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Chapter 9

Urban Streets as Micro Contexts to Commit Violence

Johan van Wilsem

Abstract Opportunities for crime are assumed to be highly localized. Therefore, using streets as units of analysis offers insight into crime patterns that are lost when they are aggregated to the neighborhood level. Previous street-level studies on crime have concentrated on variations in the amount of incidents. According to Crime Pattern Theory, more crime is expected to occur where people's routine activities coincide with suitable targets in poorly guarded circumstances. However, the theory, if extended further, is also applicable to street-level variation in qualitative aspects of crime, such as the relation between offender and victim and the use of weapons. The reason for this is that the routine of everyday life determines spatial concentrations of certain types of people at specific locales, which may determine the way crime is committed in a particular street if the characteristics of its visitors are related to the nature of the crimes committed there. For instance, if a street attracts young people, and young people use guns more often, then gun related violence will be more frequent in that street. This chapter focuses on the volume as well as the nature of violent crime, based on a sample of approximately 600 incidents committed in certain streets in Rotterdam, the Netherlands. The results suggest that (a) accessibility and social disorganization increase the number of crimes in a street, (b) co-offending and the relation between offender and victim vary significantly between streets, while weapon use and victim injury do not, and (c) incident characteristics and the street's accessibility play an important role in explaining street-level differences in the relation between victim and offender. The latter finding supports the hypothesis derived from Crime Pattern Theory that the daily functions of streets serve as a selection mechanism for who visits the street and subsequently determine against whom violence is committed in that locality.

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Introduction

The street is an interesting unit of analysis for crime research. It is possible to explore *within-neighborhood* differences of crime on this detailed level. Street-oriented research challenges the image that is often portrayed of neighborhoods as homogeneous areas. The general reason to expect substantial crime differences within a neighborhood is that the opportunities for criminal conduct are highly localized. For instance, the amount of informal surveillance is important to understand the spatial distribution of crime events, but this factor is not constant across an entire neighborhood. Some streets, within the same community, may be monitored quite well by its residents whereas others are not. As a result, the amount of crime has been found to vary across streets or street blocks (Block 2000; Roncek and Maier 1991; Sherman et al. 1989; Smith et al. 2000).

Crime Pattern Theory offers explanations for crime differences at such local levels (Brantingham and Brantingham 1993; Eck and Weisburd 1995). It assumes that the distribution of opportunities for crime across space is determined by the way people interact with their local environment. If a place is easily accessible, because of its position in the urban street network for example, a lot of people will visit that place, which increases the risk of offenders and targets converging. Such places are at risk of experiencing high volumes of crime if, on top of this, these conditions are combined with poor surveillance. Smith and colleagues, for instance, identified the presence of commercial stores and heterogeneous population structures as criminogenic risk factors for street blocks (Rice and Smith 2002; Smith et al. 2000).

The assumption that crime opportunities vary at a detailed spatial level also implies that there are street-level differences in the *nature* of criminal incidents, such as the way in which violent acts are committed and the relation between offender and victim. Streets vary in the type of public that visits them as they have different everyday functions. This has consequences for the streets' crime profile insofar as the characteristics of these visitors are related to the way that crime is committed. For instance, if certain streets attract groups of people because of local entertainment venues then the violence committed in those streets is more likely to have a group character.

However, ecological studies have almost all ignored the way in which the nature of violent crimes differs between localities. A notable exception is the work of Baumer et al. (2003), which focuses on *neighborhood* differences by looking to the qualitative aspects of violence, such as weapon possession and victim injury. Wikström and colleagues (Eisner and Wikström 1999; McClintock and Wikström 1992) have also examined the social context of criminal incidents, the victim's injuries and whether a weapon was used during the crime or not, and compared these rates across the *cities* of Stockholm, Basel, and Edinburgh. To my knowledge, a *street-oriented* study on the qualitative aspects of violence has never been conducted before.

This chapter examines the extent to which the volume and nature of violent crimes covary with the social, economic, and environmental design features of streets. For this purpose, I have used a sample of approximately 600 incidents and

more than 200 streets in three neighborhoods of Rotterdam, the Netherlands. In the same vein as recent work carried-out by Hipp (2007), these data offer the opportunity to explore if the examination of *within-neighborhood* differences is a viable step. Street-level analysis also offers insight into crime variations that are lost when they are aggregated to the neighborhood level.

Determinants of Crime Volumes in Streets

The committing of crimes at specific places is assumed to be the outcome of offenders' evaluations of the costs and benefits associated with behavioral alternatives. The better places are suited to commit a crime, the higher the expected crime volume will be. Variations in target suitability and the presence of capable guardians have become the leading explanations for concentrations of crime at certain places, especially since the development of rational choice oriented crime research (Cornish and Clarke 1986). More specifically, Cohen and Felson's (1979) 'Routine Activity Theory' argues that a larger volume of crime is expected at places where informal surveillance is lacking, where large shares of offenders are easily able to enter the area, and where offenders can meet many targets eligible for a crime. According to Wikström (1995), city centers are places where these conditions co-occur, and therefore places where high crime volumes are found.

Crime Pattern Theory connects the routine activities of offenders and victims with the places where crimes are committed (Brantingham and Brantingham 1993; Eck and Weisburd 1995). It supposes that 'nodes, paths, and edges' are important concepts to understand spatial concentrations of crime. An important assumption of the theory is that crimes are committed in 'nodes', areas that are known to offenders because of their routine activities, such as work or leisure. Targets come to the attention of offenders through these activities. Therefore, large volumes of crime are expected at places where a lot of offenders routinely move about, and where they can find many suitable targets. 'Paths' are the routes connecting the nodes and which are thus used during routine activities. 'Edges' refer to the boundaries of the places where people perform routine activities and their in-between paths.

Apart from Routine Activity Theory's notion that the degree of guardianship is important to understand varying crime volumes across places, this research concentrates on the way in which nodes and paths shape local amounts of crime. In previous research on streets or street segments, social disorganization and commercial activity have been identified as risk factors for high street (block) levels of crime. For instance, Smith et al. (2000) found that street blocks characterized by many single-parent households, motels, and bars had relatively high levels of street robbery. Similarly, Rice and Smith (2002) found these patterns for automotive theft. Apart from exerting main effects, these circumstances had also conditional influence: the presence of commercial establishments induced crime, especially in the absence of informal surveillance. Roncek and colleagues (Roncek 1981; Roncek and Faggiani 1985; Roncek and Maier 1991) found that in Cleveland street blocks with facilities such as schools and bars had higher levels of crime on average, net

of population characteristics in the block. These findings suggest that such facilities are 'nodes' that act as crime generators, that is, places where offenders commit violence while they are there for other reasons such as going to school or going out for entertainment (Brantingham and Brantingham 1995).¹

In addition, the accessibility of areas also steers the direction in which offenders travel, which indicates the importance of 'paths' for the spatial distribution of crime volumes. Beavon, Brantingham and Brantingham (1994) explored street segment patterns of property crime in two Canadian suburban municipalities, and found that high levels of crime were observed in streets with many twists and turns and with a high traffic flow, also after controlling for other risk factors. Based on these findings, they argued that "city planning practices (...) create the opportunity network for crime." (p. 138) A similar argument was put forward by Wikström (1995), who claimed that the likelihood that offenders and victims will meet in a violent encounter is dependent upon 'people's patterns of movement, the street layout, and the structure of the public transport system.' (p. 441). Larger volumes of crime are expected at places where a lot of people can gain access due to transport opportunities. Indeed, higher crime rates have been documented in the vicinity of areas with public transport stops (Smith & Clarke 2000). For instance, Block and Davis (1996) found that street robberies were concentrated around rapid transit stations in several Chicago neighborhoods, while Piza (2003) found a similar result in Newark, NJ. This research will also test whether streets with public transport stops are confronted with larger volumes of violent crime. In addition, this chapter also examines the relation between crime volumes and variations in guardianship that result from street-level differences on features related to social disorganization such as concentrated disadvantage, ethnic heterogeneity and family disruption (Sampson and Groves, 1989).

Determinants of the Nature of Crime in Streets

Streets may not only differ in the amounts of crime committed there, but also in the way in which crimes are committed. For instance, some streets may experience more group violence or use of weapons than others. Two types of explanation can be applied to understand the differences, in these aspects, between streets. The first type is an incident-oriented explanation that focuses on the participants of the crime, how their characteristics affect the way the crime is committed, and how the differential distribution of these participant characteristics across places may lead to aggregate differences in the nature of crime. The second type of explanation shifts to the role of the environment itself on the violent offender's behavior and choice of target, and argues that the local context influences how violence is committed. These types have

¹ For instrumental violence, these modes of transportation can also serve as 'crime attractors', places where offenders go to with the specific intent to commit their crime (Brantingham and Brantingham 1995).

been labeled as 'compositional' and 'contextual' explanations in previous research (Van Wilsem et al. 2003).

The incident-oriented, compositional explanation sees concentrations of incident characteristics (e.g., the density of weapon-induced violence, or the share of group offenders) as the outcome of the type of public that visits the locality due to the street's functions for everyday use. As such, this incident-oriented approach has a close link to Crime Pattern Theory (Brantingham and Brantingham 1993). For instance, streets with bars not only attract many people, but specifically young people. Violent encounters in these streets are therefore more likely to involve youths. Because they are more likely to carry weapons than older offenders, the street's everyday function may indirectly lead to a local concentration of weapon violence.

In the compositional explanation, street-level concentration of incident characteristics lead to aggregate differences in the way crime is committed. Therefore, a specification is needed of which incident characteristics affect the seriousness of violence. For instance, Felson and Messner (1996) found that incidents involving strangers are less likely to have a lethal outcome. Wilkinson and Fagan (2001) describe how offenders with disadvantaged backgrounds are likely to use guns in violent encounters. Wilcox and Clayton (2001) documented a higher frequency of gun carrying among males and nonwhites in a large-scale survey among Kentucky students. Cook (1991) found that male-on-male homicides are mostly among young people, and that gun use is high in these cases (68%), being exceeded only by the (rare) event of the offender being significantly older than the victim. Though not aimed at explaining *ecological* differences in the way violence is exercised, these studies provide useful insights for the incident-oriented explanation of street profiles of violence. They suggest that violent incidents in streets attracting more males, youngsters, disadvantaged, and non-western people may experience a higher amount of weapon use and victim injury. For other aspects of violence, this individual-level explanation of street-level differences may hold as well. For instance, co-offending and co-victimization are expected to be more prevalent if a street attracts groups and youngsters (e.g., because of a bar being located there), as they are more likely to handle conflicts collectively.

The contextual explanation emphasizes the role of the environment in shaping the nature of violent incidents. Three perspectives can be distinguished in this type of explanation, which separately highlight the importance of (a) collective guardianship, (b) facilities that attract visitors, and (c) local culture. The first contextual explanation on guardianship stresses that the seriousness and visibility of a violent act may be tempered if opportunities for informal surveillance are present. Though not tested by previous research, the expectation would therefore be that unmonitored streets suffer from a higher prevalence of weapon use, victim injury and group violence.

The second contextual explanation suggests that the nature of violence may depend on the presence of facilities that attract people to visit the area and pursue their routine activities there. The current research tests this hypothesis by relating the presence of public transport stops to the chances of the victim and offender knowing each other. As such public transport facilities increase the accessibility of

the street, the convergence of people who do not know each other becomes more likely. Therefore, it is expected that streets with public transport stops will have a relatively larger proportion of stranger violence.

A third approach to explain aggregated differences on how violence is committed is offered by Baumer et al. (2003), who use arguments from Elijah Anderson's (1999) *Code of the Street* for this purpose. They found differences between neighborhoods in the amount of weapon use, victim resistance, and victim injury in an analysis of U.S. assaults and robberies: disadvantaged neighborhoods increased gun use and forceful resistance by victims in *assaults*, and decreased the odds of non-forceful resistance in *robberies*. In accounting for these neighborhood differences in the nature of violence, Baumer et al. (2003) point toward the importance of local street culture, where 'respect, toughness, and self-reliance are highly prized forms of social capital.' (p. 41) As such, it influences which types of behavior are regular during violent interactions. For instance, because toughness is highly valued, weapon use will be more regular in disadvantaged areas where the code of the street is held in high esteem.

Apart from being an additional explanation for why the appearance of violence is different across localities, this cultural approach also raises the question at which level of explanation the impact of street codes should be addressed (Short 1998). For the current focus on differences in violent outcomes between *streets*, I argue that a cultural explanation is not suitable as these codes seem to represent a shared tolerance of deviant values on a larger scale such as neighborhoods or even groups of neighborhoods (see e.g., Sampson and Bartusch 1998). In other words, street codes are not expected to vary between (adjacent) streets but more likely between larger areas. Therefore, in my current effort to explore street patterns of violence in Dutch urban areas, I expect differences to result from the daily functions of streets, their facilities and the amount of local surveillance.

Data

The crime data used for this chapter includes all incidents of street robbery, non-lethal assault, and threats that were officially recorded by the police in 2002 and 2003 in three neighborhoods adjacent to each other in Rotterdam, the Netherlands: Hillesluis, Vreewijk, and Bloemhof.² Insight into police records was offered to the author as part of a research project on the development in volume and nature of violent crime in these three neighborhoods. Together, these areas comprise of approximately 40,000 residents. They are relatively disadvantaged areas within the context of Rotterdam neighborhoods. The mean annual income per inhabitant ranges from 8.900 Euro (Hillesluis) to 11.500 Euro (Vreewijk), while the city mean is 12.200

² Incidents that were reported by citizens, but not recorded by the police (e.g., because it was uncertain whether the incident happened at all, or because the police advised the reporting citizen to try and solve the matter him or her self) were therefore not included.

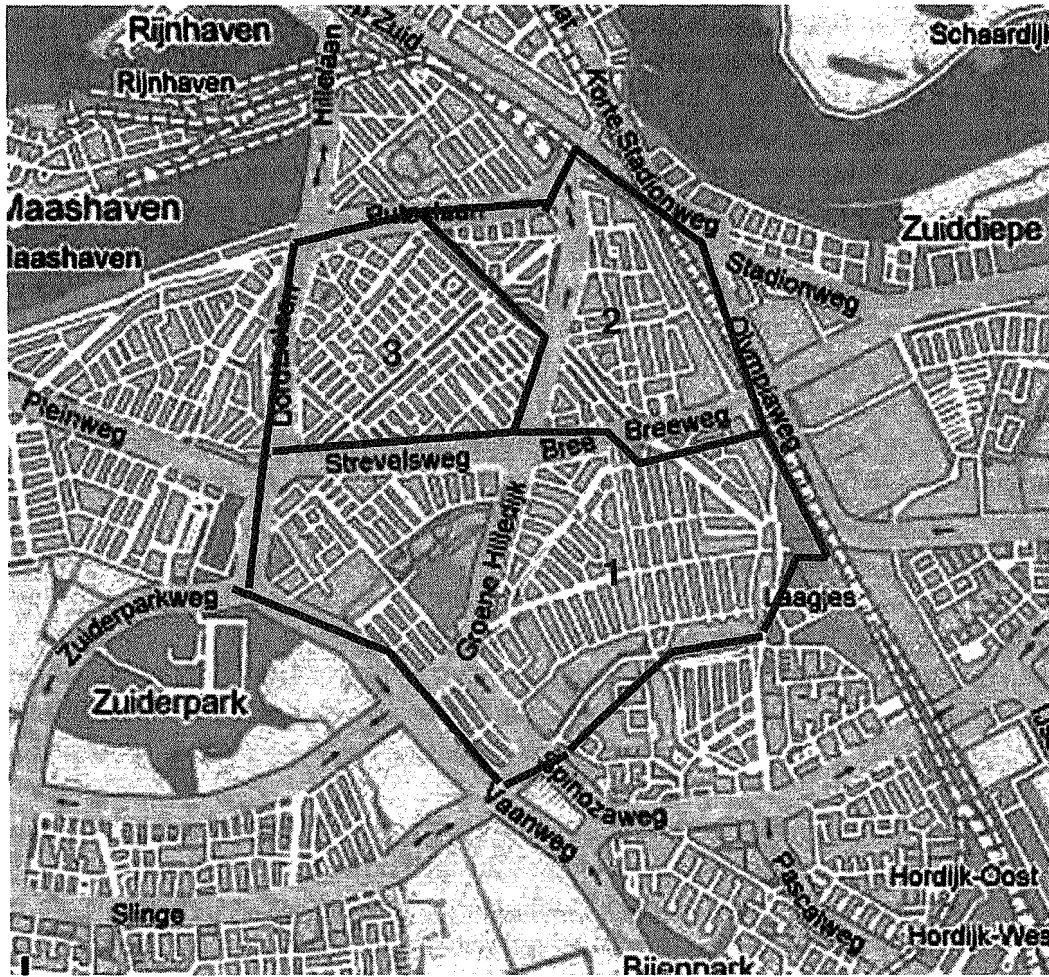


Fig. 9.1 Map of Vreewijk (1), Hillesluis (2) and Bloemhof (3)

Euro, and the Dutch mean is 12.900 Euro. Figure 9.1 shows a picture of their location and boundaries. In these three neighborhoods, the local police recorded 737 incidents of violent crime and complete data were available for 618 of them.

Street-Level Data

The incidents were geocoded at the street level. Information in the police file on the street where the incident happened was used for this purpose. Dutch streets are different from U.S. streets, as can be seen in Fig. 9.1. Bends are not uncommon in a street and, unlike U.S. cities, the street network does not follow a matrix pattern but is fuzzier. Lengths of streets and population sizes of streets vary considerably between units. The smallest quarter of this selection of streets has an average population size of approximately 24 residents, while the average for the largest quarter of streets is 408 residents. As counts of crime are the dependent variable in several analyses, natural variation caused by differences in the sizes of streets is accounted

for by including street population size into the regression equation. Out of a total of 244 streets in these three neighborhoods, 234 offered complete data on sociodemographic characteristics and the amount of crime. Analyses with crime volumes per street as the dependent variable are based on these 234 observations.

Several variables were computed for crime counts per street. After inspecting the written accounts of recorded victim reports of the incident, each incident was categorized as (a) family violence, (b) street robbery, or (c) other type of violence (e.g., traffic disputes, conflict between neighbors). An incident was categorized as family violence if it involved a conflict between (ex-) spouses, or other types of (former) family members.³ For every street, the number of crimes in each category was computed, as well as the total sum of violent crimes.⁴

Information was provided by the Rotterdam municipality's Centre for Research and Statistics (COS) for the independent variables of streets, except for the presence of public transport stops, which was derived from a detailed city map. The street names in the COS data were assigned the same code number as in the crime count data, in order to match the separate datasets. Data for social and demographic characteristics of streets, such as percentage of one-person households and proportion of young people, are based on population registration records of individuals and households (GBA). Data on local housing was drawn from the municipal administration's Service for Urban Development and Public Housing. Both sources of information were aggregated to the street level by COS.

An index measure for the amount of poor housing in each street was constructed by taking the mean of the summed z-scores for the percentages of abandoned housing, houses with no more than two rooms and houses with an estimated value of no more than 50,000 euros (Cronbach's $\alpha=0.76$). Furthermore, amounts per street were available for the percentage of (a) rental homes, (b) 15-29 year olds, (c) single-parent households, and (d) people living alone. Finally, the amount of ethnic heterogeneity per street was based on a Herfindahl index (Gibbs and Martin 1962, p. 670), by subtracting the squared fractions of the main ethnic groups (Surinamese, Antilleans, Cape Verdians, Moroccans, Turks, and other Northern Mediterranean) off the value 1.

A measure on the proximity of violent crime was included to take account of spatial dependency patterns. This was done because units of analysis tend to be

³ Whether the incident occurred in the parties' own homes did not influence its labeling as family violence. In fact, a quarter of all incidents in this category occurred elsewhere.

⁴ Though police recorded data suffer from underrecording, the extent to which this is problematic for the interpretation of results is hard to estimate. On one hand, data from victimization surveys would offer information on incidents not reported to the police. On the other hand, there have been no surveys to date that included sufficient numbers of respondents per *street* in order to allow for reliable estimates at this level of analysis, but instead, only on higher aggregation levels such as neighbourhoods. Moreover, the police recorded data offer information on incidents that are generally poorly covered by surveys, such as family violence and violence involving drug addicts. In conclusion, although these data are not free from measurement error, they nevertheless seem to offer optimal information for the research question on the level of streets that I am trying to address.

influenced by proximate units (e.g., Morenoff et al. 2001), possibly due to diffusion of criminal activity (Cohen and Tita 1999). It was established for each street if it was next to a high-crime street (which was defined as a street with more than fifteen violent incidents over the two-year period examined here) or not. This cut-off value was used to identify the top 5% in the amount of violent crime (N=11). Ninety streets in this sample (39%) are directly neighboring a high-crime street.

Crime Incident Data

For each crime (N=618), additional information on the incident's circumstances was acquired by coding the written accounts of the victim report with a structured checklist (see also Nielsen et al. 2005). Although victim reports do not offer the full story of what happened during the incident, they often give a description of how the crime was committed on several more or less objective traits, which have been used for the current research.⁵

A variety of incident characteristics were scored. With respect to *offender characteristics*, dummy variables were constructed on whether a male offender was involved or not, whether an offender was of non-western origin or not, and whether the offender had used drugs or was known as a drug user by the police. Ethnicity was derived from the name if the offender was caught (with overtly non-western names scored 1), and from victim description if the offender was not caught. Offender age was also scored, and derived from the date of birth for offenders that were caught, and from estimates in victim descriptions for offenders who were not caught. If multiple offenders were involved, offender age was determined by the oldest offender. For the incidents lacking information on age, the mean offender age was imputed. This is preferred to a listwise deletion procedure, because the missings on offender age are selective and would disproportionately exclude robberies, for which few offenders are caught or are clearly described by victims. *Victim* characteristics were scored as well. For each incident, it was assessed whether a male victim was involved or not. Also, the age of the victim was derived from the date of birth given during the report to the police. In cases of multiple victims, the age of the oldest victim was used.

With respect to *the way in which the violent crime was committed*, dummy variables indicated (a) whether the offender operated with co-offenders or not, (b) whether multiple victims were involved or not, (c) if a weapon was used, (d) if the offender made a physical attack or only engaged in threatening behavior, (e) if the victim described being injured, and (f) if offender and victim knew each other prior to the incident. With respect to weapon use, guns and knives were counted as weapons, as well as other aids used by offenders to induce force, such as paving

⁵ As far as the victim report distorts the truth of what really happened, there is little reason beforehand to assume that this measurement error would be systematically related to incident characteristics or street characteristics. For that reason, possible measurement error associated with our type of source is not expected to bias the results.

Table 9.1 Descriptives of dependent and independent variables for street-level data and incident-level data

	Mean	Std.dev.	Min.	Max
<i>Street-level data (N = 234)</i>				
Total number of violent incidents	2.88	6.77	0	62
Incidents of family violence	0.70	1.45	0	12
Incidents of street robbery	0.83	2.71	0	30
Incidents of other violence	1.32	3.25	0	27
Poor housing	-0.02	0.79	-0.82	2.77
% Rental homes	91.76	13.68	9.09	100
Ethnic heterogeneity	56.06	23.65	0.00	95.20
% 15-29 year-olds	19.65	9.46	0	50.69
% Single-parent households	16.73	9.40	0	50.00
% Living alone	32.52	16.55	0	100
Public transport stop	0.06	0.24	0	1
Total number of inhabitants	171.96	189.70	1	1356
Adjacent to a high-crime street	0.38	0.49	0	1
<i>Incident-level data (N = 618)</i>				
Co-offending	0.30	0.46	0	1
Co-victimization	0.12	0.32	0	1
Weapon use	0.33	0.47	0	1
Physical attack	0.69	0.46	0	1
Victim injury	0.47	0.50	0	1
O+V know each other	0.45	0.50	0	1
Male offender	0.93	0.25	0	1
Age offender	29.97	10.52	9	67
Non-western offender	0.73	0.44	0	1
Offender drug user	0.07	0.25	0	1
Male victim	0.54	0.50	0	1
Age victim	33.21	14.34	7	78

stones, tools or sports utilities. Table 9.1 offers an overview of the variable used for this research.

Results

A small portion of the streets under scrutiny were confronted with a relatively large amount of crime: 40% of all recorded violence takes place in 4% of the streets. In contrast, Table 9.2 shows that four out of every ten streets do not have a single registered incident of violence. Furthermore, 50% of them had a limited amount of violence, between 1 and 5 incidents. For street robbery, the concentration of incidents is the highest, with 3% of the streets having 48% of all incidents, and 75% of the streets having no robberies at all. On the neighborhood level, average numbers of violent incidents per street vary significantly ($F=7.29$ ($df=2$), $p<.01$). Hillesluis has the highest average of the three neighborhoods, with 5.29 violent incidents on average per street. For Bloemhof and Vreewijk, these numbers are considerably lower, with averages of 2.13 and 1.89, respectively.

Table 9.2 Number of violent acts

	Overall violence		Family violence		Street robbery		Other violence	
	%	N	%	N	%	N	%	N
0	40	97	68	165	75	182	59	143
1-5	50	121	32	77	21	52	36	87
6-10	5	11	0	1	3	7	3	8
11-15	2	4	0	1	1	2	2	4
More than 15	5	11	0	0	0	1	1	2
Total	100	244	100	244	100	244	100	244
Mean		2.81		0.68		0.81		1.29
Variance		44.18		2.04		7.10		10.16
Maximum		62		12		30		27

In order to examine the relation between population features, environmental design characteristics and the amounts of violence in streets, count data are used, with the number of violent incidents in a street as the dependent variable. Table 9.2 demonstrates that each of the available violence measures does not follow a Poisson distribution, as the variance exceeds the mean for each of them. Therefore, a negative binomial model was employed, which is a Poisson-based regression model that allows for overdispersion (Osgood 2000).⁶ As the counts of violence per street are nested in neighborhoods, multilevel negative binomial models were used (see also Tseloni 2006). The multilevel model allows us to reveal remaining differences in variance between neighborhoods after adjusting for street-level influences. If substantial neighborhood-level variance would remain, then this would suggest that the neighborhood is important as a contextual determinant of street-level differences in crime. If such variance would not exist, then initial differences between neighborhoods in average crime counts can be understood as a result of compositional differences between neighborhoods in their types of streets.

The results in Table 9.3 reveal that, apart from the total number of inhabitants, there is no single predictor that is consistently related to *all* types of violence counts. However, this is mainly because the determinants of family violence are distinct from the others. The total numbers of violent acts, as well as the number of street robberies and nonfamily-related acts of violence are all positively related to (a) the percentage of residents living alone, (b) the presence of a public transport stop, and (c) adjacency to a high-crime street. The first finding is in line with the expectations derived from the social disorganization perspective, as a larger share of one-person households may decrease the capacity for social control in the street. The second finding supports Crime Pattern Theory's argument that the accessibility of streets to the general public increases the potential for the committing of violence in that place. According to an additional OLS regression analysis on the number of violent acts, a public transport stop approximately results in an additional 10 acts of vio-

⁶ This option to allow for overdispersion resulted in significantly better model fits, compared to regular Poisson models.

Table 9.3 Negative binomial models of number of violent incidents per street on population and environmental characteristics (N = 234)

	Overall violence	Family violence	Street robbery	Other violence
Constant	-0.039**	-1.197**	-1.847**	-0.789**
Poor housing	0.048	0.124	0.054	-0.327
% Rental homes	1.605**	-0.806	0.638	2.484**
Ethnic heterogeneity	1.037**	2.075**	1.125	0.537
% 15-29 year-olds	-0.135	-1.312	-0.804	1.110
% Single-parent households	2.046*	1.783	1.338	2.059
% Living alone	1.674**	-1.657	3.032**	2.577**
Public transport stop	1.117**	0.357	1.381**	1.418**
Total number of inhabitants	0.004**	0.004**	0.003**	0.003**
Adjacent to a high-crime street	0.721**	0.332	1.210**	0.702**
Variance between neighborhoods	0.000	0.023	0.000	0.000
Negative extra-binomial variance	0.733	0.700	0.638	0.794

* $p < .05$, ** $p < .01$ (one-tailed test)

lence in that street, which is considerable if we take into account the average rate of almost three acts per street in this sample. The third finding, that being adjacent to a high-crime street independently increases the number of violent crimes, suggests a spill-over effect of violence. This may be present for several reasons. First, streets close to hot-spots may serve as passage ways that need to be passed in order to reach the hot-spot. As a result, relatively speaking many people visit the street adjacent to the hot-spot, which increases the chances that violent conflicts occur in that street. Second, spatial adjacency may stimulate imitation of behavior found nearby. In this context, violence in hot-spots may 'diffuse' into adjacent areas (Cohen and Tita 1999).

For family violence, ethnic heterogeneity is the only substantive factor that is related to the number of incidents. In streets with high levels of heterogeneity (i.e., many different ethnic categories), the amount of family-related conflicts are high. This supports claims from social disorganization theory that informal surveillance decreases crime, even though many of these conflicts are conducted within the vicinity of homes. Similar to the current findings, Benson et al. (2003) suggested that the negative association they found between neighborhood income and domestic violence (net of individual factors), was indicative of social disorganization.

Turning to *the way violent crimes are committed*, Table 9.4 gives an overview of the street differences of several qualitative aspects of violence: was the incident committed with co-offenders, were multiple victims involved, was a weapon used, was the victim physically attacked, did the victim report suffering an injury, and did victim and offender know each other prior to the incident? These analyses are based on streets *in which at least one incident of violence occurred during the two-year*

Table 9.4 Deviance tests – Variance of qualitative aspects of violence between streets

Aspect of violence	Variance between streets
Co-offending	0.38**
Co-victimization	0.01
Weapon use	0.02
Physical attack	0.00
Injury	0.00
O + V know each other	0.35**

* $p < .05$, ** $p < .01$ (one-tailed test)

period, and for which complete incident and street data were available. Because of missing data on one of the predictors, 10 streets were deleted. This leaves us with 137 streets (from an original 147 with at least one violent crime), in which 610 incidents occurred.

For the analysis of the incident data, multilevel logistic models were employed, with incidents nested within streets nested within neighborhoods. In order to assess the significance of differences between streets in the nature of violence, deviance tests were conducted (Snijders and Bosker 1999). The deviance test evaluates the amount of loss of fit if the random parameter of the model is dropped which, in this case, is the random intercept. The difference between the likelihood of the models including and excluding the random intercept therefore provides the deviance statistic, which follows a chi square distribution. Following Snijders and Bosker (1999, p. 90), the deviance test is conducted one-sided.

The deviance tests are performed for two-level logistic models, in which incidents are nested within streets. Table 9.4 shows that according to these analyses, streets vary significantly in their proportions of offenders operating in groups, and in the number of incidents where offender and victim know each other. Additional descriptive analysis on the 17 streets with at least 10 incidents (not shown), reveal that the range for co-offending varies from 6% of the incidents in one street to a maximum of 61%, with a mean value of 32%. For the relation between offender and victim, there is also a wide range between streets, from a minimum of 32% of the incidents where the parties involved know each other, to a maximum of 80% (mean value: 49%). Furthermore, the other aspects, such as weapon use and victim injury, do not differ significantly between streets.

Because of their significant differences between streets, co-offending and the relation between offender and victim are subjected to more detailed analyses, which are performed in two steps. The first model includes incident characteristics, while the second model adds the effect of street characteristics to the equation. This way, changes in variance between streets can be assessed after compositional differences between streets in their incident characteristics are taken into account (model 1) and, subsequently, after contextual differences are controlled for (model 2). Table 9.5 offers an overview of the results.

For *co-offending*, model 1 points out that several incident characteristics are important for understanding why some violent acts are committed with co-offenders while others are not. Co-offending was more likely if a non-western offender was

Table 9.5 Multilevel logistic regression of co-offending and relation between conflict parties on incident and street characteristics

	Co-offending		O+V know each other	
	1	2	1	2
Constant	-1.41**	-1.40**	-0.58	-0.62
<i>Incident characteristics</i>				
Male offender	0.84	0.87	0.23	0.26
Age offender	-0.08	-0.09	0.02	0.03
Age offender, squared	0.00	0.00	-0.00	-0.00
Non-western offender	0.79**	0.77**	-0.03	-0.01
Offender drug user	-1.37	-1.35	1.28*	1.35**
Male victim	0.69**	0.65**	-1.35**	-1.29**
Age victim	-0.01	-0.01	0.01	-0.01
Age victim, squared	0.00	0.00	0.00	0.00
Group of victims	0.85**	0.84*	-0.20	-0.09
Family violence	-1.33**	-1.32**	Ref.cat	Ref.cat
Street robbery	1.36**	1.33**	-3.46**	-3.43**
Other violence	Ref.cat.	Ref.cat.	Ref.cat.	Ref.cat.
<i>Street characteristics</i>				
Poor housing	-	0.01	-	-0.01
% Living alone	-	0.01	-	-0.03*
Public transport stop	-	0.22	-	-0.67*
Total number of inhabitants	-	0.00	-	0.00
<i>Street-level variance</i>	0.30**	0.32**	0.25*	0.00

* $p < .05$, ** $p < .01$ (two-tailed test)

involved, as well as for male victims, groups of victims, and for street robberies. Group violence was *less* likely for domestic violence and drug-using offenders. Controlling for these circumstances leads to a slight drop in street-level variance from 0.38 to 0.30. This means that the incident characteristics affecting co-offending, such as victim's gender, are to some extent distributed across streets in a way that they can explain differences in co-offending at this level. For instance, in streets with a lot of male victims, more co-offending is found. Controlling for street characteristics in model 2 does not reduce the amount of variance between streets on this aspect any further. In fact, none of the selected street variables succeed in predicting the odds of group violence. These results suggest that other factors need to be accounted for in order to explain street-level differences in co-offending.

The *relation between the offender and victim* is also dependent upon several incident characteristics (model 1). The likelihood that victim and offender know each other is greater for older offenders and drug using offenders, while these odds are reduced for incidents with male victims and street robberies. Although street-level differences remain significant after controlling for these aspects, the variance declines from 0.35 to 0.25. Adding street characteristics to the model leads to a further diminishing of the street-level differences on this point. More specifically, it appears that streets with public transport stops have a significantly lower proportion of incidents where victim and offender know each other, as well as streets with many one-person households. The former result is in accordance with our expectation that

streets made accessible by public transport are confronted with larger numbers of visitors who are strangers to each other. As a result, in the emergence of conflicts, the chances increase that the parties involved are unknown to each other.

Conclusions

This chapter uses *streets* as units of analysis to explore differences in the number of violent incidents as well as the nature of these incidents. Such a detailed level of analysis enables an exploration of *within-neighborhood* differences in crime. In this study of three Rotterdam neighborhoods, we find that violent crimes are highly concentrated, especially for street robbery, where only a few streets accounted for almost half of the robberies in the period 2002–2003 in the entire area. Such concentrations within specific places in neighborhoods suggest that the opportunities to commit crime are localized as well, and are not present or absent across an entire neighborhood. In general, this result supports the idea that meaningful crime variations on a small scale get lost once data are aggregated to higher levels such as neighborhoods (see also Hipp 2007).

High volumes of crime were found in streets with a large share of single-person households and high levels of ethnic heterogeneity, which points to the disruptive effects of inadequate social control structures for the maintenance of social order. Furthermore, more violence was found in streets with public transport stops. Public transport affects the accessibility of streets by directing the everyday flow of routine behavior. It is likely that streets with public transport are busier than other streets and that more opportunities for conflict are present. As such, it is a clear example of the way in which routine activities affect the distribution of crime (Brantingham and Brantingham 1993; Cohen and Felson 1979). In addition, a spill-over effect was also found, as the spatial adjacency of streets to streets with high levels of violence independently increased the amount of violent acts in that locality.

An innovative aspect of this research was that it explored the way in which violence was committed, and how this varied across streets. For several aspects such as weapon use and the reporting of victim injury, we found no substantial differences between streets. This may have been partly due to the small sample size and the relatively uniform sample of streets in three relatively disadvantaged neighborhoods. However, the likelihood of violent acts committed by groups of offenders *did* vary significantly between streets, as well as the relation between the parties involved. In some streets, large portions of violence were characterized by the fact that the victim(s) and offender(s) knew each other, while in others the majority of conflicting parties were strangers.

Incident characteristics that were connected to co-offending, such as offender ethnicity and age, were to some extent distributed across streets in such a way that they could account for street-level differences in group violence. This was in line with our expectations, as we predicted that streets would have more co-offending if they had more young offenders and victims. Street-level characteristics, such as

the concentration of poor housing or the presence of a public transport stop, were not related to co-offending, and could therefore also not account for street-level differences on this aspect. Therefore, the question why streets differ in their amounts of co-offending remains partly unanswered, which suggests we should seek additional factors that were not measured in this study. It may be that streets not only function as a selection mechanism where groups of people tend to go (and thus tend to commit violence in groups), but perhaps also as a recruiting place, where potential offenders meet. Contextual factors facilitating such recruitment for co-offenders may include places for entertainment or for hanging out, such as shopping malls.

With respect to the relation between offender and victim, both incident characteristics and street characteristics were able to explain street-level differences. Why some streets have violent incidents involving merely strangers, while others have conflicts where the majority of parties know each other depends partly upon who commits the violence, and how these offender characteristics are distributed across streets. Young offenders are more likely to victimize strangers, so the more young people choose a specific street as their offending space, the more likely it is that offenders and victims do not know each other in that locality. Also, we found that streets with public transport are more likely to yield violence between strangers, probably because public transport increases the chance that people from different neighborhoods visit the street. Strangers are therefore more likely to intersect and have a conflict, as compared to streets that are less easily accessible. Contrary to our expectations, the hypothesis on guardianship in streets was not supported, as variations in the capacity for social control did not affect how and against whom violence was committed.

Overall, the findings support the claim that the different ways of committing violence across places may be the result of the functions of streets for everyday life, which serve as a filter mechanism. These functions determine which types of people are more likely to visit the area and thus, if conflicts arise, how and against whom they are directed. This type of reasoning is akin to Crime Pattern Theory, which emphasizes how the intertwining of everyday life with illegal behavior leads to spatial distributions of crime. The results show that this is not only the case for the *volume* of crime, but also for the characteristics of violence.

An interesting direction for future research would be to assess the impact of facilities which are not in an area itself, but nearby. It may be that streets in the vicinity of people attracting facilities serve as passage ways. When we assume that routine activities are important in understanding why violent acts occur at certain places and not at others, it is expected that such passage ways also increase the likelihood of social encounters, including those resulting in violence. GIS applications that offer the possibility to identify ambient populations at specific places, such as the Landscan Population Database (Andresen 2006), may be a potentially useful tool in this respect.

Finally, it would be worthwhile to explore interactions between the type of public visiting a place and its accessibility. For instance, if motivational pressures are less among the public visiting specific places, accessibility may not lead to higher rates

of violence. In order to investigate this, a more diversified sample of streets from affluent as well as disadvantaged neighborhoods is needed. It may reveal to what extent the current patterns on the nature of violent acts can be generalized for other streets.

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