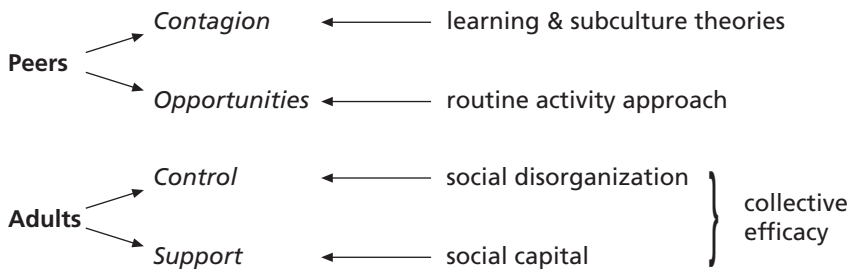

Figure 1 Two main branches of theories about the effects of neighbourhood context on juvenile delinquency.

mediating processes that translate macro-level structural conditions into adolescents' problem behaviour.

A crude but useful distinction might be that one main branch of explanations stresses the role of *adults* within the community, whereas the other main branch looks at the role of *adolescent peers*; both draw support from different traditions of sociological and criminological theories (Figure 1). The role of adults as agents of informal control is, of course, crucial for classic social disorganization theory, and it has retained its position in the renewed version of this theory elaborated by Robert Sampson and his colleagues (Sampson et al. 1997, 1999). From a 'social capital' perspective, adults are also thought to play a potentially supporting role as role models and suppliers of advice and opportunities for adolescents, for example when they look for a job. These functions of local networks have been stressed by both Mark Granovetter (1973) and James Coleman (1988); 'intergenerational closure' (defined as parents knowing the parents of their children's friends) is a specific concept rooted in this approach. The broader concept of 'collective efficacy for children' (Sampson et al. 1999) combines both aspects of community life basically provided by adults: support for families to raise their children successfully and control of children if they deviate.

Peers, on the other hand, are thought to offer delinquent opportunities to adolescents who choose their friends from the local area (or from the school). Both differential association theory and the routine activity approach can explain why contacts with delinquent peers may lead to more offending, and they have recently been used to explain additional contextual effects on juvenile delinquency (Espelage et al. 2003; Osgood et al. 1996; Osgood and Anderson 2000). If non-conventional and subcultural attitudes gain ground in a segregated community (or school) owing to the concentration of socially disadvantaged adolescents, exposure to these attitudes might add to the individual propensity to deviate and may in the

long run reinforce individual non-conventional attitudes and delinquent motivations. In a routine activity perspective, opportunities for offending are more numerous if two or more adolescents spend their time together 'hanging out' in unsupervised settings. Low supervision, in turn, has a dimension that is also captured by social disorganization theory.

It seems that, at this early stage of empirical work, researchers tend to prefer either the adult-oriented or the peer-oriented explanation of contextual effects, and integrated approaches are rare. This is also mirrored in the important question of *which* ecological context is deemed to be more important – neighbourhoods or schools. Bronfenbrenner's (1979) definition of the 'meso-system' explicitly included both neighbourhood and school. The question of how both contexts compete or interact with each other, or which one is ultimately more important, has been largely ignored in recent research; most studies focus on one context and ignore the other one (for integrating 'cross-nested' designs, see Kim 2001; Oberwittler, in preparation). This question is crucial because many adolescents go to schools far away from, and largely unconnected with, their places of residence. A related question is whether adolescents residing in a neighbourhood are evenly subjected to the influences of this neighbourhood (as multilevel regression models normally assume). If they spend a lot of their time outside their own neighbourhood, this is probably not the case (Sampson et al. 2002: 469; Wikström and Sampson 2003). This problem has led P.-O. Wikström to advocate the use of 'space–time-budgets' for a detailed measurement of adolescents' routine activities (Wikström 2002; Wikström and Sampson 2003). On the theoretical level, it is obvious that if the neighbourhood context is not equally relevant for all adolescents, and is supplemented or displaced by other contexts, the generalizability of social disorganization theory is challenged too. Sampson et al. (2002: 469) conclude that it may be easier to identify neighbourhood effects in 'event-based' models (e.g. crime hot-spots depending on neighbourhood guardianship) than in models of residents' behaviour (for a similar distinction, see Bursik 2001).

The temporal dimension poses another challenge to theoretical and empirical research on ecological contextual effects. It makes sense to assume that contextual effects are of a different kind and strength at different stages of child and adolescent development, depending on direct or indirect interactions with ecological contexts beyond the family. Wikström and Sampson (2003) make a useful distinction between long-term effects directed towards the future propensity to offend ('ecological context of development') and short-term effects directed towards the opportunity structure of offending ('ecological context of action'). It is obvious that longer-term influences that accumulate over years, such as the

adoption of subcultural values, cannot adequately be captured in cross-sectional studies, particularly if individuals move from one neighbourhood to another and have a cumulative record of diverse neighbourhood conditions (Timberlake 2002). Thus, time-lagged effects on behaviour of ecological conditions are likely to be underestimated in cross-sectional studies, as has been found in other areas of delinquency research (Loeber and Stouthammer-Loeber 1986; Matsueda and Anderson 1998; Thornberry 1996). In cross-sectional studies, on the other hand, the contextual effects of current neighbourhood conditions may be overestimated if a possible self-selection bias is poorly controlled for (Duncan and Raudenbush 1999). This problem can occur if some individual factors related to the outcome are also responsible for the differential selection of individuals to contexts (e.g. parents' low interest in their children's well-being may be related to the choice of a residential area) and are not accounted for in the multilevel model. This makes randomized experimental studies, which, however, are very rare in this field, especially valuable (Ludwig et al. 2001).

In sum, the complexity of models of human behaviour that try to integrate individual- and aggregate-level perspectives renders empirical research particularly arduous and expensive. Although ecological research is clearly moving in the direction of longitudinal studies analysing 'pathways in crime' (Sampson 2000; Smith et al. 2001; Wikström and Sampson 2003), published research results are predominantly based on cross-sectional data so far. These existing studies cannot tell the whole story, but they nevertheless represent an important starting point for a research field that is still in its infancy.

Recent empirical research has generally shown that the effects of neighbourhood context on juvenile delinquency (as on other types of problem behaviour or educational achievement) tend to be weak compared with individual-level influences (Duncan and Raudenbush 1999: 33). In a pioneering study of 12 New York City neighbourhoods, Simcha-Fagan and Schwarz (1986) reported a 2–4 percent rise in explained variance when aggregate-level predictors were added to a standard regression model. Elliott et al. (1996), in one of the first studies to employ the multilevel regression technique, found only a 1–2 percent gain in explained variance in a model of adolescents' problem behaviour in Chicago and Denver. A more recent survey of juvenile delinquency in Chicago shows a similar share of about 3 percent variance at the neighbourhood level (Cheong and Raudenbush 2000: 486, calculated from Table 4). In contrast, studies on school contextual effects usually find much larger shares of variance at the group level of about 6–7 percent (Anderson 2002; Welsh et al. 1999). This

may hint at a higher degree of social segregation (and self-selection) of adolescents in schools than in neighbourhoods; whether it is also a sign of stronger contextual effects is an open question.

Considering these rather modest results of studies on large US cities, one may be inclined to ask what can be expected from research on European cities with lower levels of concentrated poverty and less ethnic and social segregation. In fact, of the very little research conducted so far in Europe, most has not found empirical evidence for the existence of neighbourhood contextual effects on juvenile offending. This is true for studies on Stockholm (based on official data, Dahlbäck 1996), on Rotterdam (Rood-Pijpers et al. 1995) and on Peterborough (Wikström 2002). As I will report in the remaining part of this paper, our own study of two German cities and a rural area did produce evidence for the existence of contextual effects of a size similar to that in US cities.

Study design and data

Data for the following analyses were collected as part of the research project 'Social Problems and Juvenile Delinquency in Ecological Perspective' conducted at the Max Planck Institute Freiburg. The aim of this project is to bring together data from different sources – two independent surveys and various official data collections – in multilevel models and to identify possible contextual effects of concentrated disadvantage and related social mechanisms on adolescents' offending. Owing to the cross-sectional nature of the concept, all results have to be interpreted cautiously as far as causal inferences are concerned.

For this study, two West German cities, Cologne and Freiburg, and some rural communities near to Freiburg were selected (Oberwittler 2003a for details). Cologne is Germany's fourth-largest city, with a population of 1 million and a Turkish community of 80,000. Cologne's economic and social structure is very diverse, including traditional manufacturing industries but also many electronic media companies and the country's second-largest university. Freiburg, on the other hand, is a rather small city (200,000 inhabitants) with little industry and is dominated by administration and the university. The purpose of comparing these two cities is to see whether models can be reproduced in different urban settings; the purpose of including a rural area is also to enhance the variety of ecological settings. For example, the level of informal control may be much the same in most urban neighbourhoods but different in rural communities. To limit costs, in

Cologne a sample of about one-third of all census tracts had to be drawn; the distribution of structural conditions of the sampled tracts almost exactly matches the distribution of all Cologne tracts (Oberwittler 2003a: 16). In all study areas, census tracts were merged to form a total of 61 larger 'neighbourhoods' based on sociodemographic similarity in order to have enough respondents in each aggregate unit and to reduce the unequal sizes of tracts. Data on self-reported delinquency come from a paper and pencil school survey of about 6400 eighth to tenth grade students in Cologne, Freiburg and rural areas conducted in 1999 and 2000 (see Table 1 and, for further details, Oberwittler and Blank 2003). At the end of the classroom interviews, the students' addresses were geo-coded to be sure to have exact information on their place of residence. About 4800 of the respondents lived within the defined survey neighbourhoods, but the rest were scattered widely across other areas and had to be omitted from neighbourhood-focused (but not necessarily from school-focused) analyses. This is especially the case in Cologne, where the intra-urban mobility of students between home and school is quite large. The disadvantage of a relatively high dispersion of students across neighbourhoods (compared

Table 1 Survey information

	Cologne (pop: 1 million)	*Freiburg city (pop: 200.000)*	*Freiburg rural communities*	*Total*
School survey (8th–10th grade students, c. 13–16 yrs)				
Date of survey	Sep.–Nov. 1999	Nov.–Dec. 1999	Nov.–Dec. 2000	
Sample	3445	1884	1108	6437
Response rate (%)				
School level	82	83	100	85
Student level	85	86	87	86
Aggregation to neighbourhoods				
No. neighbourhoods	34	16	11	61
Mean population (approx.)	12,900	9,900	6,500	11,000
No. respondents	2429	1330	1062	4821
Mean respondents	71	83	97	79
Postal neighbourhood survey (residents, 25–80 yrs)				
Date of survey		May–June 2001		
Sample	1386	715	429	2530
Response rate (%)	42.9	60.1	59.1	49.1
Mean respondents	41	45	41	42

with a household sample of adolescent respondents) is counterbalanced by a high response rate of about 85 percent.[1]

A comparison of survey-measured and officially measured socio-demographic indicators shows that the respondents in the school survey are a highly representative[2] sample of their neighbourhoods. The correlation between the percentage of respondents of immigrant background and the officially measured percentage of foreign citizens (aged under 14 years) is $r = .89$ in Cologne and $r = .80$ in Freiburg. The correlation between the percentage of respondents who are welfare recipients and the official welfare rate (age group under 18 years) is $r = .85$ in Cologne and $r = .75$ in Freiburg. Finally, the correlation of a combined factor score measuring the socioeconomic status (SES) of respondents and a factor score based on official data on children and adolescents is $r = .96$ in Cologne and $r = .90$ in Freiburg.[3]

The delinquency scale consists of 14 items describing punishable offences and truancy (Oberwittler et al. 2002). These items cover common types of juvenile offending from shoplifting, graffiti spraying and drug consumption to the theft of motor bikes, wounding and burglary. For each offence, the respondents were asked whether they had *ever* committed it, whether and how often they had committed it during the previous *12 months*, and, if they had, how often the police were notified about this offence. The last question, which includes informal contacts with the police and does not necessarily mean that the incident was officially recorded by the police, was included in order to reduce the reporting of trivial events (Elliott and Huizinga 1989; Howe et al. 1991).[4]

[1] Household-based surveys of adolescents usually yield response rates of only about 50–60 percent in Germany and have become less common in recent criminological research. We conducted a supplementary experimental survey with face-to-face interviews of adolescents in Freiburg based on a household sample in order to compare it with the school survey. The mean response rate of the household survey was about 54 percent and correlated strongly with the socioeconomic status of neighbourhoods, falling to as low as 20 percent in deprived neighbourhoods (Oberwittler and Naplava 2002a: 64). Our conclusion is that reliable survey data on these particular neighbourhoods are more likely to be gained in school surveys than in household-based surveys.

[2] Not statistically, however, because the sampling procedure was not strictly random.

[3] Survey factor score: % immigrant background, % unemployed or welfare recipient >5 months; mean parents' highest occupational prestige, % university degree of parents, mean household goods; official factor score: % non-German <14 yrs, % welfare recipients <18 yrs, mean dwelling floor space per person. Correlations in the rural areas are much lower owing to the very small number of units (11) and the restricted variance compared with urban neighbourhoods.

[4] We also asked for the value of goods gained by the last theft and robbery: 48 percent of these goods were worth €25 or more (based on $N = 1{,}064$ answers with 160 missing values).

The actual frequencies of self-reported offences were recoded to five ordinal categories from 0 (no offence) to 4 (10 or more offences), and total and offence-specific subscales were constructed by computing unweighted means of the recoded items. The resulting indices reflect both the frequency and versatility of offending, which are known to be highly intercorrelated (Klein 1984).[5] The central subscale used for the analyses in this paper is 'serious offending', which consists of six items covering violence and serious property offences (see Table 5). Whereas 55 percent of respondents reported at least one offence from the overall delinquency scale during the previous year, 28 percent reported a serious offence and 12 percent scored higher than 0.33 on the 'serious offending' scale, which means that they had committed either 6–10 offences of one type or at least one offence each of three different types.

Additionally, a postal neighbourhood survey of about 2500 residents was conducted in these 61 neighbourhoods in Spring 2001, measuring relevant concepts such as intergenerational closure, observation of disorder and informal control (see Table 1 and, for more details, Oberwittler and Naplava 2002b). The overall response rate for this survey was 49 percent. Again, correlations between survey and official data on the sociodemographic composition of neighbourhoods indicate high data quality (r = .85 for the percentage of welfare recipients; r = .83 for the percentage of non-German citizens; r = .94 for the percentage of one- or two-family homes). Although there was a gap of about 16 months between the school and neighbourhood surveys, the study is assumed to be of a cross-sectional nature. This also means that the question of the causal direction of correlations should generally be treated with great caution. Of these survey data, the 'intergenerational closure' scale is employed in this paper as a neighbourhood-level predictor of serious juvenile offending (see below for more details).

Official data comprise data collected by the statistical offices of both cities and the rural districts, together with geo-coded police data on offences and offenders for Cologne. Using the computer files on recorded crimes, we aggregated neighbourhood-level rates of known offenders residing in these neighbourhoods and exactly matching the age group, time period and offence definitions of the self-report survey. Most of the official data refer to the years 1999 or 2000.

[5] The correlation of the total delinquency index with a summary index of the unrecoded number of offences is r = .92, and with a versatility index of the number of different offences it is r = .96.

The intra-urban distribution and structural covariates of police-recorded and self-reported offending

A good starting point for the analysis of urban pattern and neighbourhood effects of juvenile delinquency is an aggregate-level comparison of police-recorded and self-reported juvenile offending, looking at the extent of variation and segregation of delinquency within the city, the validity of self-reported measures of delinquency, and its correlation with structural disadvantage. For this purpose, we produced Lorenz curves and Gini coefficients for the distribution of both police-recorded and self-reported rates of different groups of offenders based on 34 neighbourhoods in the Cologne sample (Figure 2). Self-reported and police-recorded data, which had both been aggregated according to the geo-coded addresses of respondents and offenders known to the police, were adjusted to the same age group (13–16 years), offence definitions and time period (12 months before the survey took place).[6]

Lorenz curves are a graphical representation of the extent to which certain phenomena are equally distributed or concentrated across units. The larger the area between the diagonal (which represents total equality) and the actual curve, the larger is the concentration of delinquency in some

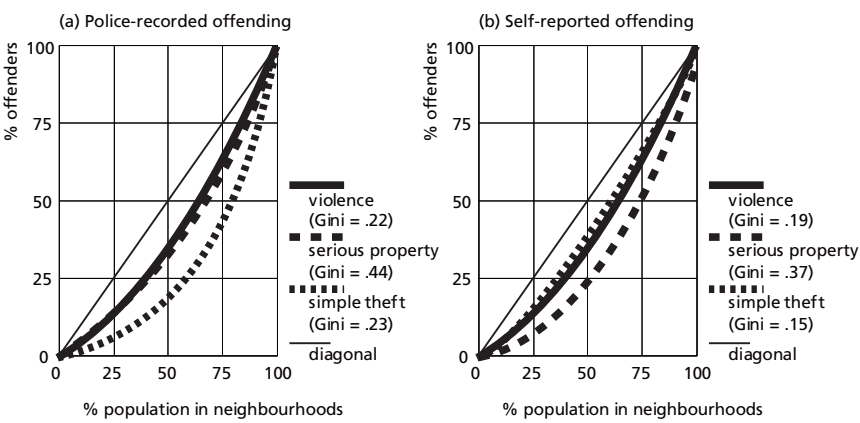

Figure 2 Lorenz curves and Gini coefficients of police-recorded and self-reported offending (prevalence rates previous year for adolescents aged 13–16 years), Cologne 1999 (*N* = 34 neighbourhoods)

[6] Each of the offence types was represented by three items on the self-reported delinquency (SRD) scale: theft of bicycles or parts of bicycles; shoplifting; personal theft (simple theft); wounding; threatening/extortion; robbery (violence); breaking into cars; theft of motor vehicles; breaking in (serious property offences).

of the 34 neighbourhoods. The Gini coefficient is a statistical representation of this area and is standardized to values between 0 (total equality) and 1 (total unequality). If we look at the graph of police-recorded offenders first (Figure 2(a)), the curves and Gini coefficients show that offenders committing simple theft and violence (Gini = .23 and .22) are distributed fairly equally within the city, whereas serious property offenders are much more concentrated in some neighbourhoods (Gini = .44). About 50 percent of serious property offenders reside in the top 25 percent of neighbourhoods (sorted by the respective offender rates). Second, looking at the graph of self-reported offenders (Figure 2(b)), the results show that there is no important difference between the spatial distributions of police-recorded and self-reported delinquency. Simple theft seems to be even more equally distributed across neighbourhoods (Gini = .15) when using self-reported data.

Two overlay scatter plots for the prevalence rates of minor and serious offending show how both measures of delinquency compare with regard to their correlation with structural disadvantage at the neighbourhood level (Figure 3). Minor offending comprises simple theft and vandalism; serious offending includes serious property and violent offences. The black dotted line represents the regression line for self-reported offender

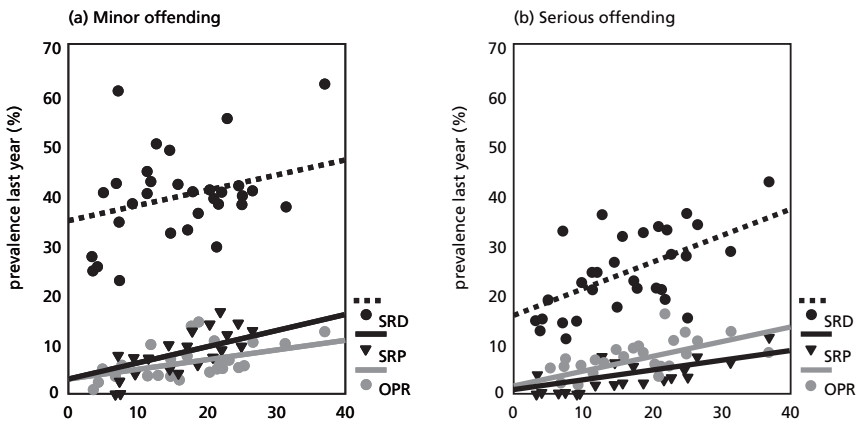

Figure 3 Bivariate scatter plots of social disadvantage with police-recorded and self-reported offending and self-reported police contacts (prevalence rates last year for adolescents aged 13–16 years), Cologne 1999 (*N* = 34 neighbourhoods)

Notes: SRD = self-reported delinquency; SRP = self-reported police contacts; OPR = official police contacts.
Minor offending: vandalism (three items), simple theft (three items).
Serious offending (see also definition in Table 3): violent offences (three items), serious property offences (three items).
Social disadvantage (*x*-axis): % welfare recipients under 18 years (sq. root).
Two outliers excluded; cases weighted by population aged 13–16 years.

rates, the black continuous line the regression line for self-reported police contact rates of these offenders; the grey continuous line represents the regression line for rates of offenders officially recorded by the police. First of all, for both minor and serious offences there is a considerable and well-known gap between self-reported and official offender rates, although the likelihood of being caught (expressed by the distance between the black dotted and the grey continuous lines) seems to be higher for serious offences. The second message conveyed by the graphs is that – irrespective of the rates of self-reported offending – the rates of *self-reported police contacts* are about the same as the official rates. This is an important finding, suggesting that self-report data are valid: because these lines both measure the same phenomenon (adolescents with police contacts), they should ideally be the same.[7]

Another important result is that the correlation with structural disadvantage of neighbourhoods tends to be higher for serious forms of delinquency than for minor forms. The correlations of both self-reported and official police-recorded offender rates with the percentage of welfare recipients among those under 18 years of age is about .2 larger for serious offending compared with minor offending; only self-reported police contacts show a reverse trend (Table 2). This result is supported by the higher Gini coefficient for serious property offences reported earlier.

Viewed together, the results of these aggregate-level analyses show that minor offending is a relatively common behaviour that is widely dispersed across neighbourhoods and only moderately linked to structural disadvantage. Serious offending, however, is more concentrated in some neighbourhoods and more strongly linked to structural disadvantage. This may hint at possible contextual effects of spatial concentrations of social

[7] However, the slope of the regression line of self-reported police contacts for minor offences is somewhat steeper than the slope of the regression line of the official offender rate, resulting in an overestimation of rates of police contacts based on self-reports, particularly in disadvantaged neighbourhoods. Police contacts for serious offences, on the other hand, are slightly underestimated when comparing self-reports with official records. The slight under-reporting of police contacts for serious offences could indicate that some of the most delinquent adolescents are underrepresented in the survey sample, or that respondents who have police records for serious offending concealed some of those. In this case, an *under*-estimation of neighbourhood contextual effects would more likely be the result. An alternative explanation is that more informal police contacts not leading to an official record take place in disadvantaged neighbourhoods where police pursue proactive prevention strategies. A large proportion of informal police contacts is plausible in the case of minor offences, whereas serious offences should more often lead to an official record. Thus, it seems reasonable to conclude that the estimation of self-reported offending with survey data yields reasonably valid results, at least on the aggregate level where individual variations tend to be neutralized (for a more detailed discussion, see Köllisch and Oberwittler, submitted).

Table 2 Zero-order correlations of social disadvantage with police-recorded and self-reported offending and self-reported police contacts (13–16 years, prevalence rates previous year), Cologne 1999 (N = 34 neighbourhoods)

	r =
Minor offending	
Self-reported offending	.31
Self-reported police contacts	.76
Police-recorded offending	.55
Serious offending	
Self-reported offending	.52
Self-reported police contacts	.59
Police-recorded offending	.77

Notes: All coefficients $p < 0.05$.
Social disadvantage: % welfare recipients under 18 years (sq. root).
Two outliers excluded; cases weighted by population aged 13–16 years.

disadvantage on serious offending, which will be explored in the next section of this paper.

A multilevel perspective on neighbourhood effects

Until very recently, individual- and aggregate-level hypotheses on delinquency causation have usually been examined separately. The advance of multilevel modelling allows for an integrated and simultaneous analysis of variables at both levels in order to disentangle the relative importance of individual- and neighbourhood-level effects. I will now use this technique to examine the role of neighbourhood-level processes in mediating the effect of structural disadvantage on serious offending of adolescents.

Drawing on learning and subcultural theories, my first hypothesis is that the concentration of peers with non-conventional and deviant attitudes will lead adolescents to offend more often than would otherwise be the case, net of individual deviant attitudes. This argument is rooted in the tradition of Cloward and Ohlin's (1960) idea of peer groups in working-class neighbourhoods offering delinquent opportunities, and in more recent research on the dynamics of delinquent peer networks (Haynie 2001; Matsueda and Anderson 1998; Thornberry 1996). It is not only through the internalization of deviant attitudes that adolescents may become more delinquent in the longer run. There are also likely to be immediate effects of association with delinquent peers and situations provoking or facilitat-

ing delinquent actions; these short-term effects are assumed to be present if a significant effect of neighbourhood-level deviant attitudes of peers is found net of individual-level deviant attitudes (Felson et al. 1994: 157). I secondly assume that deviant attitudes among adolescents are more prevalent in socially disadvantaged neighbourhoods, and that the effect of neighbourhood structural disadvantage on offending is mediated by these levels of deviant attitudes. In accordance with the Sampson et al. (1999) concept of 'collective efficacy for children', my third hypothesis is that the social organization of neighbourhoods exerts an additional, potentially mitigating influence on adolescent offending: if a neighbourhood is well organized – if the networks of adults and families within the neighbourhood are functioning – the likelihood that adolescents will offend should be lower, net of other individual- and neighbourhood-level influences.

In the model presented in this paper, a three-item 'violence tolerance' scale is chosen to measure deviant attitudes (Table 5). As an attitude scale and strong correlate of serious offending, it is assumed to be close to the outcome, and, by controlling for violence tolerance on the individual level, I hope that some part of the self-selection bias that may have shaped the composition of neighbourhood populations (Duncan and Raudenbush 1999) can also be controlled for. A four-item scale taken from the independent postal neighbourhood survey and measuring 'intergenerational closure', which was adopted from Sampson et al. (1999), is used to test the social disorganization hypothesis (see below for details). The official percentage of welfare recipients among those under 18 years of age serves as a single-item indicator of neighbourhoods' age-specific structural disadvantage, because it proved to have the strongest predictive power for serious offending of several structural indicators and a combined factor score. All of the following multilevel models have been computed with HLM 5 (Raudenbush et al. 2001).

In multilevel modelling, usually the first step of analysis is to compute the so-called 'empty model' with no explanatory variables in order to examine whether a significant proportion of variance is attributable to the aggregate level, comparable to a conventional ANOVA (Bryk and Raudenbush 1992: 17). The intra-class correlation coefficient (ICC) computed from the variance components shows how large (as a percentage of total variance) a possible contextual effect is. In the complete sample of respondents residing in the defined neighbourhoods in Cologne, Freiburg and adjacent rural communities, the ICC of serious offending is 1.9 percent, which is in the same range as results from US studies quoted earlier. However, this result dramatically changes if the sample is split into two groups: for those respondents who say that none or few of their friends live in their own neighbourhood, the share of neighbourhood-level variance is

only 0.3 percent (non-significant), whereas for those who say that many or all friends live in their own neighbourhood, the ICC is 4.2 percent ($p < .001$). This hints at the conclusion that, if friends come from the same neighbourhood, the neighbourhood context is important; if not, the neighbourhood context is not important – at least the residential neighbourhood that is mostly assumed in multilevel analysis! This dramatic difference in ICCs seems to lend strong support to differential association and routine activity theories, and severely to qualify the importance of social disorganization theory. For example, it can be shown that the choice of friends correlates with the amount of leisure time spent in or out of one's own neighbourhood (Oberwittler, in preparation). The spatial dimension of adolescents' routine activities clearly deserves more attention in future research. For the present analysis, it seems a reasonable research strategy to restrict neighbourhood-focused models of contextual effects to those respondents whose friends come predominantly from the same neighbourhoods, and to exclude all other respondents.[8] By doing so, the initial sample size of about 4,800 respondents is reduced to 2,500 respondents (see Table 3).

Table 4 reports the ICCs for minor and serious offending and for violence tolerance and compares them with those computed for the school contexts of respondents. As expected from the aggregate-level analysis of spatial distributions, the ICC of serious offending is somewhat higher than for minor offending, but the difference disappears once the sociodemographic composition of respondents is controlled for (see rows labelled 'conditional'). Violence tolerance also shows signs of contextual influences. However, the ICCs of school contexts are generally much higher than those

Table 3 Stepwise selection of sample size for multilevel analysis of serious offending (school survey)

	Reduction	*New sample size*
Total sample	–	6437
Respondents living outside of the 61 defined neighbourhoods	–1616	4821
Three rural neighbourhoods where most students commute to Freiburg	–164	4657
Respondents whose friends live predominantly outside their own neighbourhood	–2137	2520

[8] Respondents from three rural communities near Freiburg who predominantly commute to schools in Freiburg have also been omitted from further analyses.

Table 4 Intra-class correlation coefficients (% of variance at group level) for neighbourhood and school contexts (school survey)

Level 2 units	*Minor offending*	*Serious offending*	*Violence tolerance*
Neighbourhoods[a]			
Empty model	3.0	4.2	3.8
Conditional[c]	2.2	2.1	1.6
Schools[b]			
Empty model	5.5	7.7	7.6
Conditional[c]	4.6	5.5	4.1

Notes: All ICCs: $p < 0.01$.
[a] $N = 2520$ respondents (only with many/all friends in one's own neighbourhood, without commuters) in $N = 58$ neighbourhoods.
[b] $N = 5991$ respondents in $N = 56$ schools.
[c] Controlling for age, sex, immigrant background, incomplete family, parental SES, welfare recipient.

of neighbourhood contexts, and are comparable to those found in previous research (Welsh et al. 1999). As mentioned above, it is not clear whether this is owing merely to a higher segregation and self-selection of adolescents to schools than to neighbourhoods, to a tendency of respondents to give more concurrent answers in a classroom situation, or to a real difference in contextual effects sizes. Another important result contained in Table 4 is that, if one controls for sociodemographic composition, the share of group-level variance is reduced but still remains significant (see below for more details). Thus, the contextual variance is likely to be small but substantive.

Measuring neighbourhood-level social processes

One important feature of multilevel techniques is the possibility of integrating variables from different sources into regression models in order explicitly to measure the assumed aggregate-level influences on individual behaviour. As far as structural conditions are concerned, census and other official data are well suited for this purpose. Mediating social processes, on the other hand, are usually measured by aggregating the assessments of individual respondents. If both the individual-level outcome and ecological assessments stem from the same survey, the measurement errors of aggregate-level predictors assessments are likely to be correlated with the measurement errors of individual-level predictors and the outcome (Duncan and Raudenbush 1999: 38). For example, a young gang member may judge the level of neighbourhood informal control differently from a

non-delinquent adolescent. Independent data collection, which avoids this 'same-source bias', is therefore preferable and has been pursued in this study by doing a postal neighbourhood survey.

Before using it as a neighbourhood-level predictor explaining juvenile offending, the ecological reliability of the 'intergenerational closure' scale will be assessed, following the 'ecometric' approach of Raudenbush and Sampson (1999; see Oberwittler 2003b). The ICC of intergenerational closure is 25 percent, and the ecological reliability λ, which can be compared to Cronbach's a, is .93. Judged by the standards of the 'ecometric' diagnostics of survey measures of aggregate-level social processes, these results are very satisfying. Sampson and Raudenbush (1999: 642) report a lower ecological reliability for this scale in their Chicago community study.[9]

Although 'intergenerational closure' aims at a general assessment of neighbourhoods and therefore shows a higher 'inter-rater reliability' than questions on individual behaviour, it is likely to be affected by respondents' individual characteristics, such as having children or not. It is therefore advisable to adjust the respondents' collective assessment of neighbourhood conditions for compositional effects (Sampson et al. 1999: 646). Doing this leads to a conditional ICC of 17.9 percent and to $\lambda = .89$, which is still high. By introducing these sociodemographic characteristics of respondents into the multilevel model, only about 5 percent of individual-level variance can be explained (Table 6; see appendix for notation). Above all, living in a one- or two-family home, living for more than five years in the same neighbourhood, having children in one's household and being female lead to a more positive assessment of 'intergenerational closure', whereas welfare dependency works modestly in the opposite direction. Other predictors (age, educational status, non-German citizenship, home ownership) are non-significant and have been omitted from the model.

On the aggregate level, the between-neighbourhood variance of the respondents' assessments of intergenerational closure is strongly and negatively related to social disadvantage and also to commercial infrastructure, which together account for 80 percent of neighbourhood-level variance. Thus, social conditions for children seem to be endangered in neighbourhoods with concentrated social disadvantage and non-residential land-use.

The predicted neighbourhood means of intergenerational closure from this multilevel regression model, which are adjusted for individual-level compositional effects and estimated via the 'empirical Bayes' method,

[9] This is in part a result of including non-urban communities in the survey, which enhances the between-neighbourhood variance, but it holds true even when these rural communities are excluded.

have been saved for use as a neighbourhood-level predictor in the following multilevel regression model with serious offending as the dependent variable.

A multilevel explanation of serious offending

As the final step of the analysis, I computed multilevel linear regression models explaining serious offending by adolescents. For the descriptives of all variables used in this analysis, see Table 5. These models are again restricted to the subsample of respondents with friends predominantly from their own neighbourhood (Tables 7 and 8; see appendix for notation). The dependent variable is an index of the categorized frequencies of serious offending during the previous year (see above) and is – not surprisingly – highly skewed even after log-transformation. Skewed dependent variables often do not cause serious trouble in linear regression because this technique is fairly robust. There are few experiences yet with skewed variables in multilevel regression analysis, and a cautious approach is advised by Bryk and Raudenbush (1992: 198). Nonlinear regression techniques such as (extra) poisson regression are available in multilevel analysis too, but their interpretation and testing are less straightforward; for example, variance components are hard to assess (Browne et al. 2002), deviance statistics do not exist and parameter estimation seems to be less robust (Guo and Zhao 2000). However, the results of linear regression will be compared with a nonlinear model at the end of this paper.

In the first two steps of building the full model, only individual-level predictors (level 1) are entered in order to look for the reduction of variance at both levels (Table 7). Model 1 is identical to the model containing the conditional ICC (see Table 4, above). Controlling for relevant sociodemographic characteristics, 7 percent of the level-1 variance of serious offending is explained, and the level-2 random effect variance (u_{oj}), which is the between-neighbourhood variance, is reduced by about half compared with the 'empty model' without explanatory variables (not reported). Thus, half of the between-neighbourhood variance of serious offending is in fact due to the social composition of respondents.

In model 2, two theoretically important attitude scales, school bonding and violence tolerance, are introduced at level 1, leading to a substantial rise in explained variance at level 1 to 27 percent; the level-2 random effect (u_{oj}) is again reduced by about 50 percent. This implies that both attitude scales, particularly violence tolerance (as has been demonstrated above – see Table 4 for the ICC), are themselves distributed nonrandomly across neighbourhoods. One may assume that violence tolerance

Table 5 Variables and descriptives for multilevel regression models in Tables 7 and 8

	Mean	*SD*	*Min*	*Max*
Level 1 (school survey, *N* = 2520 respondents[a])				
Serious offending (6 items, *a* = .70)[b]				
Prevalence previous year (1 = yes)	0.28	0.45	0	1
Log. incidence previous year	0.11	0.24	0	1.57
Sex (1 = male, 2 = female)	1.49	0.50	1	2
Age (in years)	14.60	1.12	12	18
Immigrant background (0 = one or both parents born in Germany; 1 = both parents born abroad)	0.28	0.45	0	1
Parents: separated (1 = yes)	0.24	0.43	0	1
Parental SES[c]	2.23	0.95	1	4
School bonding (4 items, *a* = .63)[d]	1.99	0.54	0	3
Sq. root violence tolerance (3 items, *a* = .72)[e]	1.87	2.15	0	9
Level 2 (*N* = 58 neighbourhoods)				
Official data				
% welfare recipients under 18	13.2	8.9	1.4	36.9
School survey (*N* = 2520 respondents)				
Mean violence tolerance	1.04	0.13	0.74	1.48
Postal neighbourhood survey (*N* = 2489 respondents)				
Intergenerational closure (4 items scaled 0–3, *a* = .70, λ = .89)[f]	1.80	0.22	1.35	2.19

Notes:
[a] Residing in 58 neighbourhoods, friends predominantly from same neighbourhood.
[b] Wounding, extortion/threatening, robbery, theft of/from motor vehicles, breaking in (summary index of categorized frequencies, 0 = no offence, 4 = 10 or more offences).
[c] Index of educational (1 = no degree, 4 = university degree) and occupational status (Wegener's (1988) Magnitude Prestige Scale based on ISCO68 categorized to 1 = low to 4 = high; 10.5% of respondents without valid ISCO codes were coded directly to these categories; 5.5% have missing values).
[d] 'I like my school'; 'Most of the teachers strive to be on good terms with us'; 'I am interested in the things we learn'; 'I make an effort to learn'.
[e] 'It is okay to beat someone if provoked'; 'Every dispute can be solved by talking' (reversed); 'There are conflicts that can only be solved by violence'.
[f] 'Adults in this neighbourhood know who the local children are'; 'Parents in this neighbourhood know their children's friends'; 'This neighbourhood is not a good place for children to grow up' (reversed); 'There are adults in this neighbourhood that children can look up to' (empirical Bayes estimates controlling for socio-demographic composition).

is a product of (longer-term) contextual influences on adolescents too, and, as a proximate correlate of serious offending, 'eats up' a part of its neighbourhood-level variance. One can also observe that the attitude scales mediate part of the influence of sociodemographic predictors on serious offending. For example, the coefficient of parental SES is reduced by

Table 6 Linear multilevel regression model explaining 'intergenerational closure' (postal neighbourhood survey, $N = 2505$ respondents in $N = 61$ neighbourhoods)

	Unstandard. coefficient	*t-value*	*Significance*
Fixed effects – level 1			
Resident for 5 years or more	0.097	3.8	***
1- or 2-family house	0.207	9.2	***
Children in household	0.085	3.1	**
Sex: female	0.047	2.2	*
Welfare recipient	–0.095	–2.0	*
Intercept (γ_{00})	2.000	122.0	***
Fixed effects – level 2			
Predictors for intercept			
Social disadvantage[a] (γ_{01})	–0.281	–19.7	***
Commercial infrastructure (log)[b] (γ_{02})	–0.162	–3.5	**
	Var.comp.	*Significance*[c]	R^2
Random effect – level 1 (r_{ij})	0.253		4.7%[d]
Random effects – level 2 (u_{oj})	0.011	***	80.1%[d]

Notes:
[a] Factor score: population density, % divorced, % 1- or 2-family houses (rev.), % non-German citizens (under 14), % welfare recipients (under 18).
[b] Commercial infrastructure: fashion retailers, travel agencies, doctors' practices, cafés, bars and restaurants per 1000 population (mean index of *z*-standardized values).
[c] χ^2 test for the significance of u_{oj}.
[d] Proportional reduction in error variance compared with the empty model (r_{ij}) and with the conditional model controlling for level-1 sociodemographic composition (u_{oj}).

28 percent, of 'unemployed/welfare recipient' by 34 percent, and of sex by 59 percent.

In the third model, the neighbourhood percentage of welfare recipients under 18 years is entered at level 2 (Table 8). The predictor turns out to be positively and significantly related to the outcome, explaining 22 percent of its neighbourhood-level variance. There are also two dummy variables for the different cities and rural districts (with Cologne as the reference category) in order to account for possible unexplained regional variations in offending; Freiburg shows a marginally higher level of offending compared with the other sites. Furthermore, some of the individual-level structural predictors are now rendered marginally or completely insignificant. The coefficient of 'immigrant background' is reduced by 34

Table 7 Linear multilevel regression models explaining serious offending (school survey, N = 2520 respondents in N = 58 neighborhoods): Models 1 and 2

	Model 1			*Model 2*		
	Unstandard. coefficient	*t-value*	*Significance*	*Understand. coefficient*	*t-value*	*Significance*
Fixed effects – level 1						
Sex: female (γ_{10})	–0.096	–10.1	***	–0.041	–5.6	***
Age (γ_{20})	0.008	2.1	*	0.005	1.3	n.s.
Immigrant background (γ_{30})	0.039	2.6	**	0.032	2.4	*
Parents: separated (γ_{40})	0.069	6.2	***	0.055	5.1	***
Parental SES (γ_{50})	–0.018	–3.9	***	–0.013	–2.9	**
Unemployed/welfare recipient (γ_{60})	0.056	2.8	**	0.037	2.3	*
School bonding (γ_{70})	–	–		–0.047	–4.4	***
Violence tolerance (sq.) (γ_{80})	–	–		0.047	12.0	***
Intercept (γ_{00})	0.113	2.1	*	0.080	1.2	n.s.
	Var.comp.	*Significance*	R^2	*Var.comp.*	*Significance*	R^2
Random effect – level 1 (r_{ij})	0.04917		7.0%[a]	0.03858		27.0%[a]
Random effects – level 2 (u_{oj})	0.00103	0.000		0.00053	0.006	

Notes: Linear regression models, log. incidences of self-reported serious offending last year; level-1 predictors in models 1 and 2 are not group-centred in order to compare variance components.

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{+}$ $p < 0.10$.

[a] Proportional reduction in error variance compared with the empty model without level-1 predictors (not reported, r_{ij} = 0.05286).

percent and is no longer significant, and the coefficient of 'unemployed/ welfare recipient' is further reduced by 14 percent and remains only marginally significant. This result means that the *concentration* of social disadvantage in neighbourhoods has an independent contextual effect on adolescents' serious offending over and above the individual effect of disadvantage. Thus, the first hypothesis seems to be confirmed. However, as only 2 percent of the total variance of serious offending (controlling for sociodemographic composition) is between neighbourhoods (see Table 4), the neighbourhood part of this model adds very little to the total share of explained variance.

Finally, the fourth model tries to identify mediating social processes that translate neighbourhood-level social disadvantage into a reinforcement of juvenile offending. Both violence tolerance and intergenerational closure are significant neighbourhood-level predictors when added separately to the model along with the welfare rate, both reducing considerably the latter coefficient (models not shown in Table 7).[10] Owing to multicollinearity, it is not possible to enter all three predictors at the same time (see Table 9 for the bivariate correlations of neighbourhood-level predictors). When entering the two mediating variables without the exogenous structural variable, they both display highly significant coefficients of roughly the same strength, and together can explain about 50 percent of neighbourhood-level variance (model 2 in Table 7). With a bivariate correlation of $r = -.55$, there is no sign of multicollinearity in this model (Table 9). As predicted by subcultural theory *and* by social disorganization theory, the context-level effect of structural disadvantage on offending is largely mediated and, in fact, outperformed by the deviant attitudes of peers and by the intergenerational social ties within the neighbourhood. Even if peer groups with deviant attitudes do exist in a neighbourhood, a high level of social organization mitigates their propensity actually to commit offences. Thus, the second and third hypotheses – that the effects of structural conditions on offending are mediated by different social processes – seem to be confirmed as well. There is apparently no need to restrict the search for empirical models to one of the different theoretical approaches, which seem rather to supplement than to contradict each other.

To take this hypothesis further, the relationship between individual deviant attitudes and actual deviant behaviour should also be less pronounced in neighbourhoods where effective social organization inhibits the commitment of delinquent acts. This effect is formally known as a 'cross-level interaction', here between the individual-level influence of violence

[10] Violence tolerance reduces the coefficient of the welfare rate by 28 percent and intergenerational closure by 39 percent.

Table 8 Linear multilevel regression models explaining serious offending (school survey, $N = 2520$ respondents in $N = 58$ neighborhoods): Models 3 and 4

	Model 3			*Model 4*		
	Unstandard. coefficient	*t-value*	*Significance*	*Understand. coefficient*	*t-value*	*Significance*
Fixed effects – level 1						
Sex: female (γ_{10})	–0.043	5.9	***	–0.047	–6.2	***
Age (γ_{20})	0.005	1.1	n.s.	0.005	1.2	n.s.
Immigrant background (γ_{30})	0.021	1.4	n.s.	0.023	1.6	n.s.
Parents: separated (γ_{40})	0.051	4.7	***	0.054	4.9	***
Parental SES (γ_{50})	–0.011	–2.2	*	–0.012	–2.6	*
Unemployed/welfare recipient (γ_{60})	0.032	1.8	+	0.036	2.2	*
School bonding (γ_{70})	–0.048	–4.6	***	–0.047	–4.5	***
Violence tolerance (sq.) (γ_{80})	0.046	12.3	***	0.042	15.5	***
Intercept (γ_{00})	0.114	21.5	***	0.113	22.7	***
Fixed effects – level 2						
Predictors for intercept (γ_{00})						
% welfare recipients under 18[a] (γ_{01})	0.039	5.6	***			
Mean violence tolerance (γ_{02})	–	–		0.138	4.6	***
Intergenerational closure[b] (γ_{03})	–	–		–0.115	–3.2	**
Region: Freiburg (γ_{04})	0.034	2.0	*	0.029	1.6	n.s.
Region: rural areas (γ_{05})	0.025	1.4	n.s.	0.001	0.8	n.s.

Table 8 *continued*

	Model 3			*Model 4*		
	Unstandard. coefficient	*t-value*	*Significance*	*Understand. coefficient*	*t-value*	*Significance*
Predictors for slope (γ_{80})						
Intergenerational closure[b] (γ_{81})	–	–		–0.054	–4.9	***
Region: Freiburg (γ_{82})	–	–		0.016	2.6	*
Region: rural areas (γ_{83})	–	–		–0.004	–0.5	n.s.
	Var.comp.	*Significance*	*R^2*	*Var.comp.*	*Significance*	*R^2*
Random effect – level 1 (r_{ij})	0.03857		27.0%[c]	0.03682		30.3%[c]
Random effects – level 2						
Intercept (u_{oj})	0.00080	***	22.3%[d]	0.00052	**	49.5%[d]
Slope (u_{8j})				0.00018	***	47.1%[e]

Notes: Linear regression models, log. incidences of self-reported serious offending previous year; level-1 predictors are group-centred in models 3 and 4.
*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{+}$ $p < 0.10$.
[a] Official data.
[b] Postal neighbourhood survey, empirical Bayes estimates controlling for individual-level sociodemographic composition.
[c] Proportional reduction in error variance compared with 'empty model' without level-1 predictors (not reported, $r_{ij} = 0.05286$).
[d] Proportional reduction in error variance compared with 'conditional model' with level-1 sociodemographic predictors (u_{oj}= 0.00103, see model 1).
[e] Proportional reduction in error variance compared with unconditional random effect ($u_{8j} = 0.00038$).

Table 9 Zero-order correlation matrix of relevant neighbourhood-level variables (N = 58 neighbourhoods)

	Pearson's r	*A*	*B*	*C*	*D*
A	% welfare recipients <18 yrs[a]				
B	Commercial infrastructure (log)[a]	–.31*			
C	Mean 'intergenerational closure'[b]	–.83**	–.02		
D	Mean 'violence tolerance'[c]	.58**	–.25^{+}	–.55**	
E	Mean serious offending[c]	.69**	–.30*	–.64**	.74**

Notes:
** $p < 0.01$, * $p < 0.05$, $^{+}$ $p < 0.10$ (two-tailed).
[a] Official data (see Table 6).
[b] Postal neighbourhood survey (N = 2489).
[c] School survey (N = 2520).

tolerance on the outcome variable (slope γ_{80}) and the neighbourhood-level intergenerational closure predictor, and can be tested in a multilevel regression model. If a significant cross-level interaction exists, which turns out to be the case after the slope of violence tolerance is 'set free' (Snijders and Bosker 1999: 67), the steepness of the slope varies across neighbourhood contexts and may be explained by neighbourhood-level variables. As model 4 shows (Table 8), intergenerational closure successfully explains roughly half of this variance. The negative coefficient γ_{81} means that, in neighbourhoods with higher levels of intergenerational closure, the influence of deviant attitudes on serious offending is less strong than in other neighbourhoods. Again, a regional dummy variable for Freiburg significantly adds to the explanation of the slope's variance, meaning that in Freiburg the association between deviant attitudes and delinquent behaviour is stronger than in the other sites.

This cross-level interaction is somewhat difficult to understand, and therefore the graphical tool of HLM is used as a means of visualizing this particular result of model 3 (Figure 4). In this graph, the varying steepness of the slope of violence tolerance is given for two typical neighbourhoods with high and low levels of intergenerational closure, respectively.[11] The slope – which represents the predictive power on the outcome – is considerably steeper in the latter neighbourhood than in the former. This means that adolescents with very deviant attitudes commit serious offences less often in neighbourhood contexts of high levels of social organization

[11] –0.316 and 0.246 of 'SV20EB' (intergenerational closure), which is centred around its grand mean. 'Violence tolerance' (x-scale) is centred around its grand mean, too.

than they do in neighbourhood contexts of low levels of social organization (right end of *x*-scale); adolescents without these deviant attitudes do not commit many offences in either context (left end of *x*-scale) because they obviously lack the intrinsic motivation to offend.

It is possible to come to quite similar results using the raw counts of offences as the dependent variable and applying nonlinear multilevel regression analysis based on a poisson distribution with over-dispersion. Essentially, the direction and significance of most predictors are the same (results available on request; see Anderson 2002; Snijders and Bosker 1999: 234). However, the random effect of the coefficient 'violence tolerance' and its cross-level interaction with 'intergenerational closure' are not significant in the poisson regression model. The same problem has been encountered by Guo and Zhao (2000: 452) with respect to binary outcomes, which they attribute to the problems of the approximation methods of nonlinear models. It would be worth trying to replicate the model results presented here with other data sets.

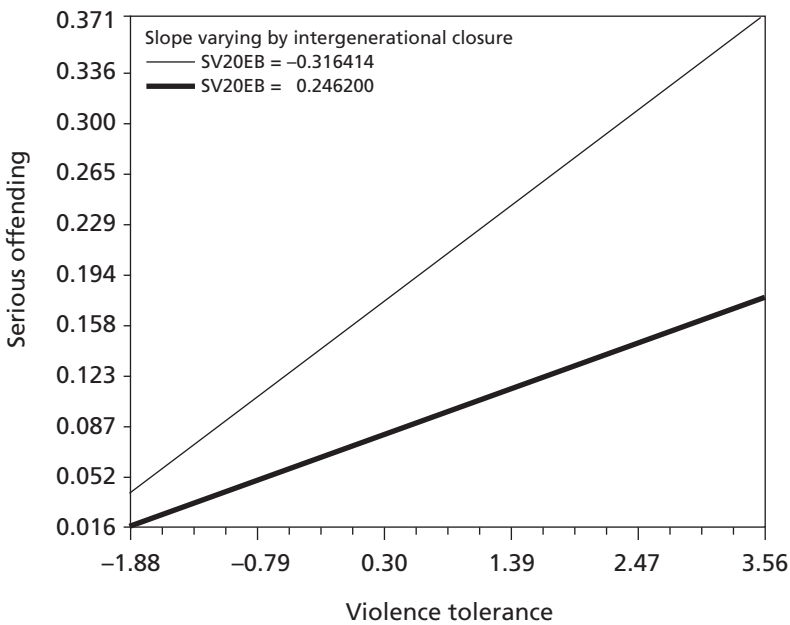

Figure 4 Cross-level interaction effect of intergenerational closure on the slope of violence tolerance on serious offending (graphical representation of coefficient γ_{80} from Table 8, Model 4)

Notes:
SV20EB: intergenerational closure (grand-mean centred).
x-axis: mean-centred scale of sq. root-transformed 'violence tolerance'.
y-axis: scale of log-transformed 'serious offending'.

Conclusion

The main purpose of the study presented in this paper is to look for the existence and possible explanation of neighbourhood effects on juvenile offending in a European urban context by applying recent theoretical and methodological advances made in research on US cities. The empirical evidence of our study of two German cities and a rural area lends strong support to a positive answer: ecological contextual effects are likely to exist, and the neighbourhood context appears to play an important role in these effects. However, as has been shown in previous research on US cities, contextual effects on adolescents' behaviour are generally very small compared with individual-level influences. The concepts applied for the analysis of neighbourhood-level mechanisms used in US research seem to work quite well in the European context too.

One of the more important findings of this study is that adolescents actively and individually shape the relevance of their neighbourhood contexts. The spatial extent of their friendship networks (and hence their routine activities) determines whether or not the neighbourhood is a relevant social context for them. This does not amount to a final blow to neighbourhood-oriented social disorganization theory, but it is a serious qualification to this theoretical approach because the neighbourhood context – and hence social processes attached to this context – can exert significant effects only for those adolescents who predominantly have their friends and spend their time within their own neighbourhood. One of the possible explanations for this 'immunity' of many adolescents could be the competing role of schools as a more meaningful social context (which is supported by the observation of higher shares of variances at the school context level compared with neighbourhoods). It is a shortcoming of existing research that this 'duality' of ecological contexts – although long present in theoretical deliberations – has escaped empirical analysis until now (but see Kim 2001; Oberwittler, in preparation). It is to be hoped that the development of more sophisticated statistical techniques will facilitate empirical research on this question (Browne et al. 2001).

A second important result is that different social processes focused on by different theoretical approaches seem to work together in translating structural disadvantage into problem behaviour by adolescents. A combination of subcultural and social disorganization theories yielded the best model explaining a large share of neighbourhood-level variation in serious offending. This may be seen as a point *for*, not *against* moves towards theory integration.

On the other hand, serious methodological limitations qualify the results of our study, which is based on cross-sectional data. If it is generally

problematic to draw causal inferences from cross-sectional data, this is even more the case with multilevel data, because there remain doubts about whether a significant aggregate-level effect is merely the result of a self-selection bias.[12] The collection of longitudinal data, although multiplying the efforts and costs of empirical research, can help to get round this dilemma and to test hypotheses about contextual effects more rigorously. Research of this kind is currently under way in several places in Europe.

The interpretation of empirical correlations of survey-measured neighbourhood-level constructs such as 'intergenerational closure' or – even more so – 'informal social control' as causal influences is a particularly critical aspect of community-focused delinquency research. It remains open what exactly induces respondents to assess the social climate of their neighbourhood in a particular way. It is conceivable, and it has often been maintained, that the observation and experience of crime and disorder may influence residents' perception of social processes and, subsequently, their actual behaviour (Bellair 2000; Liska and Warner 1991; Skogan 1990). If this is true, the causal order of adolescents' offending and the residents' judgement of social organization is not clear beyond doubt. More efforts should be made to ascertain the empirical substance of these theoretical claims by controlling for community-level reciprocal effects of crime and social organization aspects (see, for example, Morenoff et al. 2001). Also it seems necessary to develop a better understanding of the meaning of ecological scales based on rather vague questions about what happens in the locality, for example by contrasting them with harder evidence on the actual behaviour of residents, whether gained from surveys or by other methods that do not depend on the perceptions or reports of local residents.

Appendix: Notation in multilevel analysis

In contrast to standard linear regression, multilevel (or hierarchical) linear regression takes into account the nested structure of individuals within groups by decomposing the residual error variance into individual-level (level 1) and group-level (level 2) variance and by estimating coefficients of group-level predictors in addition to the coefficients of individual-level predictors. Following the notation used by Snijders and Bosker (1999), a simple multilevel regression equation ('random intercept model') with one

[12] By which is meant self-selection of people to neighbourhoods, not self-selection of people to the survey sample (Duncan and Raudenbush 1999).

explanatory variable at both the individual and the group level and a random effect for the intercept is:

$$\gamma_{ij} = \gamma_{00} + \gamma_{10}x_{ij} + \gamma_{01}z_j + u_{oj} + r_{ij},$$

where j is the index for the groups ($j = 1, \ldots, N$) and i is the index for individuals within group j ($i = 1, \ldots, n_j$). The index $_{ij}$ indicates that the respective value depends on both individuals and groups. Y_{ij} is the dependent variable, y_{00} is the average intercept of all groups (grand mean), $\gamma_{10}x_{ij}$ is the coefficient of the individual-level predictor variable x, $\gamma_{01}z_j$ is the coefficient of the group-level predictor variable z, u_{oj} is the group-level error variance, and r_{ij} is the individual-level error variance. In the regression models presented in this paper, γ_{10}, γ_{20}, ... denote the individual-level predictors, γ_{01}, γ_{02}, ... denote the group-level predictors explaining the variance of γ_{00} (the average intercept, with residual error variance u_{oj}), and γ_{x1}, γ_{x2} denote the group-level predictors explaining the variance of the slope of predictor γ_{x0} (with the residual error variance u_{xj}); in the case of Table 8, these are coefficients γ_{81} to γ_{83} and residual error variance u_{8j} for slope γ_{80}.

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Dietrich Oberwittler

Dietrich Oberwittler is a Sociologist and Research Scientist at the Max Planck Institute for Foreign and International Criminal Law Freiburg, Depart-

ment of Criminology, and Lecturer at the University of Freiburg, Germany. From 2004 to 2006 he will be a visiting scholar at the Institute of Criminology, University of Cambridge, UK. His research interests include juvenile delinquency, social ecology and urban sociology; multilevel analysis and the social history of crime. Recent publications: *Von der Strafe zur Erziehung? Jugendkriminalpolitik in England und Deutschland, 1850–1920* (Frankfurt: Campus, 2000); *Soziologie der Kriminalität. Sonderheft 43 der Kölner Zeitschrift für Soziologie und Sozialpsychologie* (co-editor with Susanne Karstedt, Wiesbaden: Westdeutscher Verlag, in press); Re-balancing routine activity and social disorganization theories in the explanation of urban violence: A new approach to the analysis of spatial crime patterns based on population at risk, *Journal of Quantitative Criminology* (forthcoming).
d.oberwittler@iuscrim.mpg.de