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Proceedings of the International Seminar on Environmental Criminology and Crime Analysis

University of Miami
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Diane Zahm and Paul Cromwell, Editors

Proceedings of the international seminar on environmental criminology and crime analysis

In May, 1992 the School of Criminology at the Université de Montréal and the Solicitor General of Canada sponsored the first International Seminar on Environmental Criminology and Crime Analysis. The meeting brought together in Montreal a score of invited participants from Canada, the United States, and Great Britain, chosen because of their research interests in the emerging area of environmental criminology and crime analysis. During the three day meeting papers were read and discussed, and ideas were shared and debated in a spirit of cooperation and collegiality.

The Montreal conference was considered a great success by those in attendance and they elected to meet again the following year. The Department of Sociology and Criminology at the University of Miami in Coral Gables, Florida, agreed to sponsor and host the meeting, and the Florida Department of Law Enforcement agreed to publish the conference Proceedings.

Participants in the 1993 Seminar on Environmental Criminology and Crime Analysis included criminologists from the United States, Canada, Great Britain, and Australia. The research presented at the Miami meeting are contained in these *Proceedings*. Readers should understand that many of the papers represent "work in progress" presented at the Seminar for the purpose of sharing the work with others, but with the understanding that it was not a finished product. Others will be or have already been published in journals or as chapters in books. Anyone wishing to cite a paper in this volume should contact the author(s) for permission and possibly a citation to a revised version of the paper.

Diane Zahm and Paul Cromwell, Editors

Proceedings of the international seminar on environmental criminology and crime analysis

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The choice-structuring properties of crime control

The Concept of Choice-Structuring Properties

According to Cornish and Clarke (1987:935), the choice-structuring properties of offenses are those characteristics, like the payoff or the risks, which are perceived by the offender as being salient to his goals and which provide a basis for choosing among alternative courses of action. The concept of choice-structuring properties is being used by Cornish and Clarke to understand displacement: "The readiness with which the offender will be prepared to substitute one offense for another will depend upon the extent to which alternative offenses share characteristics which the offender considers salient to his or her goals and abilities" (Cornish and Clarke 1987, p. 935).

Even though Cornish and Clarke do not stress this point, it is obvious that the choice-structuring properties of one offense depend heavily on the social control of this offense. For example, in their (p. 940) list of 18 choice-structuring properties of theft involving cash, one finds ten which are directly or indirectly related to social control. The ones directly dependent upon social control include the risk of apprehension, the severity of punishment, and moral evaluation. Among those indirectly related to social control, one can point to the accessibility of targets and time required to commit the offense.

It follows that it makes sense to speak of the choice-structuring properties of social control. This is indisputable in the case of deterrence: punishment is used to structure the choices of the offender. More generally, "choice-structuring" appears to me a useful concept when studying the relationship between social control and the decision-making of offenders. It can give insight into the ways social control initiatives can shape the offenders' decisions, producing a variety of effects: displacing crime, reducing it's frequency or severity etc.

My contention is that social control in its extended meaning does have a major impact on crime by structuring the offenders' choice. This impact was minimized in the positivist tradition, but it is becoming more and more accepted in contemporary theories of crime.

A New Focus on Choices and on Social Control

Cornish and Clark's approach fits nicely with the new trend in criminology focusing on offenders' choices under the constraints of social control. This applies not only to the rational choice perspective but also to Wilson and Herrnstein's theory of crime, the theory of reintegrative shaming (Braithwaite, 1989), Gottfredson and Hirschi's general theory of crime, environmental criminology, deterrence, and to the economic theory of crime.

In the past, criminology was torn between a non-theoretical crime policy and a crime theory irrelevant for practical purposes. The new crop of theories are bridging the gap between theory and practice by focusing on controllable factors, the most important being human actions: those of offenders and those of "controllers". These approaches are moving the center of interest away from "factors" toward the understanding of intentional actions and of decisions. This is not only true of the rational choice perspective but also of many different approaches. For example, Braithwaite (1989, p. 9) insists on stating that in his theory of reintegrative shaming, the "criminal is seen as making choices - to commit crime, to join a subculture, etc. - against a background of social pressures mediated by shaming".

These contemporary theories also share an enlarged concept of social control. Gone are the days when the only type of control considered by criminologists was governmental control. Now it is recognized that social control has multiple sources, including not only the informal social sanctions applied within the family, the community, and the institution, but also actions taken by potential victims in self-protection and in self-defense (the so-called "self-help").

However, most writers tend to focus on their preferred type of social control. Clarke, Cornish and most of us are interested essentially in situational crime prevention. For their part, Braithwaite (1989), Tittle, (1980), and other researchers working within the Durkheimian tradition prefer to concentrate on moral crime controls like shame, embarrassment, and informal social sanctions.

For my part, I prefer an enlarged concept of social control encompassing all crime-inhibiting human actions. In other words, a measure or action could qualify as social control if it has the potential to prevent crime and is usable by social actors wanting to do something about crime. That would include four types:

1. punishments applied by public officials and what is done by the police, the justice and the correctional system to fight crime;

2. pressures and informal sanctions applied within the family, the school, the peer group, the work place, and the community to promote moral values related to non- crime, such as honesty and non-violence;

3. self-protection and self-defense action taken against crime by citizens and organizations acting as victims and potential victims. That would include private security, target hardening, individual self-protection (locking doors, avoiding dangerous places...), self-defense, and self-protection; and, finally,

4. crime prevention measures applied through government action, such as gun control, regulations on car anti-theft systems, operation identification, etc.

Besides giving a more complete picture of social control, the new trend in crime theory achieves a better integration of crime control variables in their explanation of offender's choices. It is done precisely by concepts like choice-structuring properties. In some theories, the offenders' choices are explained by deficiencies in social control variables such as uncertain punishment, absence of guardian, vulnerable targets, stigmatizing shaming... In other theories, crime and non-crime are explained by offenders having personal characteristics making them insensitive to social control: impulsiveness, present orientation, low self-control, unbounded to family and school...

The Structuring of Crime by Social Control

So, according to major contemporary criminological theories, we can explain many aspects of crime by looking at social control and at offenders' reactions to social control. This means that, contrary to a fatalistic belief prevalent in criminology ten years ago, crime control strategies should matter. Social action against crime is no longer conceived as plagued by the "nothing works" curse. Social control includes variables much more important for the explanation of crime than was recognized some years ago.

In a discipline claiming to be practically relevant, this has a major implication for what should be our central focus, namely, that we should move away from the multifactorialist approach and give priority to the study of the impact of social control on crime. This is not to say that factors outside social control should not be considered, only that they should not have the priority given to them in the positivist tradition. I concede that criminal behaviour is under the influence of age, demographic composition, unemployment, number of cars, weight of television sets, testosterone, etc. But these factors are outside the grasp of social actors wanting to fight crime. They can do nothing about them. Since social control can affect crime and since criminology looks for practical relevance, its central task should be to study the impact of social control on offenders' choices.

As a starting point for such an endeavour, I suggest a postulate stating simply that crime is shaped by the means used to control it.

This means that a given state of crime rates and crime patterns should be seen as the result of crime control choices or, more precisely, the result of what people decide to do and not to do about crime.

This assertion is quite close to the position taken by Barr and Pease (1990). Writing about displacement, they concluded that it should be seen "in a much broader framework where the distribution of crimes and their victims is the end result of a series of choices taken by society as a whole" (p. 311).

Stating that social control structures crime does not mean that crime is under control. It means rather that crime is largely under the influence of peoples' choices about crime control. These choices do sometimes have the intended effect, often they have unintended effects, and sometimes, they have no effect. It follows that crime is in part shaped by the human action taken to control it, but the impact of that action is not always what it was intended to be.

When Crime Controls Do Have an Impact

Admitting that crime control initiatives sometimes have no impact (for example, police car patrols having no effect on burglary rates), one can nevertheless point to instances where they do have a significant impact on crime. Sometimes, crime control action has the desired result, but it can also have some undesired results. The following presents what appears to me to be the four main types of effect resulting from crime control initiatives:

1. Reducing the frequency of crime;
2. Reducing the severity of crime;
3. Rendering obsolete some criminal tactics and stimulating the development of new criminal tactics;
4. Channeling offenders toward vulnerable targets.

Intended impact:reducing the frequency of crime. Social control may structure the offender's choices by convincing him to desist from crime or to refrain from committing a crime, thus reducing its frequency.

Recent examples of this kind of impact are found in the book published by Clarke (1992) grouping 22 successful situational crime prevention projects. The book demonstrates that well-conceived action can reduce all kinds of crime: burglary, robbery, car thefts, thefts in cars, thefts in shopping bags, book thefts, vandalism, prostitution, etc.

History of crime brings us many other examples of crime control initiatives that have the intended impact.

For instance, the duel was very frequent in old regime France, especially during the 16th century. It gradually disappeared after a long struggle led by the kings who visited increasingly more certain punishments on duellists (Cuénin, 1982).

The blood feud was a common way of solving disputes all over Europe during the Middle Ages. Firm justice against individuals committing murder in the first instance and against those responsible for engaging in a blood feud was responsible for its disappearance.

Poisoning came under control with the development, during the 19th century, of toxicology, making its detection highly probable. Between 1840 and 1870, a series of notorious criminal cases involving exposed poisoners convinced most would-be poisoners that the risk of punishment was too high. (See Thorwald, 1964: in 1840, the Lafarge affair, involving arsenic; in 1851, the Bocarmé affair, where the poison was nicotine; in 1863, the Pommerais affair where the poison was digitalin).

During the 1930's, the U.S.A witnessed a surge in bank robberies and kidnappings. According to Inciardi, (1975) robbers and kidnappers "endured less that a decade essentially because of the Federal Bureau of Investigation" (p. 95). Well-armed and

well-trained agents, helped by a 1934 legislation giving them police power in all jurisdictions, succeeded in apprehending most "public enemies". Since then, the U.S.A. have known only a few well-organized gangs of robbers.

Reducing the severity of crime. Another desirable impact of crime control is that it channels offenders toward lesser crimes. Sometimes this effect is unintended, often it is an explicit goal. As early as 1748, Montesquieu wrote that it is essential that we prevent a major crime rather than a lesser one by punishing the former more severely. The individual motivation to be protected, primarily against serious damage, is universal. Citizens protect big assets carefully and are often negligent with objects of small value. They prefer to lose money rather than risk their lives. Businesses and other organizations put large sums of money in strong boxes and vaults, leaving small sums exposed. Police departments invest more resources in the investigation of murder than in burglary, completely neglecting shop thefts. The relation between the gravity of crimes and severity of punishments is a basic fact of sentencing research.

The obvious fact is that everybody's priorities are to prevent and curb major crimes and large losses with the result that the more serious a crime, the more difficult and risky it will become. This has the major and universal effect of structuring offenders' choices toward lesser crimes. As a result, one finds an inverse relationship between the severity of crimes and their frequency. This is also a universal fact: the more severe the type of crime, the less frequent it will be, as can be seen just looking at the rank order of types of crime according to their frequency and to their severity.

Rendering some criminal tactics obsolete and stimulating the development of new criminal tactics. The net effect of some crime prevention measures is to render certain criminal tactics obsolete by making them too difficult, too risky or useless. Improvements in the making of strong boxes and bank vaults have driven safe-crackers out of business. In the long term, this put pressure on successive generations of offenders to invent criminal tactics better adapted to the state of the crime protection system. I have argued elsewhere (Cusson 1993) that contemporary mundane crime is the offender's response to 20th century improvements in social control. Today, big assets are nearly impossible to steal because they are so strongly protected in bank vaults, with alarm systems and all the new technology of security. Another change in social control is the capacity of police forces to act quickly, because of their omnipresence, mobility and communication systems. Because of this, today's burglars and robbers cannot realistically mount big operations with a view to stealing huge amounts of money: the time they would need to defeat the protection system would be amply sufficient to have a strong police force on their backs. This is the reason for the multiplication of shop thefts, small time burglaries, muggings, etc. Unable to commit big and lucrative thefts, thieves have developed new tactics: speedy, unobtrusive, and crude quantity thieving.

Criminal tactics characteristic of one era can be seen as strategic responses of offenders to a given state of social control.

Channelling offenders toward vulnerable targets. The victimization rates of different social groups show that the poor residents of American inner cities are more often victimized than the rich. The same trend is even more visible regarding murder rates. In the U.S., the burglary victimization rates are highest for households headed by blacks and the ones located in central cities (Shover 1991, p. 78). The rate of murders by Canadian Natives has been as high as ten times the rate of the rest of the population. And 80% of Natives murders involve an Indian victim. (Silverman and Kennedy 1993) In the U.S.A., both the murder and victimization rates of blacks is also very high. Generally, Americans living in disorganized inner-cities suffer very high rates of victimization due to serious crimes.

It is no longer true that robbers go where the money is. In Quebec, only 19% of armed robberies take place in banks; 79% occur is small businesses, convenience stores, garages, parking lots or taxis (Gabor et al 1987). Given the choice between rich but well protected targets or poor and vulnerable ones, most offende s choose the latter. The over-victimization of the weak and the vulnerable can also be seen in terms of the structuring effect of social control. It is the result of private choices made by individuals whose priority is their own self-protection, combined with the unequal distribution of the capacity to protect oneself from crime. In a situation where most people care more about their own risk of victimization and that of their family than about the victimization of others, the capacity of each individual for effective self-protection should correlate negatively with individual levels of victimization. In principle, public crime policy should make some difference: the fear of punishment is an umbrella protecting everybody, including the poor. But only to a point. The over-victimization of the

weak and of minorities is not a political issue. (Discrimination against criminals coming from minorities is an issue, but not the vulnerability to victimization of minorities.) In Canada, nobody really cares about the fact that natives suffer very high murder rates. Even native representatives keep silent about it; except for a few criminologists, this very fact is unknown. Hence the indifference of public officials, combined with the priority given by individuals to their own protection, and with the unequal distribution of means for self-protection, leaves vulnerable citizens overexposed to crime.

The Calculus of Crime Control Choices

If crime control does have a significant impact on crime, social control choices made by citizens, firms, and public officials should be taken into account in a general theory of crime. This is because crime rates and patterns will be structured by those choices. To understand the contemporary crime scene, we must have a grasp of the logic of social control choices. To achieve this, the rational choice approach should be as useful as it was for the understanding of offenders' decisions. It should be useful to study potential victims' choices, peers' choices, private security choices, and public choices, using concepts like costs, benefits, preferences, alternatives, trade-offs, priorities, scarce resources, etc.

In the following, I try to show that some aspects of the contemporary crime situation are the results of public and private crime control choices.

Preferring alternatives to crime control:burglaries. It can be argued that the high rate of burglaries we suffered during the second part of the 20th Century is not only the consequence of changes in routine activities, it is also the result of our preference for alternative solutions, having nothing to do with crime control. Private and public choices showed a marked preference for alleviating the consequences of burglary rather than preventing it. Most individuals preferred to live in houses and apartments lightly protected, with vulnerable windows and doors, rather than live in a fortress-like structure. Most police forces adopted a fatalistic approach to the low clearance rates of burglaries. Most judges, following public opinion, did not considered burglary a serious crime and did not punish it severely.

The weaknesses in the control of burglary are not unrelated to alternative solutions to this problem, namely, using banks and insurance. Instead of protecting our houses, we prefer to put our money in banks and insure our valuables against theft. Being protected from the worst consequences of burglary, we do not pressure our politicians to wage war against this crime. On the other side, police officers and judges, lacking the political incentive to vigorously attack the problem, adopt a matter-of-fact attitude. In short, putting money in banks and insuring our goods is seen as a convenient alternative to controlling burglary, thus encouraging offenders to be active in this type of crime.

Preferring results other than controlling crime: shop thefts. The high frequency of shoplifting can be seen as the result of shopkeepers preferring to promote sales by exposing their merchandise without much surveillance, despite the cost of losses due to theft. Since those primarily concerned tend not to see shop theft in dramatic terms, the police and judges tend not to be overzealous in fighting this "crime".

Preferring to control one type of crime to another: car theft vs violence and drugs. The fact that car thefts have become very frequent can be seen in the light of priority given elsewhere. Clarke and Harris (1992) underlined the fact that car thefts are not punished very severely and that the probability of punishment is small. They make the point that considering the heavy emphasis given to punishing violent offenders, not much prison space is left for auto thefts.

Conclusion: Individual Self-Protection and Crime Rates

I would like to conclude by suggesting that the impact of the totality of individual self-protection action on aggregate crime rates should become the object of investigation by criminologists. On that question, two possibilities should be examined. First, individual self-protection initiatives have nil or minimal effect on crime rates. Second, they have a significant effect in pushing down crime rates at the aggregate level. The first possibility could be taken seriously under conditions of complete displacement, where every crime prevented by one individual is committed elsewhere or by other means or at another time. This is a plausible hypothesis when suitable targets are plentiful and accessible. But is it not rare for most potential offenders to enjoy an abundance of tempting and vulnerable targets within their reach? And it should be rare, precisely because of private self-protection: a lot of people keep their precious goods out of reach of thieves and are careful not to expose themselves to potentially violent men. Billions

of decisions made by individuals to protect themselves create a situation where most offenders have a difficult time finding worthwhile and vulnerable targets. Such a situation should contribute to push down crime rates at the national level.

Criminologists tend to believe that public choices regarding crime control are a more important factor affecting aggregate crime rates than private choices. Economists in the Adam Smith tradition think the opposite concerning wealth: individual work and entrepreneurship within a free market contribute more to the wealth of nations than public intervention in the economy. Considering the disregard of public officials for the crime problem and their lack of any incentive to be efficient, one is tempted to agree with the economist's way of reasoning.

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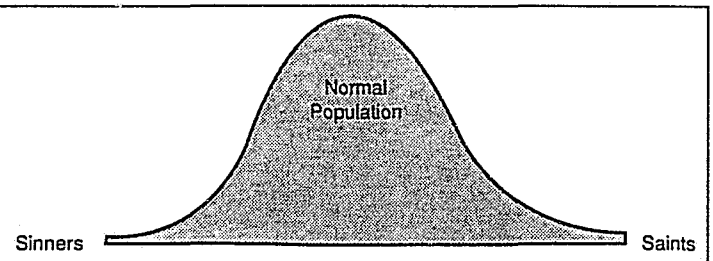
by Ronald V. Clarke

The distribution of deviance and exceeding the speed limit

Introduction

Criminologists have spent much time on questions of the geographical, spatial and social distribution of crime, but little on the more fundamental, if problematic, question of how crime and deviance are distributed across the population at large. This may seem an arcane topic, but it relates to some fundamental theoretical issues. Thus, theorists such as Hirschi (from a sociological perspective) and Becker (from an economic one) have argued that people are predominantly self-seeking and consequently differ little in their propensity to crime, whereas other theorists, such as Wilkins (1965), have argued that the propensity to deviance is normally distributed in the population (Figure 1). For Hirschi and Becker, levels of crime are relatively straightforward functions of the effectiveness of formal and informal social controls in constraining the individual's natural selfishness, whereas for Wilkins, social control has to be appropriate to the individual's natural level of deviance or its runs the risk of "amplifying deviance" through the imposition of overly severe punishment for relatively minor infractions.



Source Wilkins, 1965

Figure 1. *Wilkins's normal curve of saints and sinners*

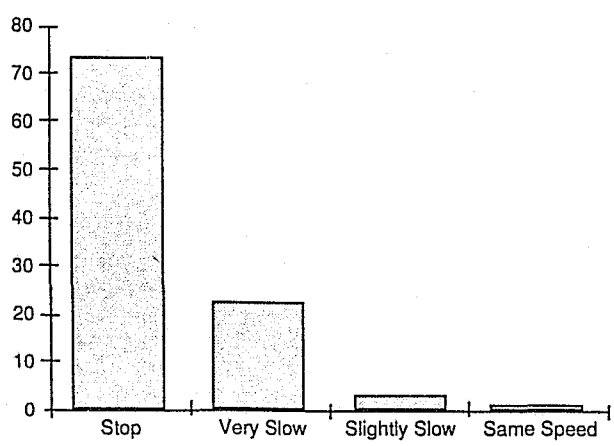
Wilkins' argument shows that the distribution of deviance is not simply a theoretical matter, but also has policy implications. Indeed, much of the criminal policy of the past few decades has been based on the assumption that crime and deviance are largely confined to a minority of the population. This assumption has legitimated the substantial investment of societal resources in programs of treatment, deterrence and incapacitation designed for this criminal minority. It has also held the implication that situational or opportunity-reducing measures are of limited value since these are not

usually powerful enough to affect determined criminals and are unnecessary for everyone else. On the other hand, if crime were normally distributed, it would follow that such a heavy concentration of resources on the minority of apprehended offenders would be inappropriate and, as Wilkins argues, may also be counter-productive. Under these circumstances, situational measures to reduce opportunities for crime for the population at large become considerably more attractive.

Previous Research

Perhaps the best known findings on the distribution of deviance have been reported in the context of the Philadelphia cohort study, which showed that a small proportion of offenders committed a disproportionately large proportion of crime (Wolfgang et al., 1978). However, this cohort (like most others) did not include females and was also from a geographically confined area. Moreover, the data relate not to some underlying propensity for crime as discussed by Wilkins, for example, but to the observed outcome in terms of crime resulting from the mixture of propensity and environment. To use the language of biologists, the distributions identified in the cohort studies relate to phenotype and not to genotype which is the principal concern of the theorists.

While it may be legitimate to use phenotype and genotype when discussing some biological attribute such as size, however, it may not be when discussing a social behavior such as crime. This would be the position taken by Floyd Allport, who, with his collaborators, undertook the most extensive program of research so far reported on the distribution of deviance (Allport, 1934; Katz and Schanck, 1938; Fearing and Krise, 1941; Bernard,1942). In this almost forgotten work undertaken more than fifty years ago, Allport and his team observed people's compliance to laws and rules in a variety of contexts. For example, they studied times of arrival for lectures and for church and observed motorists' compliance with stop signs and parking regulations. In all cases the results were the same. Most people complied, with increasingly smaller proportions of people deviating by greater amounts from the proscribed behavior (see Figure 2).



Source Katz and Schanck, 1938

Figure 2. J-curve of institutional behaviour of motorists at a street crossing

Because the resulting distributions were in the shape of an inverted j, with the straight back of the j denoting compliance, Allport called this the "j-curve of institutional conformity". He went further to argue that the j-curve was an inevitable result of social control and that the existence of rules and laws would always push the distribution of deviance into this characteristic shape:

There is no such thing, for example, as purely normal probability distributions in the times of the required arrival of individuals at appointed places, in their stopping behavior before red lights, or in their participation in church rituals. Without any economic pressures, sanctions, or other conformity influences acting upon the individuals to make them do a particular thing, they would not do these things at all, or else they would do them purely by chance. Now in the latter case the distribution would depend upon simple probability (not the so-called, compound probability of the normal curve); and the curve resulting would not be bell-shaped, but flat. The distribution of behavior in relation to a rule is that of the steep, double-j-form, produced by pressures to conformity, or it is nothing at all. (Allport, 1934, p. 167).

In Allport's mind, therefore, it was impossible to conceive of a normally-distributed "genotype" of deviance as proposed subsequently by Wilkins (who does not appear to have been aware of Allport's work). To Allport, rules and laws were social institutions designed to constrain people's behavior in specific ways. Without these rules, behavior would be random and would not be distributed according to any particular distribution.

This is an appealing argument, especially when supported, as it was, by numerous empirical

observations that seemed to confirm the existence of the j-curve. Some of the observed variations on the basic j-curve seemed intuitively also to make sense. Thus, it was found that the more serious the deviance, the taller the j. In other words, while many people might commit minor infractions, hardly anyone commits serious crimes such as murder.

The difficulty of imagining some in-born propensity to rule-breaking (except perhaps where mediated by some more fundamental personality trait such as selfishness or lack of self control) also lends some credibility to Allport's position. Nevertheless, his work has attracted criticism, in particular for measuring only lack of compliance and not, what might be called, over-conformity. In other words, it has been suggested that Allport's j-curve is simply the right hand side of a normal distribution, the left hand side of which would be represented by people who arrive early for lectures or show extreme caution at road intersections.

Allport responded to his critics by arguing that his observations reflected the purpose of most social rules, which attempt to draw a line that must not be crossed; in most cases it is of little social consequence whether people stop well before the line. Thus, the stop sign at the road junction defines the level of caution required and there is little need to be even more cautious. Accordingly, it would make little sense in most situations to measure the left hand side of the curve.

Nevertheless, Allport did attempt to measure "over-conformity" in some of his studies. For example in a study concerned with arrival for work, he recorded not just how late people were, but also how early (Allport, 1934). The result was, he claimed, that the distribution of behavior represented two back-to-back j-curves. This was not a normal distribution because each j-curve was positively accelerated on its upward slope, not negatively as in the two sides of a normal distribution. Despite the ingenuity of this argument, the visual interpretation of a curve is highly subjective and the possibility cannot be excluded that in most of their work Allport and his colleagues observed only half of what in reality was a normal curve. This might have become clear had greater efforts been made to quantify over-conformity.

It is also possible that the differing views about the distribution of deviance result from the fact that two different things are being discussed: in the one case (represented by Wilkins), it is a general behavioral propensity, whereas in the other (represented by Allport), it is actual behavior in highly specific situations. If this were so, one might then expect in line with Wilkins that empirical data would show that the more general the measure of crime or deviance, the more closely will the distribution of deviance approximate to a normal curve. In line with Allport, one would also expect that the more specifically data related to a particular rule or law, the more likely the resulting distribution would fit a j-curve.

This was indeed what David Weisburd and I found when using self-reported crime data from the National Youth Survey (Clarke and Weisburd, 1990). For specific offenses, especially those of a more serious kind such as aggravated assault, the distribution was j-shaped. For the aggregate measure of delinquency, however, it more closely approximated a normal distribution (though with an elongated tail indicating extremely frequent offending by a very small minority of respondents).

However, this test was somewhat unsatisfactory as it involved frequency distributions of the sample's self-reported crimes over a fairly lengthy time span. It is not clear that a distribution of this kind can be legitimately compared with a distribution of the behavior of a sample of individuals in one specific context (which characteristically comprised Allport's method). A further difficulty was that over-conformity was not measured and we had to assume that the distributions we studied represented only half the curve. This is clearly unsatisfactory since it is difficult to imagine what would represent over-conformity in relation to, say, robbery and difficult to see how this might be measured.

One way to avoid this conceptual problem might be to reformulate the issue, not in terms of specificity/generality, but in terms of crime seriousness. Under this formulation, it would be hypothesized that the more serious the deviance, the more closely this would be distributed in the population according to a j-curve, and the less serious, the more closely the distribution would resemble a normal curve. The fact that Weisburd and I found that the general measure of delinquency in the National Youth Survey approximated to a normal curve would have the been the result of including a large number of very minor infractions which dictated the shape of resulting curve.

Present Study

Rationale. Existing data seems to confirm that for the more serious infractions (robbery, aggravated assault, etc.) the distribution is clearly j-shaped. It is also for these infractions that it makes least sense to attempt to measure over-conformity. The present study is therefore confined to examining the distribution of deviance at the relatively minor end of the scale. Because of limited resources it was not possible to collect primary data and a search was made for an existing data set that, (i) related to a minor form of deviance, (ii) included a measure of over-compliance on a scale continuous with that of non-compliance and, (iii) was based on a representative sample of the population (Allport's studies were undertaken with samples -- churchgoers, for instance -- who would be unlikely to be representative of the population at large).

Data. A data set meeting these criteria was found in the context of a federal program to monitor compliance with speed limits. In order to qualify for federal subsidies for highway improvement, U.S. states must demonstrate a commitment to enforcing federally-mandated speed limits and, as part of this demonstration, they are required to provide routinely-collected data concerning traffic speeds for various categories of highway. To qualify for subsidies, set percentages of vehicles must be in conformity with the speed limit, presumably on the assumption that high percentages of vehicles exceeding the limit indicate that state speed limits are not being adequately enforced.

One sophisticated speed monitoring program is undertaken by Illinois which has a highly developed sampling process and monitors speeds electronically for large numbers of vehicles. The Illinois Department of Transportation (IDOT) kindly supplied the data illustrated in Figures 3 and 4, which, respectively, show speeds for cars and trucks on rural interstates monitored for 1992. It should be noted that the speed limit on rural interstates in Illinois during this period was 65 mph for cars and 55 mph for trucks and other large vehicles.

Findings. Examination of Figure 3 for cars (based on nearly 16.5 million observations of speed) reveals a remarkably normal distribution, centered at the speed limit (according to IDOT calculations, the median speed was 64.7 mph -- see Table 1). There are slightly larger numbers of vehicles travelling 5-15 mph below the limit than are found at 5-15 mph above, which means that slightly larger numbers of people are obeying the limit than not. However, these differences result in only a small distortion of the curve.

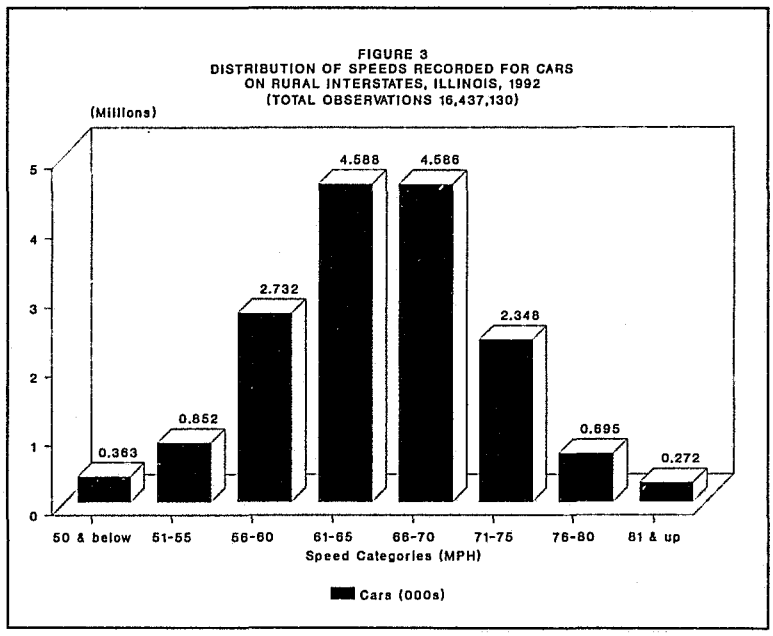
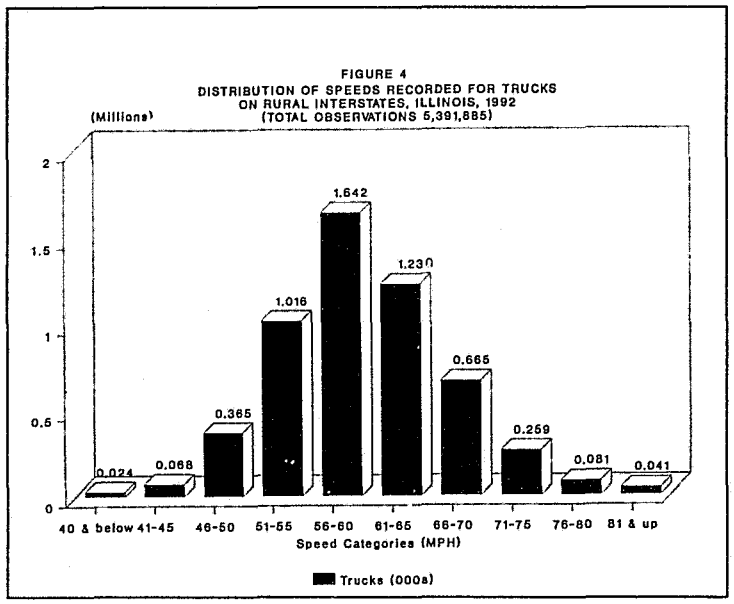


Table 1
Speeds Recorded for Cars and Trucks on Rural Interstates, Illinois, 1992

	Cars	Trucks	All Vehicles
Total Observed	16,437,100	5,391,885	21,829,015
Average Speed (mph)	65.0	59.7	63.7
Median Speed (mph)	64.7	58.8	63.4
85th Percentile (mph)	71.9	66.8	70.9
Percentage of Vehicles Exceeding:			
50 mph	97.8	91.5	96.2
55 mph	92.6	72.7	87.7
60 mph	76.0	42.2	67.6
65 mph	48.1	19.5	41.0
70 mph	20.2	7.1	16.9

Figure 4 for trucks (based on about 5.4 million observations of speed) shows a slightly different picture, though the distribution still appears fundamentally normal. In this case, however, the peak of the curve is located within the five-mile range (56-60) just above the limit (according to IDOT the median speed was 58.8 mph) and the whole curve is somewhat skewed to the right so that larger

numbers of trucks are found within each five mile grouping above the limit than at each of the corresponding groupings below the limit. This means that rather more trucks are disobeying than obeying the limit.



Discussion

Before considering the implications of these findings for the j-curve hypothesis, some discussion is needed of the differences between the two observed speed distributions, in particular the finding that more of the trucks were observed to break the speed limit. This may be surprising since the consequences of being caught for speeding would be more serious for truckers than private motorists, who, unlike truckers, would not usually face any job-related sanctions. However, truckers may reduce these already small chances of detection by making use of radar detectors and CB radio. They may also be less inclined to obey the limit because they may regard the 55 mph limit as being unrealistically low. (Indeed, the limit was recently raised for cars partly on the grounds that laws without public support are widely disregarded). Finally, truckers may have an economic incentive to travel fast because their incomes are often related to how many miles they drive.

These may be some of the reasons why the speed distribution for truckers is somewhat skewed to the right when compared with that for car drivers, but neither distribution much resembles the back-to-back j-curves that would be predicted by Allport. This suggests that, at least for behaviors that are minimally sanctioned, his observations might have been biassed by unrepresentative populations and/or failure to adequately measure degrees of over-conformity. Given the size of the present samples (about 16.5 million speed observations for cars) and the likelihood that the sample is fairly representative of the motoring population as a whole (most truckers, for example, would also be car drivers), it seems likely that the distribution of deviance for less serious offences is not j-shaped as argued by Allport, but is normal as argued by Wilkins.

This conclusion results in a difficult theoretical task, given the persuasiveness of Allport's arguments about the necessity of the j-curve. It is very clear, as predicted by Allport, that the speed that motorists drive is markedly influenced by the law. In both cases, the median speed driven by the truckers and car drivers was close to the legal limit though in one case this was 10mph higher than the other. However, there was no real tendency, as Allport would also have predicted, for the speeds to cluster at or just above the limit. Despite the fact that the speed limit is an entirely artificial creation of society and has no natural moral imperative (as might be the case for some of the more serious acts of deviance), the distribution of compliance/deviance is normal.

On the face of it (and I cannot for the present see another interpretation), this is evidence that people's propensity to deviance is indeed normally distributed and that this may be mediated by some personality predisposition such as selfishness or lack of self control.

These observations on speeding, a relatively minor form of deviance, do not of course call into question the existence of the j-curve for more serious offences. Indeed, it is hard to see how the distribution could be anything other than a j-curve when the frequency distributions of more serious offences committed are plotted for the population as a whole. Hardly anybody has committed a murder, and only a tiny proportion of individuals has committed more than one. It would also be highly artificial to try to devise some measure of over-conformity for an act such as homicide. Perhaps sacrificing one's life for others would come closest, but the nature of this act and the circumstances in which it arises are so different from homicide and its precipitants that it would be hard to argue that a continuum of behavior exits

between the two. For the present, therefore, the conclusion that seems to fit best the existing empirical observations is that the propensity to deviance (that is to say the "genotype" for deviance) is normally distributed, but that through the action of social control the actual distribution of criminal behavior (the "phenotype") comes increasingly to resemble a j-curve as offences increase in seriousness. This means that, as observed by Cusson in this volume, there is an inverse relationship between the frequency and seriousness of offenses.[1]

Conclusions

The most general conclusion to be drawn from this study is that both Wilkins and Allport may be correct in part. While there may exist a normally distributed propensity to deviance (or a "genotype") reflective of some underlying personality variable (as argued by Wilkins), this is modified by the action of social control so that when expressed in behavioral terms it comes to resemble a j-curve (as argued by Allport). Nevertheless, this does require quite substantial modification of Allport's "law of institutional conformity" since he had argued that the distribution of deviance was j-shaped of necessity. This seems only to be true of the more serious offences. On the other hand, the support provided to Wilkins' view by the present study, if confirmed in later research, has potentially profound implications for theory. This is because it supports the existence of some fundamental, perhaps biologically-determined, propensity to crime. In terms of the policy implications referred to above, it also provides some general support for the situational approach to prevention since these measures are directed to the population at large, rather than simply to the criminal minority.

One other general implication of the present results should not be overlooked, which is that laws certainly do have a powerful effect on behavior. This is contrary to the idea in some quarters that informal social control is much more important than legal sanctions in keeping crime in check and is suggested by the fact that the median speed observed for both cars and trucks was close to the designated limit even though the risk of detection for speeding is low. While the truckers were less inclined overall to obey the limit applying to them, the difference was not great and there were a number of practical reasons why this group of drivers might be more disinclined to obey the limit.

In conclusion, it should be underlined that work on the distribution of deviance is bedeviled by conceptual and empirical problems and the present study cannot be regarded as definitive. Even if its conclusions about the competing hypotheses of Allport and Wilkins are not subsequently confirmed, there is still one respect however in which it may be of lasting value. This relates to the nature of the data presented, particularly in Figure 3. To my knowledge, there has never previously been reported in the criminological literature so many empirical observations of compliance (about 16.5 million for car drivers) relating to a specific law. These observations which were unobtrusive, non-reactive and very accurate, were apparently derived from a fairly representative sample of the adult population. Even if we are presently unsure of the interpretation, the fact that they closely fitted a normal curve is highly interesting and in my view merits a place in the textbooks.

Notes

1. Though not all infrequent offenses are very serious; for example, as laws become obsolescent, the offenses to which they relate (such as riding a horse recklessly) become less frequent (cf. Cusson, 1993; Walsh, 1993).

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by D. Kim Rossmo

Geographic profiling: Locating serial killers

Introduction

Clues derived from the locations of violent serial crimes, including serial murder, rape, and arson, can be of significant assistance to law enforcement. Such locations include encounter/apprehension sites, murder scenes, and body/property dump sites. This information allows police departments to focus their investigative activities, geographically prioritize suspects, and to concentrate saturation or directed patrolling efforts in those zones where the criminal predator is most likely to be active.

The process whereby the probable spatial behaviour of the offender is derived from the information and context of the locations of the crime sites is termed geographic profiling. This form of analysis has both subjective and qualitative dimensions, and is related to the broader investigative strategy of criminal or psychological profiling.

Geographic profiling is concerned with the analysis of spatial behavioural patterns. A variety of techniques exist for such an analysis, including distance to crime research, demographical analysis, centrographic analysis, point pattern analysis, point spread analysis, crime site residual analysis, spatial-temporal ordering, directional analysis, and criminal geographic targeting (Rossmo, 1993).

Criminal geographic targeting appears to be a particularly useful technique for the needs of police investigators attempting to solve complex serial crimes. By examining the spatial data connected to a series of crime sites, the criminal geographic targeting (CGT) methodological model generates a three-dimensional probability surface, represented as an isopleth map, that indicates those areas most likely to be associated to the offender - home, work site, social venue, or travel routes.

Based on the Brantingham model for crime site selection (1981, chap. 1), and the routine activities approach (Felson, 1986), criminal geographic targeting was developed from a perspective informed by the theory and practice of environmental criminology. In this sense it goes beyond centrographic analysis, though the formulation of the model owes much to earlier studies in the geography of crime. Parameters are empirically derived from specific serial crime geographic research, and the methodology is sensitive to the target/victim opportunity backcloth, landscape issues, anisotropic spaces, and problems of spatial "outliers".

Serial Murder Investigation

Investigative Difficulties. The nature of serial murder creates unique problems for law enforcement, requiring special police responses and investigative strategies. It has been suggested that there are only three ways to solve a crime: (1) via a confession; (2) through a witness; and (3) by using physical evidence (Klockars, 1983, pp. 134-135). Traditionally, the search for witnesses, suspects, and evidence has followed a path, originating from the victim and the crime scene, outwards. Most homicides are cleared for the simple reason that they involve people who know each other, and the process of offender identification is often only one of suspect elimination.[1]

Such obvious connections rarely exist in cases of serial murder. The lack of any relationship between the victims and the offender make these crimes difficult to solve. Working outwards from the victim during the investigation of stranger homicides is a difficult task. The alternative, then, is to work inwards, trying to establish some type of link between potential suspects and the victim or the crime scene.

Such a process requires the determination and delineation of a likely group of potential suspects. This effort typically involves the inspection of those parties with relevant criminal records, the accumulation of intelligence, and the collection of suspect tips from members of the public. Because these efforts can produce a large number of potential suspects, often numbering into the hundreds and even thousands, problems with information overload usually develop.

In the still unsolved Green River Killer case, for example, 18,000 suspect names have been collected, but as of February 1992, the police have only had the time and resources to check out some 6,000 of these. The police have collected 8,000 tangible items of evidence from the crime scenes, and a single television special on the case generated 3,500 tips (Montgomery, 1992). The Yorkshire Ripper case had, by the time it was solved, 268,000 names in the nominal index. The police had initiated 115,000 actions and taken 31,000 statements. Up to 1,000 letters were received daily from the public, and a total of 5.4 million vehicle registration numbers were recorded by investigators (Doney, 1990, pp. 101-102).

Corollaries to this problem include the strains placed on police resources by too many suspects and too much information, and the high costs involved in such extensive, long-term investigations. Green River Task Force costs were, up to early 1992, approximately $20 million (Montgomery, 1992), while the Yorkshire Ripper investigation involved over five million hours of police time at a cost of four million pounds (1981 figures) (Doney, 1990, p. 102).

It is also important for police detectives to know which murders are connected and which ones are not so that information between related cases can be collated and compared.[2] In some cases, particularly those involving high risk victims, the authorities may not even be aware that a serial murderer is operating within their jurisdiction.

With mobile killers who do not commit their crimes in a single area, the problem can become much worse. When a criminal investigation has to cross jurisdictional boundaries, issues of coordination, cooperation, and competition arise. This "lack of sharing or coordination of investigative information relating to unsolved murders and to the lack of adequate networking among law enforcement agencies" has been termed linkage blindness (Egger, 1984, p. 348). This problem can even occur within a single police organization if it is large enough. Such an oversight occurred in the early part of the "Son of Sam" case, when David Berkowitz killed his first victims in different police precincts within New York City (Bufton, 1993, pp. 8-9; Leyton, 1986, chap. 5).

Several other investigative difficulties exist that complicate efforts to link and solve serial murders and to identify and apprehend the killer(s) (Egger, 1990, pp. 177-179; Holmes & De Burger, 1988, pp. 112-121, 148-154; James, 1991, pp. 1-4). These problems include: (1) the intense public, media, and political pressure surrounding such cases; (2) the learning process experienced by organized offenders as they become "practiced" at killing; (3) false confessions from unbalanced people attracted by the publicity; (4) the possibility of copy cat murders occurring; and (5) personnel and coordination issues (especially when multiple agencies are involved).

Investigative Responses. In efforts to overcome the investigative obstacles faced during serial murder cases, a variety of law enforcement strategies have been developed over the past few years (Egger, 1990, pp. 180-198). One of the most important responses has been the effort to create systems of information management, methods of prioritizing potential suspects so that the investigation can proceed in the most effective and efficient manner possible. Proper scrutiny of suspects, in the effort to work backwards to the victim, is a difficult and time consuming

process. Comprehensive interrogations of suspects, detailed interviews of suspect associates (who may be witnesses, whether they know it or not), and thorough searches for and analyses of physical evidence consume valuable and limited resources. By using a prioritization methodology, the comprehensiveness of the investigative approach can be tailored to the priority rating of the individual suspect. By focusing on the most probable suspects, the identification of the offender, all else being equal, is more likely to occur sooner.

Criminal or psychological profiling is one of the primary investigative tools used to prioritize suspects in serial murder cases. Profiling seeks to develop a behavioural composite - a social and psychological assessment - of the perpetrator of certain types of crimes. This process is based on the premise that the proper interpretation of crime scene evidence can indicate the personality type of the individual(s) who committed the offence. Certain personality types exhibit similar behavioural patterns, and knowledge of these patterns can assist in the investigation of the crime and of potential suspects. Criminal profiling is also used to perform linkage analysis. Within the United States, investigative support, research, and training in this area is provided by the Behavioural Science Unit (BSU) at the Federal Bureau of Investigation (FBI) Academy. The Royal Canadian Mounted Police (RCMP) Violent Crime Analysis Section (VCAS) provides a similar service in Canada.

The major response to the problem of linkage blindness has been the establishment of centralized investigative networks, such as the Violent Criminal Apprehension Program (VICAP), developed at the National Centre for the Analysis of Violent Crime (NCAVC) in Quantico, Virginia. Some states have their own computerized investigative systems, including the Homicide Assessment and Lead Tracking (HALT) system in New York State, the Homicide Investigation Tracking System (HITS) in Washington State, and the Indiana Criminal Apprehension Assistance Program (ICAAP) in Indiana. British Columbia, Canada, has, through the RCMP, the Major Crime Organizational System (MaCrOS). In Britain, Scotland Yard uses the Home Office Large Major Inquiry System (HOLMES) for managing large volumes of investigative case data (Doney, 1990).

Geographic Analysis in the Investigation of Serial Murder. In addition to psychological profiling and computerized linkage analysis systems, other creative investigative methodologies have been advanced in recent years to assist in efforts to solve cases of serial murder. Still others are currently being developed and experimented with by police agencies and universities. One of the more promising research directions is in the area of geographical pattern analysis (Egger, 1990, p. 197). This enterprise involves the examination of spatial information, derived from the geographic locations of the crime sites, as a basis for efforts to find or track the repetitive killer.[3]

During 1977, in an effort to focus the Hillside Strangler investigation, the Los Angeles Police Department (LAPD) attempted to determine the most likely location of the scene of the homicides. It was correctly suspected that the actual murders had occurred in the residence of one of the serial killers. The police knew where the victims had been apprehended and where their bodies had been dumped, and the distances between these two points (Gates & Shah, 1992, pp. 163-167). Computer experts Dr. Bill Herrman and Carl Holt, both retired LAPD officers, viewed the problem in terms of Venn diagrams. The centre of each circle represented victim availability, the circumference represented capability, and the radius represented capability (C. Holt, personal communication, February 22, 1993).

From this perspective they developed a technique using vectors drawn from the point where the victims were abducted to the location where their bodies were found. The vectors were then resolved down to a common radius, the circle of which encompassed an area they called the "sphere of concern". The resulting circle, however, with a radius of approximately one mile and an area of over three square miles, was large.

The LAPD saturated this zone with 200 police officers in an attempt to find the murderers (Gates & Shah, 1992, p. 166). While they were not successful, it is possible that the heavy police presence inhibited the killers, and prompted murderer Kenneth Bianchi's move from Los Angeles to Bellingham, Washington (C. Holt, personal communication, February 22, 1993). The location of the centre of the "sphere of concern", the LAPD later found out, was not far from co-murderer Angelo Buono's automobile upholstery shop-cum-residence (Gates & Shah, p. 166).

Newton and Newton (1985) applied what they termed geoforensic analysis to a series of unsolved female homicides that occurred in Fort Worth, Texas, from 1983 to 1985. They found that localized serial murder or rape tends to form place-time patterns

different from those seen in "normal" criminal violence. The unsolved Fort Worth murders were analyzed by employing both quantitative (areal associations, crime site connections, centrographic analysis), and qualitative (landscape analysis) techniques.

Newton and Swoope (1987) also applied geoforensic techniques in a retrospective analysis of the Hillside Strangler case. Different geographic centres (see below) were calculated from the coordinates of the locations of various types of crime sites. They discriminated between points of fatal encounter, body or car dump sites, and victim's residences, and found that the geographic centre of the body dump sites most accurately predicted the location of the residence of murderer Angelo Buono. A search radius (circumscribing an area around the geographic centre in which the killers were most likely to be found) was also calculated, the range of which decreased with the addition of the spatial information provided by each new murder.

When they plotted these locations on a map of Los Angeles, Newton and Swoope detected what they termed a "coal-sack effect" - the presence of an area surrounding the home of Buono in which no crimes were known to have occurred. This appeared as a conspicuous void in the pattern of points that represented the crime sites of the Hillside Strangler. They suggest that the discovery of such a phenomenon, presumably resulting from a desire on the part of the killer to avoid drawing attention too close to home, should alert police to the investigative significance of the area.

Rogers, Craig, and Anderson (1991) discuss the potential application of geographic information systems (GIS) to the investigation of serial murder. Since a GIS can store geographic attributes and integrate spatial and other data for analytic purposes, it could assist in the reduction of linkage blindness and help identify crime series. They quote from a 1975 International Association of Chiefs of Police (IACP) report: "Geographically coded information from police records can be used to detect crime trends and patterns, confirm the presence of persons within geographic areas, and identify areas for patrol unit concentration" (p. 17). They also suggest that it might be possible to identify serial murder solvability factors, using GIS, through retrospective analysis of known cases. Such knowledge might then assist investigators in their efforts to apprehend criminal offenders in unsolved murders.

Geographic Profiling. For any crime to occur there must have been an intersection in both time and place between the victim and the offender. How did this happen? What were the antecedents? What do the spatial elements of the crime tell us about the offender and his or her actions? What are the hunting patterns of such killers? Efforts can be made to understand the spatial behaviour of such offenders through information derived from known crime site locations, their geographic connections, and the surrounding areas. This approach is known as geographic profiling and has both quantitative and a qualitative dimensions (Rossmo, 1993).

Geographic profiling examines the target location patterns of serial violent criminals in an effort to determine spatial information about the offender - in particular, residential location. This process is done from a perspective informed by theoretical principles and practical ideas developed in studies within the areas of environmental criminology[4] and the geography of crime. Such an approach suggests the need to be aware, at a microspatial level, of the dimensions of the offender, the victim, the crime, and the environment.

Since a criminal profile provides insight into the probable motivation, behaviour, and lifestyle of the offender, the two profiling processes act in tandem to help investigators develop a "picture" of the person responsible for the crimes in question. The geographic profile will therefore be optimized if a psychological profile has first been completed.

Also, since geographic profiling is based on an analysis of crime site locations, a linkage analysis is a necessary prerequisite to determine which crimes are part of the same series and should be included in the development of the profile.[5] While the inclusion of an unrelated crime or the exclusion of a connected crime is not necessarily debilitating, the product of the profile is dependent on the quality of the initial information used for the analysis.

It should be noted that not all types of offenders or categories of crime can be geographically profiled. In appropriate cases, however, such a spatial analysis can produce very practical results from the police perspective. There are a variety of ways that geographic information about the offender can assist the investigation including the prioritization of suspects by address or area, the direction of patrol saturation efforts, and the establishment of computerized data base search parameters.

Hunting Patterns

The Brantingham Model. The locations where crimes occur are not completely random, but instead often have a degree of underlying spatial structure. As chaotic as some crimes may appear to be, there is often a rationality influencing the geography of their occurrence. Using an environmental criminology perspective, Brantingham and Brantingham (1981, chap. 1) have developed a model to assist in the understanding of the processes affecting the geography of crime.

Crimes tend to occur in space at those locations where suitable (in terms of profit and risk) victims or targets are found by offenders as they move throughout their activity spaces. As an offender travels between his home, workplace, and social activity sites, his or her activity space (composed of these locations and their connecting paths) describes an awareness space which forms part of a larger mental map - an "image of the city" built upon experience and knowledge.

Brantingham and Brantingham (1981, chap. 1) suggest that the process of criminal target selection is a dynamic one. Crimes occur in those locations where suitable targets are overlapped by the offender's awareness space (see Figure 1). Offenders may then move outward, following a distance decay function, in their search for more targets. Search pattern probabilities can be modeled by a Pareto function, originating from the locations and routes that comprise the activity space, and then decreasing with distance away from the activity space. There may also be a "buffer zone", centred around the criminal's home, within which the offender sees targets as being too risky to victimize because of their proximity to his or her residence (cf. the "coal-sack effect", Newton & Swoope, 1987).

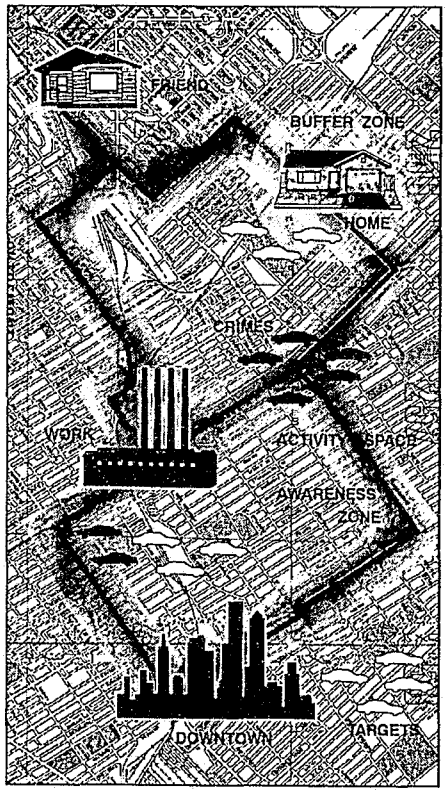

Figure 1. The Brantingham model of crime site search geography.

An awareness of certain geographic concepts and terms can help in the analysis of criminal target patterns and for an understanding of the model of crime site selection proposed by Brantingham and Brantingham (1981, chap. 1, 1984, chap. 12). Perhaps one of the most basic of these heuristics is the nearness principle, known in psychology as the least-effort principle. All else being equal, a person who is "given various possibilities for action ... will select the one requiring the least expenditure of effort" (Reber, 1985, p. 400). This maxim describes a great deal about human spatial action, but it is important to remember that many factors come into play in decision making and choice behaviour (Cornish & Clarke, 1986; Luce, 1959; Tversky & Kahneman, 1981).

The least-effort principle, as applied to geography, means that when multiple destinations of equal desirability are available, all else being equal, the closest one will be chosen. The determination of "closest", however, can be a somewhat problematic assessment. Isotropic spaces, exhibiting equal physical properties in all directions, are rarely found within the human geographical experience. Instead, people are usually confronted with anisotropic surfaces where movement is easier in some directions or along certain routes, and harder along others. People travel through networks of roads and highways by "wheel distance" (Rhodes & Conly, 1981), rather than by Euclidean distance.

Other factors are just as important as physical space. Macrolevel travel choices are usually based on minimizing time and money expenditures. Air flight bookings are made by considering connections, time, and cost - not on actual distances covered. Income and socio-economic status thus have an important influence on spatial behaviour, as a shortage or lack of financial resources will constrain choices and determine which options are seen as being viable.

Microlevel movement within cities is similarly affected; urban areas are primarily anisotropic, often conforming to some variation of a grid or Manhattan layout (Lowe & Moryadas, 1975, pp. 15-17), with dissimilar traffic flows along different routes. As it is not just a question of minimizing distance, but of reducing time, effort, and costs, the geographic layout of the city, the offender's modes of transportation, and any significant mental/physical barriers must be considered in the spatial analysis of crime patterns.

The subjective psychological perception of distance is just as critical as the objective physical space involved. An individual's perception of distance is influenced by several factors, including (Stea, 1969): (1) the relative attractiveness of origins and destinations; (2) the number and types of barriers separating points; (3) familiarity with routes; (4) the actual physical distance; and (5) the attractiveness of routes.

Cognitive images may vary in relation to a person's biography, social class, geographical location, and environment, however, most people's mental maps have much in common. This is due to the fact that humans tend to perceive things in a like fashion. Lynch (1960, pp. 47-48), for example, states that image composition is based on five elements: (1) paths (routes of travel that tend to dominate most people's images of cities; e.g. highways, railways); (2) edges (boundaries of lines that help to organize cognitive maps; e.g. rivers, railroads); (3) districts (subareas with recognizable unifying characteristics, possessing well-established cores but fuzzy borders; e.g. financial districts, skid rows); (4) nodes (intense foci of activity; e.g. major intersections, railroad stations, corner stores); and (5) landmarks (symbols which may not be entered but which are still used for orientation; e.g. signs, buildings, trees).

Criminal or psychological profiling can assist in determining the relationships between a suspect's personality, lifestyle, and activities, and his or her target patterns. Disorganized offenders, for example, will tend to strike closer to the nodes and routes which comprise their activity spaces, while organized offenders will be more likely to expand the boundaries of their awareness space and hunt in areas located further away from home. Additionally, the size and complexity of their awareness space will probably be greater than that found for more disorganized offenders.

Hunting and Target Pattern Typologies. Most commentaries on geographic categorizations of serial murder have been descriptive (Egger, 1990, pp. 26-27; Hickey, 1991, pp. 17, 78-81, 132-138; Holmes & De Burger, 1988, pp. 49, 54, 73). A serial murder spatial typology that moves from empirical to theoretical description must incorporate at least three elements: (1) the activity space of the offender; (2) the changes over time in that activity space; and (3) the hunting style (in relationship to the activity space) of the offender. These, in conjunction with each other, define the target pattern typology.

The first step in the process of constructing such a typology is the development of relevant categories for both activity spaces and hunting styles. One of the purposes of this exercise is the identification of those situations where an analysis of the relationship between the offender activity space and the crime location is appropriate. This allows those cases where such an analysis is impossible or redundant to be eliminated.

For example, the peripatetic movements of Henry Lee Lucas produce such a random pattern that little can be derived from his target sites. In effect, he did not have a residence to relate to the locations of his crimes. John Wayne Gacy, Jr. buried most of his victims under his own house, making the form of examination proposed here redundant. And commuting offenders,[6] who live in one area and commit their crimes in another, may not be amendable to this type of analysis. It is important to determine the limits of geographic profiling so as to prevent incidents of inappropriate application.

Target Backcloth. The locations of suitable victims may not be uniformly distributed within the killer's hunting areas. The Brantingham model implies that the structure of this distribution is important for an understanding of the geographic arrangement of crime sites. The target backcloth is the spatial/temporal distribution of "suitable" (as seen from the offender's perspective) crime targets or victims across the physical landscape. The availability of such targets might vary significantly according to neighbourhood, area, or even city, and victim selection opportunities may also be influenced by time, weekday, and seasonality (Brantingham & Brantingham, 1984, pp. 104-106, 158, 361-363).

The availability and locations of suitable targets play a key role in the determination of where and when offences will occur. Victim selections that are nonrandom or based on specific and rare traits will require more searching on the part of the offender than those that are random, nonspecific and common (Holmes & De Burger, 1988, pp. 51-52). For example,

if an arsonist prefers to select warehouses as targets, their availability and distribution, geographically determined by city zoning bylaws, will have a strong influence on where the crimes occur. If the arsonist has no preference as to structure then the target backcloth will probably be more uniform as houses and buildings abound, at least in urban areas. The target sites of a predator who seeks out prostitutes will be determined primarily by the locations of the various "hooker strolls" in the area, while the attack sites of an offender who is willing to prey on any woman found on the street could be located almost anywhere in the city.

In the latter cases the more or less uniform victim backcloth means that target patterns are influenced to a large extent by the offender's activity space, while in the former cases, crime geography is closely related to the victim backcloth. In the extreme cases of an arsonist for hire or a contract killer, victim location totally determines crime site. Victimology thus has an important role to play in the development of an accurate geographic profile.

Crime Location Types. There may be several spatial points involved in a case of serial murder, each with a slightly different geographic meaning (cf. Newton & Swoope, 1987):

1. victim's last known location
2. victim-offender encounter site (stalking sites)
3. attack location (contact location)
4. holding location
5. murder scene
6. body dump site
7. vehicle and property disposal sites
8. travel routes.

In many cases, some of these locations could be the same (i.e. the body dump site may also be the murder scene). While all of these sites are important in the construction of a geographic profile of the offender, their locations are not always known to the investigating police officers. Prior to the apprehension of the killer, the only way these places can be determined is through evidence recovery or by witness statements. Typically the police only know the body dump site (which may or may not be the murder scene) and the place where the victim was last seen. In some circumstances, they may only know the latter location.

Additionally, not every type of site has the same degree of relevance for all cases. If target selection is specific, as in a series of prostitute murders, then the encounter locations will be restricted, influenced more by the victim backcloth (i.e. where the red light district is located) than by the offender's activity space. Actual murder scenes may not be known to the police but dump sites will be, at least in those cases where the victims have been discovered. Since bodies can be disposed of in a multitude of locations, dump sites are relatively unrestricted and might well be the most significant location type for an understanding of the offender's geographic profile (see Newton & Swoope, 1987; Rossmo, 1993).

Cases with minimal spatial information can hinder efforts to spatially analyze a series of crimes. The victims' last known locations may not be close to the sites of victim-offender encounters and thus would not provide much information about the murderer. Nonuniform target backcloths can control the offender's selection of victim encounter sites. Multiple bodies may be dumped in a single location, providing only one geographic point for analysis. Thus the numbers of locations, their types, and the victim backcloth are all relevant variables in the construction of a geographic profile.

It is important to be aware of both internal and external influences on the offender's hunting process. Serial offenders can gain knowledge with each new crime and they often learn from their experiences. Media disclosures and certain investigative strategies, particularly patrol saturation tactics, can create spatial displacement (Gabor, 1978, p. 101; Reppetto, 1976, p. 177), altering the geographic behaviour of the offender to the point that apprehension can be hindered or delayed. Such influences, while often unavoidable, can change or alter spatial target patterns.

Criminal Geographic Targeting

The Brantingham model of crime site selection can be used as a heuristic for constructing a model designed to locate offender residence. As Brantingham and Brantingham seek to describe where crimes are most likely to occur on the basis of the offender's activity space, such an effort is, in effect, an attempt to invert their model, using crime locations as the means for predicting the most probable areas in which the murderer's residence or workplace might be found. So while the two models have different purposes, the underlying concepts and ideas are similar.

Preliminary work in this area has led to the development of a computerized geographic profiling model called criminal geographic targeting (CGT).[7] Criminal geographic targeting, by analyzing the spatial information associated to a series of linked crimes, attempts to determine the most probable areas in which the offender might be located. The process can handle the effects of anisotropic travel and nonuniform target backcloths. The use of CGT in actual police investigations of serial murder and serial arson, and tests of the model on solved cases of serial murder and serial rape, have produced promising results, usually locating the offender's residence in the top 5% or less of the total hunting area. An inversion of the model can even be used to help predict those areas in which the offender is most likely to next attack, though the confidence of such results is not overly strong.

The CGT model is based on a four step process:

1. Map boundaries delineating the offender's hunting area are first calculated from the crime locations. The borders are determined by adding to the northernmost point one-half of the average y inter-point distance, subtracting from the southernmost point one-half of the average y inter-point distance, adding to the westernmost point one-half of the average x inter-point distance, and subtracting from the easternmost point one-half of the average x inter-point distance.[8] (This assumes a Manhattan grid oriented along north-south and east-west axes.)

2. The Manhattan distances from every point on the map to each crime location are then determined. While there are an infinite number of mathematical points in any area, the model uses a limited number of "points" (on the order of 10,000) based on the measurement resolution of the x and y scales.

3. Next, this Manhattan distance is used as an independent variable in a function that produces a value that: (a) if the point lies outside the buffer zone (see below), becomes smaller the longer the distance, following a form of distance decay; or (b) if the point lies inside the buffer zone, becomes larger the longer the distance. A value is computed from this function for each of the crime locations. For example, if there are 12 crime locations, each point on the map will have 12 values associated to it.

4. Finally, these multiple values are added together to produce a single score for each map point. The higher the resultant score, the greater the probability that the point contains the offender's home or workplace. The function is of the form:

$$P_{ij}=k\sum_{c=1}^{T}[\phi/(|x_i-x_c|+|y_j-y_c|)^f+(1-\phi)(B^{g-f})/(2B-|x_i-x_c|-|y_j-y_c|)^g]$$

where:

$$B<|x_i-x_c|+|y_j-y_c|\supset\phi=1$$

$$B\geq|x_i-x_c|+|y_j-y_c|\supset\phi=0$$

and :

P_{ij} is the resultant probability for point ij;
k is an empirically determined constant;
B is the radius of the buffer zone;
T is the total number of crime sites;
f is an empirically determined exponent;
g is an empirically determined exponent;
x_i, y_j are the coordinates of point ij; and
x_c, y_c are the coordinates of the cth crime site location.

When the probabilities are calculated for every point on the map, the end result is a three-dimensional probability surface which can be represented by an isopleth map (see Figures 2, 3, and 4). Alternatively, if viewed from above, the probability surface can be depicted by a two-dimensional choropleth map (see Figure 5, derived from Figure 2) (Harries, 1990, pp. 31-37). In the latter case, the result can be overlaid on a city map of the involved area, and specific streets or blocks prioritized according to the associated scores shown on the CGT choropleth probability map.

Key to this process is the above function which assigns probability values based on the distances between map points and crime locations. While the Brantingham model suggests that the criminal search process can be modeled by a form of Pareto function involving distance decay, they also propose a buffer zone, centred around the residence of the criminal, in which no or few crimes are likely to be committed. Developing and optimizing the specific parameters of this function, the size and nature of the buffer zone, and examining the influence, if any, of other variables on the model (such as spatial-temporal ordering influences, directional effects, size of hunting area, offender mobility, organized versus disorganized behaviour, etc.), are the goals of ongoing research.

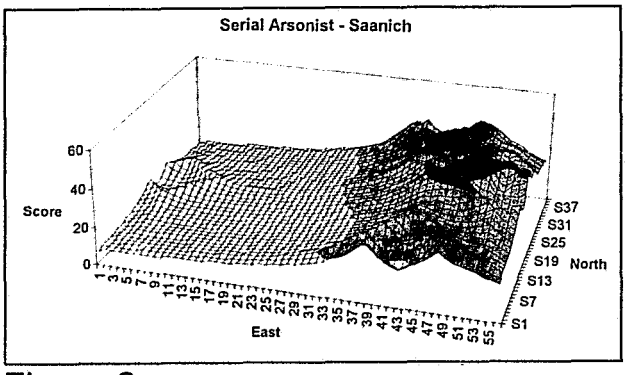

Figure 2

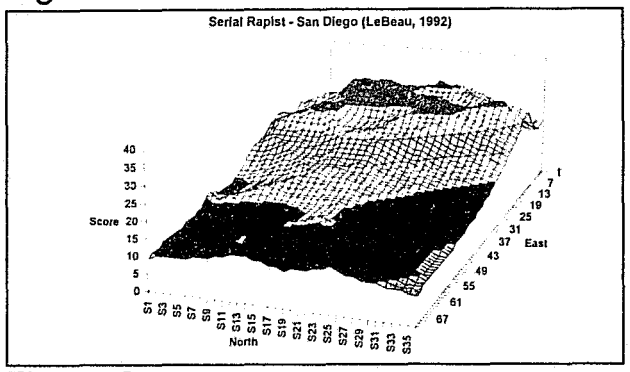

Figure 3

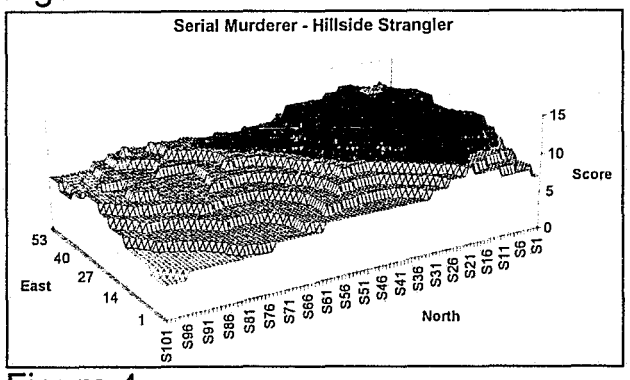

Figure 4

One method for empirically determining the parameters of the model is through the use of the gravity model. Derived in its classical form from Newton's gravitational law, the gravity model provides a mathematical formulation to address problems of scale and distance (Haynes & Fotheringham, 1984). It is widely used to analyze and forecast spatial interaction patterns in such diverse fields as transportation, development, planning, marketing, retailing, urban analysis, history, linguistics, anthropology, and archæology. Its concern with destination, origin, and distance impacts can assist in the optimization of the criminal geographic targeting model for different types of offenders and under a variety of environmental conditions.

Figure 5. Two-Dimensional Choropleth Map.

An investigative methodology should meet three important criteria - validity, reliability, and utility. The CGT model works on the assumption that a relationship, modeled on some form of distance decay function, exists between crime location and offender residence. The process can be thought of as a mathematical method for assigning a series of scores to the various points on a map that represents the killer's hunting area. To be valid, the score the model assigns to the point containing the offender's residence should be relatively high; that is, there should be few points with equal or higher scores.

The "success" of the CGT model in a given case can be measured by determining the ratio of the total number of points with equal or higher scores to the total number of points in the hunting area. In other words, in what percentage of the total area would

the offender's residence be found by a process that started in the locations with the highest scores and then worked down? The smaller that percentage (referred to as the "hit percentage"), the more successful the model.

The validity of the CGT model can therefore be tested by plotting, in a Lorenz curve, the cumulative hit percentages for a series of cases against a uniform distribution (i.e. what would be expected strictly by chance), and then applying some form of index of dissimilarity, such as the Gini coefficient (Goodall, 1987, pp. 195, 280; Taylor, 1977, pp. 179-185). Statistical significance, error estimates, and confidence intervals also need to be established.

The reliability of the CGT model should be high as the calculations are mathematically straightforward and the procedure has been computerized. The determination of exactly which crime locations in a given case are relevant to the analysis (see above), however, is a subjective process dependent upon the knowledge, experience, and interpretation of the profiler. The qualitative dimensions of geographic profiling are also subject to personal biases.

No matter how valid or reliable a particular investigative technique is, it will have little practical value if it cannot be effectively used by police detectives in the real world of murder investigation. The utility of the CGT model is demonstrated by the various geographically-based investigative strategies that such a process makes possible. Some examples of these are described in the following section.

Investigative Strategies

Once a geographic profile has been constructed, a variety of criminal investigative strategies can be employed in a more effective and efficient manner. While the specific approaches are best determined by the police investigators familiar with the case in question, some examples of tactics used or suggested in the past are presented below. The development of further spatially-based applications and innovative investigative techniques is an interactive process which involves the police officers responsible for the case in question.

Suspect Prioritization. If a lengthy list of suspects has been developed, the geographic profile in conjunction with the criminal offender profile can help prioritize individuals for follow-up investigative work. The problem in many serial violent crime investigations is one of too many suspects rather than one of too few. Profiling can help prioritize lists of sometimes hundreds if not thousands of suspects, leads, and tips.

Patrol Saturation. Areas that have been determined to most probably be associated with the offender can be used as a basis for directed or saturation police patrolling efforts. This strategy is particularly effective if the offender appears to be operating during certain time periods. Prioritized areas can also be employed for neighbourhood canvassing efforts, area searches, information sign posting, and community cooperation and media campaigns. Police departments have used this approach to target areas for leaflet distribution, employing prioritized letter carrier (LC) walks for strategic household mail delivery. For example, LeBeau (1992, p. 136) mentions the case of a serial rapist in San Diego who was arrested through canvassing efforts in an area determined from the locations of his crimes.

Police Information Systems. Additional investigative leads may be obtained from the information contained in various computerized police dispatch and record systems (e.g. computer aided dispatch (CAD) systems, records management systems (RMS), the RCMP Police Information Retrieval System (PIRS), and the like). Offender profile details and case specifics can help focus the search at this point. For example, if the police are searching for an anger retaliatory rapist, it might be worthwhile to examine CAD data for domestic disturbance calls from the dates of the rapes to see which ones are located near the areas most probably associated to the offender, as determined from the geographic profile.

Outside Agency Databases. Data banks are often geographically based and information from parole and probation offices, mental health outpatient clinics, social services offices, and other agencies located in the most probable areas can also prove to be of value. For example, LeBeau (1992, p. 133) discusses the case of a serial rapist who emerged as a suspect after the police checked parolee records for sex offenders.

Postal/Zip Code Prioritization. The geographic profile can also prioritize postal or zip codes in a city. If suspect offender description or vehicle information exists, prioritized postal codes (representing the most probable one or two percent of a city's area) can be used to conduct effective off-line computer searches of registered vehicle or driver's licence files contained in provincial or state motor vehicle department

records. These parameters act as a form of linear program to produce a surprisingly small set of records containing fields with all the appropriate data responses. Such a strategy can therefore produce significant results by focusing on limited areas that are of a manageable size for most serious criminal police investigations.

The following is one example of the use of this approach. The postal codes for a city neighbourhood within which a violent sexual offender was attacking children were prioritized by using the criminal geographic targeting model. First the relevant forward sorting areas (FSA) - the first three digits of the postal code - were identified. The criminal geographic targeting probability map was then superimposed over the letter carrier walks (LC) which could then be prioritized by probability.

Planning and zoning maps were used to eliminate industrial, commercial, and other nonresidential areas. Socioeconomic and demographic census data were also consulted to reevaluate the priority of those neighbourhoods that were inconsistent with the socioeconomic level of the offender as suggested by the psychological profile. Finally, the local distribution units (LDU) - the last three digits of the postal code - associated to the letter carrier walks were determined.

The complete postal codes, ranked by priority of probability, were then used to conduct an off-line computer search of the provincial motor vehicle department records which contain postal codes within the addresses connected to the vehicle registered owner and driver's licence files. Suspect vehicle information and an offender description had been developed by the detectives working on the case, and this was combined with the geographic data to effectively focus the off-line search.

For example, a new red station wagon driven by a tall white middle-aged male, with dark hair, may seem to be somewhat vague information. The description actually contains several parameters, however: (1) vehicle style; (2) vehicle colour; (3) vehicle year range; (4) driver height range; (5) driver race; (6) driver hair colour; and (7) driver age range. When combined with a prioritized list of postal or zip codes, representing the most probable one or two percent of a city's area, these parameters can narrow down hundreds of thousands of records to a few dozen vehicles or drivers. This is sufficient discrimination to allow a focused follow-up by police investigators.

Task Force Computer Systems. Task force operations that have been formed to investigate a specific series of major crimes usually collect and collate their information in some form of computerized system. Often these operations suffer from information overload and can benefit by the prioritization of data and by the application of correlation analysis. Geographic profiling can assist in these tasks through the prioritization of street addresses, postal codes (FSA's, LC's, LDU's), and telephone number (NNX's) areas. The details of the specific computer database software used by the task force, including information fields, search time, number of records, and correlational abilities, determine the most appropriate form that the geographic profile should take to maximize its usefulness to the police investigation.

Conclusion

All violent offences have crime scenes. The offender and the victim have to encounter each other at some point in time and space, and these points form spatial and temporal patterns (LeBeau, 1992, pp. 124-126). Whether these patterns have meaning, and whether that meaning is significant for law enforcement, depends on a variety of factors. Offender type, activity space, hunting style, target backcloth, area characteristics, physical and psychological barriers, land use, and neighbourhood demographics are all relevant variables in an analysis of criminal target patterns.

Geographic profiling infers spatial characteristics of the offender from these target patterns. This method has qualitative and quantitative approaches that attempt to understand the pattern from both subjective and objective perspectives. Criminal geographic targeting is a specific statistical method that enhances the efforts of geographic profiling by delineating the most probable areas to which the offender might be associated.

This prioritization, which can be at the postal code, block, or letter carrier walk level, allows for the focusing of police investigative efforts. Suspects can be prioritized and patrol saturation efforts directed. In cases of serial murder and other serial violent crimes, there are usually heavy pressures, both external and internal, to apprehend the offender(s). When traditional law enforcement strategies have not been successful, or when the number of suspects or volume of information is high, geographic profiling

can help prioritize areas and focus investigative strategies. This can lead to a quicker case resolution, thereby reducing police costs and increasing community safety.

Geographic profiling therefore appears to have significant investigative value in certain types of criminal cases. It is also a practical example of the application of criminological theory to a criminal justice problem. Environmental criminology, because of its rich context and diverse roots, has been particular fruitful in this area, and holds the promise of many future practical applications.

Geographic Profiling Requirements

The following is a standard list of geographic profiling information requirements. Any particular case may require additional details. The majority of the information will likely have already been collected during the course of the investigation, and the remainder is readily obtainable from most city or regional planning departments. The absence of some of the requirements should not be seen as a barrier or reason to delay the analysis as alternative sources of information may be available. In such cases, consult with the geographic profiler.

1. Crime Data: Case summaries for all the crimes believed to be part of the series, including any details regarding locations, directions, movements, and other spatial data. Information should include: crime type, modus operandi, weapon type, date, day of week, time, weather.

2. Geographic Data: For all relevant sites (i.e. where victims last seen, first contact sites, crime sites, victim/body/property/vehicle dump sites, evidence recovered sites, etc.).

a. exact location (address and cross streets)

b. location type (residential, commercial, industrial, including relevant buildings)

c. neighbourhood demographics and general area description (census demographic details including age and sex ratios, socio-economic character, overall crime rate, relevant specific area crime problems, and transiency levels)

d. maps (city or region, arterial routes, bus routes, crime scenes, land use, zoning)

e. photos (crime scenes, general area, aerial).

3. Victimology: For all victims: sex, race, age, risk level assessment, residence, business, social, transportation methods and routes.

4. Criminal/Psychological Profile: The criminal profile plays a very important role in determining the probable life and mind set of the offender and consequently is of great value when constructing a geographic profile, particularly in those cases where there is a minimum amount of spatial information (i.e. only a few relevant crime locations).

5. Suspect Data: If available: sex, age, race, criminal record, previous police contacts, psychological/psychiatric history, location of present/past residences, present/past schools, and present/past occupations, social activities, transportation methods and routes, addresses of family members and friends.

Endnotes

1. Boyd (1988) found that 80% of convicted murderers in Canada had killed either family members or acquaintances. It should be realized, however, that the arrest of the offender, a prerequisite for conviction, is more likely to occur in those cases where a close relationship exists between the killer and the victim.

2. See Egger (1990, pp. 156-158) for a discussion of this problem in the Henry Lee Lucas investigation.

3. Research has also been conducted into the geography of other types of serial violent criminals, including serial rapists (Canter & Larkin, 1993; LeBeau, 1987a, 1987b, 1992), and serial arsonists (Icove & Crisman, 1975).

4. "Environmental criminologists set out to use the geographic imagination in concert with the sociological imagination to describe, understand, and control criminal events" (Brantingham & Brantingham, 1981, p. 21). The concern with the geographic environment, and a change in focus from the offender to the criminal event, distinguish environmental criminology from the earlier ecological work of the Chicago School (Brantingham & Brantingham, p. 18). This also represented a shift to a uniquely criminological perspective.

5. In certain cases, where the crimes are so unusual or the modus operandi so distinct, a formal linkage analysis is not necessary. The Dallas "Eyeball Murderer", operating during the period from late 1990 to 1991, surgically removed his prostitute victims' eyeballs before he dumped them on residential streets (Hollandsworth, 1993). Authorities immediately made the obvious connection between the bizarre killings.

6. In a study of 45 serial rapists, responsible for a total of 251 offences committed during the 1980s in Greater London and South East England, Canter and Larkin (1993) found little support for the commuter hypothesis. Only 13% of the rapists had their home base situated outside of what was termed the circle hypothesis prediction area (the diameter of which was defined by a line connecting the two crimes furthest away from each other) - comparable to the concept of offender hunting area as defined below. There appear to be strong similarities between the hunting patterns of serial murders and those of serial rapists.

7. Due to the large number of calculations involved (up to 100,000), the model has been computerized by writing the process in the *QuickBasic* language. By creating a software program that automates the mathematical procedures, the required computations can be done in just a few minutes.

8. For example, the northernmost point (y_{high}) is calculated as follows: $y_{high} = y_{max} + (y_{max} - y_{min})/2(T - 1)$. See Boots and Getis (1988, pp. 39-45) for a discussion of alternative techniques for dealing with edge effects.

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by Derek B. Cornish

Crimes as scripts

Introduction

Those involved in exploring situational aspects of offending and designing environmental approaches to crime prevention face a fundamental problem. While there is general agreement about the importance of adopting a crime specific approach, it is not always clear how to go about it. Where situational measures are concerned, it means operating at a level of analysis which provides enough concrete information about how particular crimes are committed to enable the process to be disrupted in as many different ways as can be devised. Using the concept of the "script", borrowed from cognitive psychology, this paper offers some suggestions for getting more closely to grips with the procedures involved in committing particular offenses.

Background: Conceptualizing a Complex Crime

Recently, the present author was involved as a consultant in research being conducted by a member of the Metropolitan Police [1] to look at a rather complex crime. This was a species of professional car theft, known as "ringing" - a term borrowed from racing, where it involves the entering of a horse into a race under various conditions of misrepresentation, whether of identity, ability or record. As applied to vehicles, the offense involves the theft and disguise of automobiles for eventual re-sale, often across national borders. It was already clear from informal inquiry that professional car crime covers a rich variety of subtypes, and that "ringing" itself can employ a range of techniques at each stage in the crime-commission process. One of the aims of the study was to investigate police perceptions of the crime and its organization in more detail. To this purpose, survey findings were gathered from police officers of stolen car squads throughout the country. But while preliminary analysis showed some evidence of variation in the perceptions of this crime by the different squads, this was not nearly as great as had been expected. Instead, what the survey seemed to be polling was the prototypical, the ideal, or "average" ringing offense.

For anybody interested in the variety of methods used in such offenses, this was a disappointing finding. On reflection, however, a certain uniformity of response was to have been expected. The survey had been designed by an experienced officer from the UK's leading investigatory team, the Metropolitan Police's Stolen Car Squad, the operations of which

are quite specialized. Because of this, the response categories of the questionnaire, while covering many patterns of offense- commission, may have subtly cued respondents to restrict their answers to the sorts of "ringing" offenses in which they thought the Metropolitan Police had most interest. Polling perceptions, rather than analyzing data on cases handled, is also likely to encourage the over-representation of particul· · types of cases, especially where these provide vivid, interesting, or glamorous examples (Nisbett and Ross, 1980), or call for a high degree of investigative skills.

Indeed, to those interested in the procedural aspects of offending, the survey instrument itself - quite apart from its findings - became the focus of interest, since it provided an expert's view of the sequencing of a particular form of professional car crime. Of course, it was to be expected that certain stages in the crime-commission process would inevitably be somewhat better articulated in the survey than others. Professional experience and preoccupations dictated that more attention would be paid to stages which offered information relevant to the police tasks of detection and collection of evidence. For example, the officer responsible for the design of the instrument was particularly concerned in his own work with the issues of disguise and identification. Nevertheless, at a general level it offered a well-articulated view of the elements involved. Thus, the crime-commission sequence could be readily broken down into at least five separate elements: THEFT; CONCEALMENT; DISGUISE; MARKETING; AND DISPOSAL. And questions about the activities of offenders within these elements or stages in the process suggested a view of the offense as akin to that of a theme with variations.

Modeling Complex Crimes

At this point it seemed useful to try to develop a model which would express what seemed to be known about this form of professional car crime. "Ringing" has some pretensions to being considered a complex crime: It is a member of a large family of auto crimes; it comprises a group of closely-coupled crimes which constitute serially-dependent components within the overall offense. And "ringing" itself is one of a family of related crimes, distinguishable by the use of different techniques, casts, locations, targets, methods of concealment, disguise and disposal, and characterized by different levels of organizational complexity.

A first attempt at such a model (Figure 1) depicted the separate elements of this complex crime as cubes strung out along an axle, rather as kebabs are skewered on to a stick. Each of the cubes represents a successive stage in the crime-commission process, while different facets of each cube offer alternative methods of committing each of the "sub-crimes" involved in the complete offense.

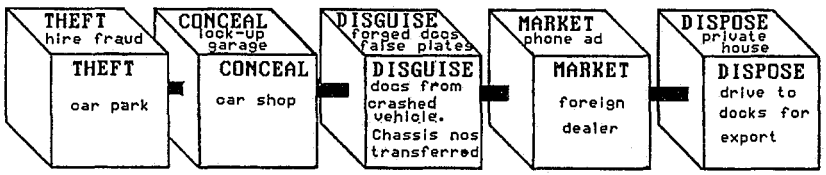

FIGURE 1: ELEMENTS OF THE OFFENSE OF "RINGING"

In a crude way, this graphical representation tried to illustrate the dynamic interrelationships between and within such elements. The axle serves to express the serial dependencies among the elements, by holding them together in a temporal sequence. It also provides a dynamic function, by allowing the individual cubes to be rotated and re-aligned with each other so that their facets can offer alternative routes to the same outcome - that is, variants within the family of "ringing" offenses. Since, however, only a few of the possible alignments are likely to be practicable or effective, the different permutations are best viewed as "prospects" with variable payoffs - a model akin to that of the slot machine with its winning and losing combinations of symbols.

Such a model stimulates thinking about the procedural aspects of (particular) complex crimes, about ways in which they may vary while still constituting the "same" offense, and about issues of substitutability and innovation of methods within and across elements. The cubes and their facets also suggest ways of graphically representing a wealth of contingent relationships to other crimes via shared interfaces. Thus, intermediate elements, such as the CONCEALMENT stage, may share facilities with other criminal enterprises, while terminal ones may feature the total crime as but one element in a larger

or different enterprise -- as where a vehicle is "ringed" and supplied for the purposes of another crime.

Although arguably useful as a heuristic device for depicting complex crimes, it is difficult to take such a model further without knowing considerably more about either the crime as a whole, or about its constituents and their range of permissible permutations. There simply was not enough detailed, crime- specific information available. If such a model is to be useful, we need to be sure:

- That all the sequential elements in the crime have been identified;

- That, similarly, all the facets of the individual elements have also been identified (are they cubes, hexagons, octagons?);

- That the correct facet of each element is aligned with each preceding or succeeding one (based upon which combinations are permissible, and what their relative payoffs are in relation to the crime as a whole).

Much more information about all these aspects was required if such a model was to be used for locating the maximum number of intervention points at which the crime could be disrupted, and even more so if it were to be used in any way as a guide to thinking about disrupting linked crimes. What such models require is a better and more detailed way of looking at the crime- commission process itself. Even so, it may be somewhat premature to try to model complex crimes until we have a clearer picture of the processes involved in simpler ones.

The Script Concept

Any discipline dealing with complex behaviors in settings needs metaphors to guide its work. Metaphors draw parallels, provide fresh perspectives and impose simplifying heuristics. Some offer overall frameworks, such as ways of conceptualizing human action in terms of behavioristic or rational choice perspectives (Cornish, 1993). Others provide more limited help in the form of sensitizing concepts, such as the notions of crime as work, or the criminal career, which draw analogies between phenomena or suggest new ways of conceptualizing them. One such sensitizing concept - which has the advantage of being compatible with the rational choice framework for talking about offenses and offenders - is that of the "script".

Scripts constitute one of a family of hypothesized knowledge structures, or schemata, long considered by cognitive psychologists and cognitive social psychologists to organize our knowledge of people and events in ways which guide our understanding of other's behavior, and our own actions (cf. Hewstone, 1989) [2]. The script is generally viewed as being a special type of schema, known as an "event" schema, since it organizes our knowledge about how to understand and enact commonplace behavioral processes or routines (see Fayol and Monteil, 1988, for a review). As Schank and Abelson (1977: 37) put it:

We use specific knowledge to interpret and participate in events we have been through many times. Specified detailed knowledge about a situation allows us to do less processing and wondering about frequently experienced events.

They suggest that this knowledge has a specific nature and form - that of a causal chain or a standard event sequence, rather akin to a theatrical script. A favorite example of one such sequence is the "restaurant script", which organizes our knowledge about what to do in a restaurant: Enter; wait to be seated; get the menu; order; eat; get the check; pay; and exit. The script concept is part of a larger theory about the organization of semantic memory, and the concept itself was developed by Schank and Abelson (Abelson, 1976; Schank and Abelson, 1977; Abelson, 1981; Schank, 1982) in the context of a cognitive science project aimed at the computer simulation of the human cognitive structures and processes involved in understanding text. Scripts exemplify just one level of a complex theory about mental representations which also addresses other important knowledge structures - such as plans, goals and themes - involved in intentional action.

Considered outside its specialized cognitive science context, the script concept offers a useful analytic tool for looking at behavioral routines. First, the view of human action put forward by Schank and Abelson (1977) is similar to other rational, purposive, goal-oriented action theories current in the social sciences. Second, the script concept pays particular attention to the way that events and episodes unfold - to the sequential aspects of complex, but routine behaviors. Third, as Hewstone (1989:103) comments, event-structures such as scripts deal with "...concrete explanations about specific actions in specific domains." This emphasis on specificity, and on the analysis of actions and events, fits in

particularly well with the crime- specific orientation to be found in rational choice and allied approaches to crime-control.

The notion of the script, and its associated terminology, provides a useful way of representing "...the causally connected actions, props, and participants that are involved in common activities." (Galambos et al., 1986:19). Scripts can be divided up into scenes - units of action, or plans required to achieve major sub-goals (Galambos, 1986) - with particular spatiotemporal locations. Indeed, the term "scene", in everyday parlance, suggests episode, location, background, and plan of action all at the same time, just as the notion of "behavior setting" used by the ecological psychologist, Barker (cf. Wicker, 1979), conveys a similar sense of locations which afford particular activities. In the restaurant script, the scenes might be: ENTERING, ORDERING, EATING, EXITING, or more detailed breakdowns of these into what Galambos call "plan actions" (1986: 31). A script has associated with it a number of roles although, as we shall see later, these roles are not always consensual ones (consider, for example, the role of victim). Furthermore, scripts require props, such as situational furniture and facilitators, and take place in a variety of settings specified by the script.

Lastly, since the script concept can operate at different levels of abstraction (Abelson, 1981), it also provides a rough-and- ready way of calibrating degrees of specificity. For example, as used by Schank and Abelson, the original restaurant script is quite general: It provides a knowledge structure appropriate for handling procedures in restaurants. But within the general script are related "tracks" - the fast food track; the cafeteria track, the plusher up-market tracks - which organize knowledge about the various kinds of restaurants, and enable the individual to deal with differences in procedures in specific circumstances. In this way, families of conceptually-related scripts can be linked hierarchically, from the most specific instances to more inclusive and more abstract categories of script. [3]

Table 1 summarizes some of the terminology associated with script analysis, and indicates the various levels of generality at which the script concept can operate.

Table 1
Terminology

GENERIC TERM: Script

LEVELS: Universal Script; Metascript; Protoscript; Script; Track

COMPONENTS: Scenes; Paths; Actions; Roles; Props; Locations

Scripts in Consumer Research, Marketing and Management

Not surprisingly, it is the script concept's potential as a way of analyzing performances - and, in particular, the routine performance of skilled tasks - which has attracted the attention of applied researchers. Script-theoretic analyses have taken off most quickly in areas such as marketing, management, and consumer research. As Leigh and Rethans (1984:22) comment: "Script theory would suggest that professional buyers and sales persons possess buying and selling scripts which guide their respective thinking and behavior in sales interactions." Since academics often regard these as prototypical offender-victim relationships, it is ironic that the potential for crossover of concepts and methodologies between consumer research and criminology has been largely overlooked.

Marketing research is particularly interested in developing techniques to investigate the theories-in-use of such professional groups as sales staff (Leigh and McGraw, 1989), and buyers (Leigh and Rethans, 1984). Research has looked at overall processes of selling; at parts of the process, such as the initial sales call; at the negotiation phase of the buying process; and at differences between the initial buy situation and the "re-buy" one. These processes have their analogues in offending, although marketing research has, of course, a different focus from crime-control. In the former the emphasis is on evaluating existing scripts (e.g. of novices and experts: Leong et al., 1989), on elucidating best practice, and on designing training packages to improve performance. In the case of criminology, the scripts that are to be improved are those of the criminologist, *not* the offender.

The Procedural Analysis of Crimes

Given its potential, it is odd that the script concept has not been utilized more widely in criminology. It is hard to avoid the conclusion that its neglect reflects the relative lack of interest, outside the fields of environmental criminology and situational crime prevention, in how offenders go about committing crimes. Where the script concept is used, this has tended to be in the context of traditional social psychological or clinical concerns, such as examining alleged deficiencies in the cognitive processes of particular groups of people (such as policemen: Mortimer, 1993) or as an aid in the diagnosis and treatment of disturbed sex offenders (van Beek and Mulder, 1992). Only in the area of police officers' expertise (Dwyer et al., 1990) has the concept been used for purposes similar to those in marketing and consumer research.

In general terms, the script concept offers potential contributions in two major areas: As a way of organizing our knowledge about procedural aspects and procedural requirements of crime-commission; and as part of a broader dramaturgical metaphor. This paper concentrates upon the first of these, and proposes that the script concept offers a helpful way of approaching the problem of developing better accounts of crime- commission. By "better", is meant fuller, appropriately crime- specific, and useful for crime prevention purposes.

The need for detailed crime-commission information is, of course, widely recognized, and is becoming available for a range of crimes such as robbery (Lejeune, 1977; Walsh, 1986), and burglary (Walsh, 1980; Bennett and Wright, 1984; Rengert and Wasilchick, 1985, 1989; Cromwell et al., 1991a; Wright, personal communication). But for many crimes much of the work has so far concentrated upon aspects of the crime-event thought to be particularly salient - on target-selection aspects, for example, or offender-victim interactions (see, for example, Block, 1977; Luckenbill, 1980), rather than looked at the whole process of carrying out the crime. Designers of situational crime prevention measures have therefore had to work primarily with fragmentary, general information provided by offenders' accounts of what they do when committing particular crimes; and, like the police, they have tended to focus upon those points in the crime-commission process which appeared to offer the greatest potential for fruitful intervention. The application of script theoretic analysis to crimes offers an opportunity to systematize the collection of data about crime-commission, to make the exercise more crime-specific, and to extend consideration to all the elements of the crime-commission sequence.

Figure 2 represents a preliminary attempt to cast information about a particular type of crime - in this case, a form of auto theft (Light, Nee and Ingham, 1993) - into a rudimentary script format, using existing data. This basic framework of scenes and sequences of activities, together with information about roles, props and locations, enables the particular form of car theft under scrutiny - the "track" concerned with temporary use for transport purposes - to be quite closely specified. As can be seen, this track can be viewed as one of a family of related "temporary user" (or "joyriding") crimes with similar but distinguishable motives and methods. This script family can, in turn, be subsumed under the broader category of auto theft (the protoscript).

It is immediately apparent, however, that not nearly enough is yet known about the full range of individual scenes making up the script in Figure 2. For example, Light et al.'s research - and this is no criticism of their work - has very little detail on preparation, on search, on obstacles and errors, on

Figure 2
A Simple Offense Script

PROTOSCRIPT: Auto Theft
SCRIPT: Temporary Use
TRACK: "Transport"

SCENE 1	Get screwdriver (p.49) Get scaffold tube (p.50) Select (2) co-offenders (p.29)
SCENE 2	Go to public car-park (pp.46-7)
SCENE 3	Reject alarmed cars (p.50) Choose older Cortina (pp.47-8)
SCENE 4	Force lock with screwdriver (p.49) Enter vehicle
SCENE 5	Break off trim (p.50) "Scaff" ignition barel (p.50) Remove ignition and steering lock (p.50) Activate starter switch (p.50)
SCENE 6	Drive away and use vehicle (p.30)
SCENE 7	Abandon next day (p.30)

Data from Light, Nee and Ingham, 1993

the use to which the vehicle is put, and on its disposal. As we saw earlier, some "scenes" - and especially those immediately surrounding the act of theft or violence itself - tend to attract a disproportionate amount of attention from researchers. Again, the information required for the figure often had to be inferred from aggregated data. This can be a problem where data are reported for a group of respondents whose activities may span a range of "tracks"; in such cases, even though there is a wealth of information on location, time, techniques, co-offending, and stages of crime-commission, it is not always possible to allocate this procedural data unambiguously to particular tracks. Without this degree of crime-specificity, it is difficult to perform a rational reconstruction of offenders' strategies in relation to particular criminal objectives - and hence to use the information to best effect for crime prevention purposes.

Most people could supply simple scripts for commonplace crimes, based upon some sort of generic action plan specifying the stages: e.g., preparation; search for target; main action; and exit (cf. for example, Gottfredson and Hirschi, 1990: 15-44). For such crimes, then, it may seem almost pedantic to seek a more detailed knowledge of their commission. But even for these offenses, there is some value in systematically outlining the sequence of events, since it draws attention to the full range of possible intervention points. Moreover, much less is known than we think about many apparently simple crimes, or the frequency with which they undergo modification and innovation. It is clear from the above discussion that useful scripts require considerably more comprehensive and detailed data at the most crime-specific "track" level than is usually currently available. Similarly, although the ability to draw attention to successively more crime-specific levels of analysis - for example, from theft of property (metascript level), through burglary (protoscript), residential burglary ("script"), to individual tracks such as burglary of apartment blocks - might seem a rather unremarkable feature of script theory, these are distinctions which make a difference. Research which is guided by generic rather than specific offense scripts, may fail to elicit or make best use of offenders' perceptions (Ekblom, 1991).

Figure 3
A Complex Crime

PROTOSCRIPT: Auto Theft
SCRIPT: Professional Auto Theft
TRACK: "Ringing"

Professional Auto Theft Script "Ringing" Track				
ACT 1	ACT 2	ACT 3	ACT 4	ACT 5
Steal	Conceal	Disguise	Market	Dispose
SCRIPT				
• steal from street	• acquire disused premises	• obtain false documents	• put advertisement in paper	• sell to greedy punter
SCENES				
• select target • break in • deliver to premises	• locate premises • do deal • deliver any equipment	• obtain crashed auto • transfer documents, get false plates	• arrange safe phone number • place advertisement • wait for calls	• take to buyer • offer big discount for cash • exit
CAST				
Andy	Chas Bill	Chas Bill	Chas Di	Eddie Chas

Crimes, even those committed by lone offenders, are more complicated than they appear: Preparatory work may have to be done; the products of offenses - consumer goods, credit cards, etc. - marketed; and items now surplus to requirements, such as vehicles, weapons or bodies (cf. Rossmo, this volume), disposed of. As we saw in the case of "ringing", crimes become particularly complex when the script (or, more accurately, "track") as a whole requires numerous sequential activities for its successful completion, some of them contracted out to other offenders. Since the elements in such crimes often involve quite complex sequences of behavior (which may be crimes on their own account), it can be helpful to view the whole enterprise as a complex script, the sequential stages (or ACTS) of which are comprised of component SCRIPTS with their own sets of SCENES and CASTS - people who may, or may not, take part in other aspects of the crime in question (Figure 3).

Such a model (a two-dimensional version of Figure 1) allows for a considerable amount of variation in the way the total enterprise is organized. As mentioned earlier, however, permutations within and between scenes will be constrained by the demands of the overall "track" (i.e. the crime as a whole), since resources and objectives will limit the range of permissible means-ends combinations. Because complex crimes usually involve co- offenders, however, the latter are often given responsibility for individual ACTS and SCENES. The cast's choice of appropriate methods, and their adequate implementation, then become a crucial issue to the success of the enterprise as a whole.

Variation Within Scripts: Actions, Paths and Tracks

Scripts are not necessarily rigid, stereotyped sequences of actions, although for pedagogical purposes it may be useful to talk about them as if they were. "A script is more than just a linear list of inexorable events. In learning a script, one presumably learns variations in addition to constancies." (Abelson, 1981: 723; and see also Galambos, 1986). Fully developed scripts may be entered upon in a variety of ways, they may contain optional elements, their component scenes may be taken out of order, and action rules may be developed to cover decisions to abort as well as to attempt. Some variations may have a relatively short shelf-life, owing to changes in casts, opportunities, and the responses of crime-control agencies. In sum, offense scripts may be structured in ways which allow for - and, indeed, enable - thinking and decision-making on the run, and in response to a range of unwanted but foreseeable contingencies, such as barriers and hitches. Indeed, repeated exposure to obstacles and errors is a major way in which scripts grow and change.

As scripts evolve, alternative scenes and actions within scenes may develop as new ways of breaking into a car are discovered, or new ways of depriving owners of their vehicles are found. These all seem to be examples of equifinality with respect to overall goals - of different routes to the same outcome. Three important sources of variation (Abelson, 1981) are, in order of generality:

(1) Equifinal Actions: These are best regarded as new instrumental techniques within scenes which maintain the same subgoals. An example would be different modes of travel to the scene of a crime.

(2) Script Paths: These refer to the development of short-cuts or options within scenes, sometimes involving more substantial changes such as the omission of steps. Paths, or optional or alternative routes, through scenes involve sequences of equifinal actions which probably develop mainly in response to obstacles and errors.

(3) Script Tracks: As Abelson (1981) points out, these variants may involve characteristic paths, scene selections, props, casts, and locations, which may not be shared by other related tracks within scripts of the same family.

Levels of Analysis

Scripts are cognitive structures that are behaviorally oriented, and their focus on procedures and actions encourages description at the level of individual episodes. Nevertheless, in principle the script concept can be used at many different levels of generality, and for different purposes, rather as film-makers utilize the concepts of synopsis, treatment and shooting script to handle different levels of detail in the planning, sequencing, and shot-by-shot final script of a movie. But whatever the utility of the other levels of generality - script; protoscript; and metascript - of the script concept in relation to the purposes for which it was originally developed, it seems to this author that it is at its most concrete and crime-specific level - that of the "track" - that the script concept is most helpful at this stage in our knowledge of the crime-commission process. For

analytical purposes I have made assumptions about family resemblances amongst "tracks" and assigned them to particular "scripts" (or "scripts" to "protoscripts") on that basis. But although tracks may be considered to be equifinal means in the service of a common objective (for example, doing a residential burglary; doing a commercial robbery; doing a "temporary user" auto theft), it is a moot point whether the encouragement this conceptual exercise in categorization gives to premature abstraction is helpful. Aggregation and generalization should always be approached with caution. As Abelson (1981) asks, are meals at MacDonald's sufficiently similar to those at, say, the Ritz, to be considered "tracks" of the same restaurant "script"?

Instead, it might be wiser to view differences in target locations (rich city-center enclave vs. suburban dwellings) or payoffs (cash vs. electrical goods) of crimes such as burglary as *prima facie* evidence that a more crime-specific analysis into distinguishable tracks may be required. For situational crime prevention purposes the least ambiguous (because most concrete) level at which to operate is the track level. This is to favor the heuristic value of making distinctions before making generalizations. The temptation to force distinguishable crime- events into procrustean categories such as script families, especially where these are casually modeled on existing legal categories developed for quite other purposes, should probably be resisted. At this time, the levels of specificity provided by script theory should act more as signposts to guide investigators down to the murky crime-specific sources of data, and away from the content-free upper reaches of speculation.

Interference with the Execution of Scripts

As Schank and Abelson (1977: 55) point out:

Every act in the...script is potentially subject to obstacles and errors, each of which suggests its own appropriate prescriptions or loops. A few of these will occur with sufficient frequency that a person repeatedly exposed to the script situation will learn them along with the rest of the script. This is the major way in which scripts grow. In time, he may learn a sizeable number of alternative script paths which were once detours, even to the point of having prescriptive sub-branches to follow if there are anticipated interferences to prescriptions themselves.

Offense scripts are particularly likely to be rich in detours. Those carrying out crimes often meet obstacles which have to be worked around using corrective actions; or they may make errors, which may involve loops of actions, repetitions of sequences to enable the script to continue. Such obstacles and errors may also arouse emotional responses which may cause the goal of the crime to be aborted, or which lead to distracting expressive responses (such as the use of excessive violence with uncooperative victims). Perhaps the most important source of errors tend to be generated by a range of offender variables: Lack of experience, which implies rigid or poorly-developed scripts (see later); lack of requirements, such as the necessary skills and props; and altered states of arousal and disequilibrium (Cromwell et al., 1991a). The presence of co-offenders (Cromwell et al., 1991b) also offers further scope for problems. There is a need to explore these sources of interference, not only in order to obtain a fuller picture of the complexity of offending scripts, but also to identify where scripts are most vulnerable to failure.

Routine and Contingency in Scripts

A crucial feature of offense scripts - and one that has further implications for their complexity - is their uncertainty. The offender, for example, may well have a script ready for others to play, but their capacity or willingness to carry out that role cannot be taken for granted. This is to say that the script from which the offender works is a personal one, rather than a shared or consensual script in which all the players have interlocking roles to follow, and a common understanding about what is supposed to happen. As Schank and Abelson comment (1977:62):

Personal scripts do not behave in the stylized fashion of...[shared] scripts. All the participants in personal scripts are not necessarily aware of their participation.

Co-operation of those who do not share the offender's script is achieved by force or deception (for example, the roles of Di and Eddie in Figure 3). The offender may have a clear idea of the role he wishes the victim to play (the quiescent victim role; the actively cooperative role); and he needs to prompt his reluctant cast of victims and onlookers as quickly as possible with simple stage directions (don't move; open the till; lie down) if the crime is to unfold satisfactorily. This feature of most crime scripts limits the amount of routinization that can occur; or, to put another way, the routines which develop will

be complicated and contingent ones. This scope and potential for handling eventualities gives the offense script characteristics which, while making it more difficult to elicit fully, may also help us to understand better the scope for improvisation, displacement or innovation which its rather open-ended structure allows.

This leaves us with a concept of the offense script as being at one and the same time particularly well-suited to handle both routinized crimes - where it provides a procedural dimension to similar concepts such as templates (Brantingham and Brantingham, 1993) - and those which involve strategies of surprise and coercion. Here, the concept of "pattern planning" (Feeney, 1986) draws attention to the fact that scripts can look sketchy precisely because they are so contingent; there are just too many uncertainties for a rigid template to be constructed, and such contingent scripts are harder for respondents to describe.

It is important, however, to distinguish the sense of foreseen contingencies expressed by the concept of pattern planning from plans themselves. When scripts for a crime are not available or cannot be not well enough articulated, plans will have to be developed as, for example, when new forms of crime are evolving, since new crimes have to be planned for the first time before they can be scripted. But, as Schank and Abelson (1977: 78) point out: "Planning is not usually a purely creative process. There is a natural mixture of scripts and plans in day to day functioning." Plans, then, are essentially scripts in embryo, and novel criminal enterprises may involve both plans and scripts. Although the development of scripts from plans is interesting (and may cast a useful sidelight on the processes of innovation: Cf. Tremblay, 1986), as crime-controllers, however, we are primarily interested in looking at behaviors that have become routinized, since it is easier to secure the procedural knowledge on the basis of which they can be disrupted.

How Scripts Develop

For the offender, scripts are the product of learning - either symbolically and vicariously, or through lived experience (cf. Gioia and Manz, 1985). Characteristically, his or her scripts will vary in number, completeness, and defectiveness, according to the skills and knowledge of the individual offender about the requirements of the offenses in question. That is, the offender will have a repertoire of more or less well-developed and satisfactory scripts, culled from his or her own experience and the experiences of others. Scripts in this sense are close to the idea of behavioral repertoires, but more flexible and more cognitive. They share the essential feature, however, of being more-or-less available through the life span: Once learned they become guides to action, and communicable knowledge structures.

Abelson (1975) and Gioia and Manz (1985) suggest that the process of developing scripts may begin with the initial experience of a particular behavioral sequence which is then memorized as a very concrete and specific instance of the crime in question: An episodic script. After further experience of similar episodes in similar situations, some generalization occurs and the offender develops a categorical script - "...a script appropriate for a relatively narrow class of situations" (Gioia and Manz, 1985: 530). (One might see this as somewhat analogous to a particular script "track".) Further learning may lead to the generalization of experience across contexts, and to the development of more abstract and generalized "hypothetical" scripts - analogous to the levels of scripts, protoscripts, and metascripts (see Table 1) - which permit the transfer and generalization of learning to new tasks and settings.

The view that studying the decision-making processes of offenders is of any practical importance - much less the belief that offenders might possess highly elaborated and complex scripts of the kinds outlined above - has often been criticized by commentators such as Gottfredson and Hirschi (1990) on the grounds that it over-glamorizes and intellectualizes offending. Such assumptions probably underestimate the complexity, in cognitive terms, of the crime-commission process. In addition, the belief that crimes are simple activities committed with little skill may also be encouraged by an over-sampling of the behavior of occasional or new offenders who are still using plans rather than scripts as they learn the business. Again, less able offenders at any level of experience might also be expected to have less well-articulated scripts, applied in a more stereotyped way and relying on fewer options. Yet in such discussions, a misleading equation is often made between the possession of expertise, and the possession of the intellectual tools required to generate it. For scripts, as intellectual property, are part of the everyday commerce in information in criminal networks and do not have to be developed *de novo* by individual offenders. In practical terms, armchair reconstructions which assume the simple nature of the crime-event tend to generate scripts at a level of abstraction (the level of

"script" or "protoscript") which reduces their utility for crime prevention purposes. What is more, by devaluing the empirical procedural analysis of crime-commission in this way, they run the risk of perpetuating the neglect of precisely those features of specific types of crimes which provide the intervention-points for situational prevention.

Eliciting Scripts

Criminologists collect information about crime-commission procedures in order to identify the necessary and sufficient requirements for such criminal events to take place. This makes the detailed study of criminal behavior crucial to crime-control. This information is very rarely gained as the result of direct observation on the part of the researcher, however. Instead, accounts are reconstructed from interviews, surveys, simulated crime-commission studies, process-tracing, victim reports and from physical traces of crime-commission. From these resources a criminological script emerges which, it is hoped, will not only supply a detailed rendition of the crime-event in question, but may well be more comprehensive than the offenders' scripts from which it was derived. Since this knowledge is constructed largely via secondary sources, however, the inferential steps involved may be quite complex (Gioia and Poole, 1984), especially since the raw material itself - the offender's own account - may be the outcome of introspection and inference. It is also possible that the methods by which information is stored by and retrieved from event-schemata such as scripts may further hinder accurate recall (Graesser et al., 1979; 1980).

The potential for scripts to be generated at various degrees of complexity and levels of generality poses interesting methodological and practical problems for those who want to investigate offenders' scripts for situational crime prevention purposes. When reconstructing the crime-commission sequence, do we use techniques which elicit scripts, or techniques which may generate or construct them? Methodologically, this may resolve itself partly into questions of whether to use "free elicitation" techniques with minimal prompts (to obtain the offender's own script, and to maximize individual variation); the same, but with extensive prompts (to generate fuller responses); or to employ a standard, closed question, multiple-choice format, which generates answers within the framework of the researchers' understanding of how the crime is scripted. Each of these techniques can, when suitably designed and analyzed, provide information about individuals, sub-groups (e.g. beginners or experts), and provide typical (or "normative") scripts for the groups as a whole. The question is which technique, in the light of our present knowledge about crime-commission, is likely to do the best job.

Results will be determined by a number of factors: The quality of the offender's script; the level of specificity at which the request for a script is pitched; and the quality, systematic nature, and detail of the questions, and any associated stimulus material. All can have an important influence upon the richness of information, and the degree of specificity attained. If the elicited scripts are not merely to record the combined abstractions of interviewer and respondent, more attention may have to be paid to these methodological issues than is often the case at present. Current techniques sometimes fail to provide enough detail, or to relate what detail there is closely enough to their relevant offense script tracks or offender subgroups. Under such circumstances, where findings from different studies appear to be in conflict, it can be difficult to identify the source of the differences. One possible explanation for such difficulties may be that the crime-commission analysis has taken place at too general a level. When an *a priori* metascript or protoscript has been used as the basis for formulating questions, these may fail to tap available information about the more concrete, crime-specific aspects of crime-commission, or to explore any loops and branches in the script which might relate to environmental contingencies.

At this stage some form of free elicitation may be the method best suited to the development of an understanding of offenders' scripts, although for the purposes of situational crime prevention we may need more actively to probe offenders' scripts in order to develop as full a picture as possible of the cues, techniques, and paths used by offenders. In this context, it is interesting to compare the often rather casual methods used in some criminological studies with the much more detailed and rigorous approach of those involved in consumer research, management and marketing (Leigh and Rethans, 1983: Leigh and Rethans, 1984; Leigh and McGraw, 1989). There, researchers involved in the study of commercial expertise use free-form techniques borrowed from cognitive psychology (Bower et al., 1979) to elicit detailed individual scripts of highly specified behaviors from respondents, followed by quantitative procedures to construct group norms, which are subsequently validated on a new sample of similar

Figure 4
Scenes from the Universal Script

PREPARATION

ENTRY

PRECONDITION

INSTRUMENTAL PRECONDITION(S)

INSTRUMENTAL INITIATION

INSTRUMENTAL ACTUALIZATION

DOING

POSTCONDITION(S)

EXIT

After Leddo and Abelson, 1986

respondents.

Universal Scripts

One useful device for helping to develop fuller scripts may be provided by the notion of the universal script. Recently, (Leddo and Abelson, 1986:118) have suggested, following Schank's (1982) discussion of the role played by script-like knowledge structures in memory, that scripts can be "...abstracted into a set of generalized scenes, which are indeed similar in function regardless of the script they come from." Such "universal scripts" can be regarded as one step above metascripts, for while the latter still have some content at a general level, universal scripts contain the only most highly generalized scenes, arranged into a sequential order.

When used to organize the crime-commission process, the universal script runs as follows (Figure 4). Preparations, often made outside the crime setting, are followed by entry to the setting, and the awaiting for, or establishment of, conditions under which the crime in question can be committed. Various instrumental actions - instrumental precondition(s); instrumental initiation(s); and instrumental actualization(s) - then occur, followed by the consummatory activities which comprise the main action. Further actions associated with the aftermath of the main action follow and, lastly, the players exit from the crime-scene. The procedural framework offered by universal scripts thus supplies a useful way of approaching the task of modeling crime-commission in more detail.

Figure 5
A Robbery Script

PROTOSCRIPT: Robbery
SCRIPT: Robbery from Person
TRACK: "Subway Mugging"

PREPARATION	Meet and agree hunting ground
ENTRY	Enter underground system
PRECONDITION	Travel to hunting ground Wait/circulate at hunting ground
INSTRUMENTAL PRECONDITION	Select victim and circumstance
INSTRUMENTAL INITIATION	Close in/prepare
INSTRUMENTAL ACTUALIZATION	Strike at victim Press home attack
DOING	Take money, jewelry, etc.
POSTCONDITION	Escape from scene
EXIT	Exit from system

After Ekblom, 1991

Ekblom's (1991:39) proposal to depict the offense as "... a series of 'logistical steps', which the offenders must successfully pass through to complete the crime" parallels this idea and, in Figure 5, his own example of a subway mugging has been mapped on to the universal script. Apart from the lack of a "Preparation" phase, the former follows very closely the universal script. Unlike the previous figures, which have simply based themselves upon what is already known about specific scenes relevant to script tracks, this one gives some indication of the usefulness of standardized guidelines for constructing all such track-level scripts, whatever the state of knowledge about the offense in question.

Such a framework may both enable more thorough-going discussions of the commission of particular crimes, and help to guide exploratory studies of new crimes. For particular scripts, of course, the number of intermediate steps that are subsumed under each stage of the general process will vary. In practice, most crimes will contain many further steps, with partial iterations, loops, branches, and arrays of equifinal actions which may come into play under certain contingencies. Some may best be treated as complex crimes, consisting of linked scripts, where particular scenes involve complicated subplots, such as the disposal of goods or people. In Figure 6, details from Cromwell et al. (1991a) provide the

Figure 6
A Burglary Script

PROTOSCRIPT: Burglary
SCRIPT: Domestic Burglary
TRACK: "Suburban Dwelling"

PREPARATION	Select a setting Assume appropriate role for setting
ENTRY	Enter setting
PRECONDITION	Drive around neighborhood
INSTRUMENTAL PRECONDITION	Select target dwelling(s)
EXIT	Leave setting
PREPARATION	Take drugs or alcholog Assume appropriate role for setting
ENTRY	Enter the setting
PRECONDITION	Wait in vicinity of target dwelling
INSTRUMENTAL PRECONDITION	Assess cues relating to surveillability Assess cues relating to occupancy Assess cues relating to accessibility
INSTRUMENTAL INITIATION	Approach dwelling
INSTRUMENTAL ACTUALIZATION	Break into dwelling
DOING	Select and collect up goods
POSTCONDITION	Leave dwelling with goods
EXIT	Leave setting

After Cromwell et al., 1991a

basis for developing a sequential treatment of burglars' decision-making, using a single iteration.

Adapting the universal script to offending is not without its problems. It is, for example, sometimes difficult to distinguish between preconditions and instrumental preconditions, and it is not always clear what constitutes the end of the main action - when, that is, the act in question ("DOING") should be defined as occurring and as having concluded. With crimes like assault, there often seems little difficulty in defining this; as with Schank and Abelson's (1977) original restaurant script, the main action is a consummatory response. But with burglary and other forms of theft, for example, the main action may be more complex: A successful burglary involves not only the act of taking, but also means getting safely away with the spoils. This has implications for both the definitions of the main action and of the subsequent "postconditions". Leddo and Abelson (1986) tend to regard the latter more as a process of tying up loose ends in the script than as a part of the main action. In practice, however, these issues can usually be dealt with in three ways: By spelling out the main action in more detail and, if necessary, dividing it up into stages; by extending the main action through the postconditions (perhaps by explicitly terming some of the latter, "instrumental postconditions" to emphasize their links to the main action and to distinguish them from less crucial ones; or, where necessary, by providing a separate script for activities which follow the main action, and linking the scripts together.

Although the guidelines offered by the universal script may seem rather obvious, its provision of information in a standardized format has a number of advantages. First, it facilitates the organization, discussion, and comparison of decision-making information within and between research projects. Second, it provides a sequential framework within which the sources of crime-commission failures - especially those caused by failures of planning (see Leddo and Abelson, 1986) - can be better investigated (Figure 7). This provides a further stimulus for studies of attempts and aborted crimes.

Third, it can be used as a heuristic device for the armchair exploration of new crimes where techniques and details of crime- commission have yet to be properly established. This may alert investigators to look more carefully at the requirements of particular crimes and at conditions that facilitate or inhibit their commission. Fourth, it provides a detailed, purposive framework within which to elucidate the putative roles and effects of drink and drugs, props and facilitators (such as weapons and vehicles), and the presence of co-offenders, on decision-making at various points in the crime-commission process. Cromwell et al. (1991a and b), for example, have noted the instrumental use of drugs during the period of preparation for burglary; the differential effects of various drugs on ratings of target attractiveness; and the possibility that high arousal by way of social facilitation may either help or hinder crime-commission at different stages of the process.

Figure 7
Some Ways of Failing

PROTOSCRIPT: Auto Theft
SCRIPT: Temporary Use
TRACK: "Performance Driving"

FUNCTION	SCRIPT ACTION	FAILURE EXPLANATION
Preparation	Gather tools	Forgot scaffold tube
Entry	Enter car park	Car park closed
Precondition	Loiter unobtrusively	Noticed by security
Instrumental Precondition	Select vehicle	No Ford Cosworths
Instrumental Initiation	Approach vehicle	Driver returns
Instrumental Actualization	Break into vehicle	Vehicle impregnable
Doing	Take vehicle	Vehicle immobilized
Postcondition	Reverse out of bay	Crash into wall
Exit	Leave car park	Gates closed for night

After Ledo and Abelson, 1986

Lastly, the universal script offers a systematic way of looking at possible intervention-points during the crime-commission process, especially where much is already known about the script in question, and about the likely points of difficulty and failure for offenders. The many situational measures recorded and classified by Clarke (1992), for example, can be precisely located at their respective intervention-points within any crime- commission process (see Figure 8). Such an exercise can be useful both in suggesting new uses for existing measures and in pinpointing where new applications are required, and might be developed.

Crime-Commission Scripts and Beyond

It is hoped that the script concept will provide the framework for a more systematic and crime-specific approach to the procedural analysis of crime-events - and, hence, to the planning of situational methods of crime-prevention. The notion of the script as a way of conceptualizing procedural knowledge fits in well with the sorts of decision-making, rational choice, routine activities, and pattern theory perspectives now current in criminology, where it has the merit of introducing in a practical way the benefits to be gained linking these more closely to the cognitive information-processing models used in cognitive psychology (see, for example, Anderson, 1990; Lord and Maher, 1990).

There are, however, further possible benefits to be explored, although these can only be signaled in the present paper. A fuller appreciation of the procedures and procedural requirements involved in the commission of specific crimes may cast further light on the following topics (Cornish, In preparation):

Figure 8
Intervention Points for Situational Measures

PROTOSCRIPT: Vandalism
SCRIPT: Graffiti Writing
TRACK: Generic

FUNCTION	SCRIPT ACTION	SITUATIONAL CONTROL
Preparation	Buy spray-can Find good setting	Sales regulation City paint-out program
Entry	Enter setting	Access control Entry/exit screening
Precondition	Loiter	Surveillance
Instrumental Precondition	Select target	Remove target
Instrumental Initiation	Approach target	Surveillance
Instrumental Actualization	Reach target	Protective screens Legal target provided
Doing	Spray graffiti	Graffiti-resistant paint
Postcondition	Get away quietly	Moisture-activated alarm
Exit	Leave setting	Entry/exit screening
Doing (later)	"Getting up"	Rapid cleaning

After Ledo and Abelson, 1986; Clarke 1992

- Novice-expert differences in procedural knowledge (Martin, 1991);

- The choice structuring properties of crimes (Cornish and Clarke, 1987);

- Recruitment, casting, and co-offending (Tremblay, 1993);

- The bases for interactions amongst crimes ("procedural networks" and "hot spots"), and among offenders;

- Displacement and innovation;

- The development of larger behavioral sequences, such as lifestyles;

- The relevance of individual offenders' scripts for detection, profiling and rehabilitation.

The exploration of dramaturgical aspects of offending, and the treatment of scripts as discourses offer even more ambitious directions for research. Taken together, the possibilities outlined above suggest that "crimes as scripts" may have some value as a sensitizing concept - albeit with the usual caveats against the uncritical and over-literal use of metaphors and analogies in criminology. Crimes are, of course, not scripts: They are actions and events, in relation to which scripts may provide the means to reconstruct the procedural knowledge involved. As well as further highlighting the importance of crimes as behavioral sequences extended through space and time, the script concept may help to locate them as activities which form an intrinsic if not always central part of the larger routines which constitute the lives and lifestyles of offenders.

Notes

[1] Hinchliffe, Michael (Stolen Car Squad, Metropolitan Police) "Professional car thieves, their knowledge and social structure." A Police Award Scheme Project. Ron Clarke was also a consultant to the project, and I thank him for many helpful exchanges of views in that connection.

[2] The script concept has also been used in role theory (Gagnon, 1974; Harris, 1977) and dramaturgical approaches and, in a very different sense, has an important place in transactional analysis (Cornell, 1988). But it is with its development as a event schema with which this paper is concerned.

[3] This paper is mainly concerned with the script concept at its most specific and concrete level, that of the script "track". However, the generic term, script, will be used throughout the discussion, except where this would cause confusion.

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by Carol J. DeFrances and Richard M. Titus

The environment and residential burglary outcomes

Introduction

Crime, disorder, and fear exert a powerful influence on the fate of urban neighborhoods (Reiss and Tonry, 1986; Skogan, 1991). Crime is not randomly distributed in geographic space; criminals use the features of the environment in ways that increase their payoffs while reducing their risks. One sees this readily in residential burglary, a form of crime that may appear to be benign relative to the high levels of violent crime in the United States. However, studies show that 25% of burglars carry a weapon, that many burglars also engage in other forms of violent crime, and that if there is household member present during the burglary, a violent crime will be committed in almost 40% of those cases (Bureau of Justice Statistics, 1988). Other studies show that the enduring psychological effects of burglary on its victims are just as severe as for personal crimes such as assault and robbery; victims speak of a profound sense of violation, of not feeling secure even in their own homes, (Hough, 1984; Wirtz and Harrell, 1987; Shover, 1991).

Some criminologists have spoken of the "journey-to-crime". In the case of residential burglary, there seems to be a minimum distance from his home that a burglar will travel to a burglary target: being too close to home raises the risk that either he or the stolen property will be recognized. The burglary pattern for a given offender will also be affected by where he works or goes to school, passes his leisure time, fences stolen property, and purchases drugs (Brantingham and Brantingham, 1978; Rengert and Wasilchick, 1985). Another factor is the offender's cognitive imagery; his knowledge of potential burglary opportunities in the urban area as gained for example from prior burglary experience, from other burglars or from fences, from the media, and from information acquired fortuitously during routine activities.(Cromwell et al, 1991; Shover, 1991).

A burglar may come upon an opportunity while travelling on some routine trip and exploit it then and there, though this type of burglary is not typical. More often, there is some planning and the purpose of the trip is to commit a burglary at a particular time in response to a perceived pressing need for money. In selecting a particular dwelling unit to victimize, the offender may utilize knowledge of a particular house, the occupants' routines, and its contents, from having been there before, from an informant, or from the media. The burglars studied by Wright and Decker (1992) stated that they generally had a specific dwelling in mind for some

time before burglarizing it. Such offenders would go directly to that house at an appropriate time. Perhaps more typically, the burglar does not set out with a particular house in mind, but instead goes to a neighborhood that meets his criteria on proximity, type of opportunity, and risk (Taylor and Nee, 1988; Bureau Van Dijk, 1991; Cromwell et al, 1991; Hakim and Buck, 1991; Shover, 1991). He then cruises the streets of that neighborhood looking for a suitable target.

Both the likelihood that a residential burglar will be on a particular street incidental to some other trip purpose, and the likelihood that a burglar will have acquired information about a particular neighborhood and the streets therein, are influenced by such factors as planning and transportation decisions relative to the design and location of road networks, mixtures of residential and non-residential land uses (e.g., schools, parks, bars, stores, entertainment), and subdivision and site design. These decisions do not "create" burglary, but they do influence the burglar's movement patterns, and awareness of opportunity.

Burglars talk about being concerned with such things as being seen or heard while carrying out a break-in, and with whether it is easy to access and depart from targeted dwellings. These factors are influenced by regulations governing development and site design. The burglary prevention literature is oriented toward actions that aim to convince the burglar that a particular target will not be very rewarding and/or is too risky. We advise people not to locate valuable items where they can be easily seen from outside the house or garage, to engrave identification numbers so that property will be more difficult to fence, and to keep precious jewelry in the bank. We tell people how to make a house look like the occupants are at home. We recommend the use of extra-strong locks on doors and windows to impede unauthorized entry. We urge the proper trimming of shrubbery and placement of exterior lighting so that the house is easily seen from the street and from adjacent houses. We encourage the formation of Neighborhood Watch groups and the posting of street signs proclaiming the vigilance of the community.

These burglary prevention strategies can be considered along two dimensions: (1) The point at which the information is available to the offender, dichotomized as from a distance or up close: An automobile in the driveway (implying occupancy) can be seen by an offender cruising by in a car, while extra strong locks on windows will not be seen until he is at the window; and (2) The phase of the burglary process: Burglars first go through a target selection phase in which they sequentially select a neighborhood, a block in that neighborhood, and a house on that block. There follows the entry phase in which illegal entry is carried out. Lastly is the completion phase which consists of selecting what they want to steal and making their departure with it. This paper will concentrate on the entry phase and the environmental factors which influence it.

An environmental variable can influence more than one phase of the burglary process. For example, Neighborhood Watch signs could influence the target selection phase (in this case, choice of neighborhood), the entry phase (by making the offender more jittery about persisting with any door that he cannot quickly and quietly force open), or the completion phase (by making him abbreviate his search for valuables in his desire to shorten his stay in the house).

Studies of the distribution of residential burglary typically compare victimized with nonvictimized dwelling units in a search for features that are disproportionately associated with one status or the other. Since the data sets most often include attempts among the victimizations, they merge what we have called the "target selection" phase with the "entry" phase. Shover(1991) provides a recent review of the burglary literature. He finds greater risk of burglary victimization to be associated with areas that are urban, minority, youthful populations, and renters; and with dwelling units that are unoccupied much of the week, are in or near high-burglary rate neighborhoods, are on corner lots, are multiunit without access control, near parks and open spaces or distant from other units, have obstructions to surveillance, and are on or near through streets and major traffic arteries. Lynch and Cantor (1992) examined burglary victimization using the Victim Risk Supplement (VRS) to the National Crime Victimization Survey (NCVS); this data set contains more environmental measures than the parent NCVS. They find that burglary victimization is higher in socially disorganized communities and lower on blocks where neighbors watch each others' homes. Lynch and Cantor (1992) also find that home occupancy reduces victimization at night but not during the day.

Few burglary studies have specifically examined the effect of environmental variables on whether or not entry is gained. Garofalo and Clark (1992) found that entry through doors of single-family dwellings was less likely if door locks were in use, if someone was home at the time, and if there was special exterior

lighting. Entry through windows was less likely if someone was home at the time. In an examination of data from the 1982 British Crime Survey, Hough and Mo (1986) found that 95% of failed burglary attempts, where the resident was unaware of the incident at the time of occurrence, involved a failure of the burglar to successfully force doors and windows. Titus (1990) conducted a bivariate analysis of completed forcible entry vs. attempted forcible entry against the variables in the VRS. The key variables that emerged from this analysis were those that measure home occupancy and neighborhood safety. Surveillance, property-marking, and target-hardening did not play a significant role in determining burglary outcomes. The current study expands upon Titus (1990) by conducting a multivariate analysis to examine which environmental factors impact on the entry phase of residential burglary.

The Victim Risk Supplement

The National Crime Victimization Survey (NCVS) is a continuing survey of the residents of approximately 50,000 dwelling units. They are interviewed twice yearly for three years concerning their experiences with criminal victimization; household demographics and other information is also gathered. In February of 1984, 14,258 NCVS households also received the Victim Risk Supplement (VRS), which asked additional questions about the respondent's work, leisure activities, and burglary prevention measures, as well as the interviewer's observations of household security measures and neighborhood characteristics for 7,557 of the households. Of the 2,952 crime incidents reported in the VRS there were 436 residential burglaries; of these there were 143 forcible entries, 189 non-forcible entries, and 104 attempted forcible entries.

In our data set, the target selection phase has already occurred: all these dwelling units have been selected as targets by the burglar. We will look only at forcible entry and attempted forcible entry; by excluding non-forcible entries we eliminate cases where security hardware such as door and window locks was present but was not used, and therefore was not really tested. By examining these two types of burglary incident we will be concentrating on what factors appear to be important in determining the outcomes of the entry phase of forcible residential burglaries.

We are aware that the attempted forcible entries in the VRS are somewhat problematic since there could be incidents in which an attempt left no evidence of the use of force that was discovered and reported by the respondent, (Garofalo and Clark, 1992; Hough and Mo, 1986). It is also possible that known burglary attempts were less likely than burglaries involving entry to be remembered and reported by the household respondent to the VRS interviewer, though in Biderman and Lynch (1981) measurement error in the reporting of attempts vs completions appeared to be minimal.

We have NCVS data from February, 1981 through August, 1985 for the housing units that were given the VRS in February, 1984. The person-level and household-level variables could have changed over the time period that a VRS housing unit was in the NCVS, but many environmental characteristics would almost certainly not have changed significantly over the four and one-half years that a unit was in the sample. Making these assumptions allows us to expand our data set from the 436 burglaries mentioned above to a new total of 1,949 burglaries, at least for purposes of examining the VRS "environmental" variables that are characteristics of the housing unit and neighborhood, not of the household. There were 616 forcible, 863 non-forcible, and 470 attempted burglaries. These were filtered to remove incidents that occurred at other than the respondent's current primary dwelling or at structures on that property. This resulted in 469 forcible, 646 non-forcible, and 394 attempted burglaries.

Concepts in the Model

Dependent Variable. Most studies which focus on the risk of burglary do not differentiate the dependent variable. Instead, attempted and completed burglaries are combined into the same category. In contrast, this study concentrates on a different part of the burglary process, event outcome. As a consequence, attempted and completed burglaries must be distinguished. For this study, burglary outcome is the dichotomous dependent variable, coded 1 for attempted burglaries and 2 for completed burglaries. In our sample, 54 percent (n=469) of households had a completed burglary and 46 percent (n=394) had an attempted burglary.

Independent Variables. As noted above, if there was a change of household or of household members

during the three years that a VRS dwelling unit was in the NCVS panel, relevant person-level variables (e.g., has dog, is retired) or household-level variables (e.g., uses light-timers, participates in Operation Identification) could have changed from those recorded by the VRS. However, certain housing unit characteristics (e.g., distance of house from street) would not have changed; other housing characteristics (e.g., visibility from neighbors) most probably did not change; and neighborhood characteristics (e.g., has abandoned buildings, has Neighborhood Watch program) are also unlikely to have changed significantly over that period. In this analysis we include only those VRS variables that are attributes of dwelling unit and neighborhood, and that can be assumed to have been invariant.

Areal Characteristics. Geographic identification is the only variable in the VRS that can be considered an areal characteristic. This item is categorized as follows: 1) residence in the central city within the Standard Metropolitan Statistical Area (SMSA), 2) residence within an SMSA but outside the central city, and 3) residence outside the SMSA. In our sample, 44 percent of the households are located in a central city. Since the literature on crime and victimization shows that central cities are more dangerous than the suburbs and rural areas, it is hypothesized that central city residences are more likely to have completed burglaries. To facilitate the use of log linear analysis, we created a dichotomous variable for central city residence. We treated persons living in central cities of SMSAs as central city residents and all others as non-central city residents. The former were coded as 2 on the central city variable and all others were coded as 1.

Neighborhood Characteristics. Neighborhood nuisances are measured by the additive score of five nominal items in which the interviewers reported the presence of establishments such as a grocery store, convenient store, bar or night club, fast food restaurant, and liquor store. Possible scores range from 0 to 5. The higher the score, the more of these establishments in the neighborhood. The variable was dichotomized at the median to enable use in the log linear analysis. Households with a score of 2 or lower were coded as 1 and households with a score of 3 or higher were coded as 2. Seventy-five percent of the households in our sample had at least one of these establishments in their neighborhood. Since the presence of these establishments increases the flow of persons to a neighborhood and also draws individuals from outside the area, it is hypothesized that the more nuisances in the neighborhood, the more likely a completed burglary.

Neighborhood disorganization is measured by an additive score comprised of four nominal items in which the interviewers reported the presence of neighborhood problems such as trash or litter, broken windows, graffiti, and boarded up buildings. Possible scores range from 0 to 4. The higher the score, the more of these problems present in the neighborhood. In our sample, 61 percent of the households did not have any of these problems present in their neighborhood. It is hypothesized that the more neighborhood disorganization, the more likely a completed burglary. Again, to facilitate use in the log linear analysis, the variable was dichotomized with households having no problems coded as 1 and households with a score of one or more problems coded as 2.

The VRS also contained one item which asked respondents whether or not a neighborhood watch or citizens' protective group existed for their area. For inclusion in the log-linear analysis, the variable was recoded as 1 for respondents with a neighborhood watch program and 2 for respondents without such a program. It is expected that respondents with a neighborhood watch or citizens' protective group in their area are less likely to have a completed burglary. It should be noted that 50 percent (429 cases) of the respondents in our sample did not answer this question. However, of those who did respond, 21 percent indicated that such a group existed in their area, 62 percent did not have such a program, and 17 percent indicated they did not know.

Unit Characteristics. Unit characteristics are divided into two categories: 1) accessibility measures and 2) safety measures. The accessibility of the housing unit is measured in two ways: 1) by the number of units in the structure and 2) by an additive score for unit visibility. The variable for the number of units in the structure was collapsed into two categories with one unit structures coded as 1 and two or more unit structures coded as 2. It would be hypothesized that one unit structures would be more likely to have a completed burglary: one unit structures have more points of entry than multiple dwelling units. Sixty percent of the households in our sample lived in one unit structures.

An additive score for unit visibility was constructed from interviewer reports of three items: 1) distance from the road to the unit, 2) whether the unit was visible from the road, and 3) the speed limit of the nearest road. These three items were combined into an additive score which ranged from 3 to 11, with three being the most accessible and 11 being the

least accessible. The variable was dichotomized at the median to facilitate use in the log linear analysis. Households with a score of 5 or lower were coded as 1 (more accessible) and households with a score 6 or higher were coded as 2 (less accessible). It is hypothesized that units easily accessible are more likely to have a completed burglary. However, on the unit visibility scale, 51 percent of the households in our sample are excluded because of missing data. We have only 424 valid cases for this variable.

Safety precautions also are measured two ways. The additive score for protective measures includes eight nominal items assessed by interviewer observation. Interviewers were asked to indicate whether the sampling unit had the following outside protective measures: 1) fence or barricade, 2) doorkeeper/guard, 3) intercom, 4) surveillance camera, 5) burglar alarm signs, 6) other warning signs, 7) bar on windows, and 8) other outside protective measures. One point was given for each of the protective measures observed at the building that contained the housing unit. Possible scores can range from 0 to 8. However, in our sample, the scores on the scale ranged from 0 to 3. Moreover, only 16 percent of the sample (125 respondents) had one or more outside protective measures. The presence of outside protective measures should make it more difficult to enter a unit and hence, more likely to result in an attempted burglary. For inclusion in the log linear analysis, the variable was recoded 1 for households with no outside protective measures and 2 for households with at least one outside protective measure.

Likewise, the additive score for security measures is comprised of three items reported by interviewer observation which include whether the sampling unit had inside security measures such as 1) locks on doors, 2) peephole in door, and 3) other inside security measures. Possible scores range from 0 to 3. The higher the score, the more inside security measures present in the unit. In our sample, 30 percent of the households had at least one inside security measure. It is hypothesized that households with inside security measures should be more likely to have an attempted burglary. The recoded variable for the log linear analysis was coded 1 for households with no inside security measures and 2 for households with one or more inside security measures.

Routine Activities. We used the item which indicates whether a household member was home or not during the incident as measure of guardianship. The dichotomous variable was coded 1 for respondents who indicated someone was at home during the incident and 2 for if no one was home during the incident. It would be hypothesized that if someone was home, the more likely the incident was an attempted burglary. In our sample 90 percent of the households did not have a member home at the time of the incident.

Method

Among the various approaches that have been developed for the analysis of dichotomous dependent variables, we chose log-linear techniques developed by Goodman (1972) to determine the predictors of burglary outcome. Log-linear analysis with its hierarchical modelling component allows for the identification of significant interactions among variables in the model, which cannot be done with the other approaches such as logistic regression (Agresti, 1990). However, we are aware of the problems of utilizing this technique. For instance, interactions between polytomous variables are difficult to interpret. Consequently, to avoid this problem polytomous variables are usually dichotomized, which potentially eliminates useful information. Despite the limitations of log-linear analysis, it was thought that the identification of significant interactions among variables was an important consideration in determining the predictors of burglary outcome, particularly in an exploratory study. Hierarchical log-linear models are evaluated by estimating the expected cell frequencies and comparing them to observed frequencies, using either the Pearson chi-square (X2) or the likelihood ratio chi-square (G2) (Agresti, 1990). However, the likelihood ratio chi-square is the preferred statistic because expected frequencies are estimated by the maximum likelihood method and can be partitioned uniquely for more powerful tests of condition-al independence in multiway tables (Knoke & Burke, 1980). The larger G2 relative to the degrees of freedom, the more the expected frequencies depart from the actual cell entries. For a large G2 we should conclude that the model does not fit the data well and should be rejected as an inadequate representation of the relationship among the variables. A model should fit the data and be substantively interpretable and as parsimonious (simple) as possible. For example, if models with and without higher-order interactions fit the data well, the simple models are usually preferable since higher-order interaction terms are difficult to interpret.

Our sample is not large enough to permit the testing of a model using all the variables previously described. Consequently, we had to simplify our analysis in several ways. First, we dichotomized all of the variables in an effort to maximize the number of variables that can be included in the model and to avoid the difficulty of interpreting polytomous interactions. Second, given the importance of sequential processes revealed through ethnographic studies of residential burglars, we entered variables into the model sequentially in blocks. Areal characteristics were entered first, followed by neighborhood characteristics, unit safety precautions, unit accessibility measures, and routine activity variables. Blocks of variables were added together. Variables in each block that did not have a statistically significant effect on the dependent variable were not excluded in subsequent analyses that included additional blocks of variables. Throughout the analysis we employed a significance level of .05 to select the most parsimonious model for each block of variables.

Results

Areal Characteristics. Table 1 shows the effect of central city residence on burglary outcome. Central city residences are more likely to have a completed burglary than residences in the suburbs or rural areas (lambda=.13, std. value=3.81). It appears that central city residence is not only related to the risk of burglary victimization but to burglary outcome as well.

Table 1
Log Linear Model Predicting Burglary Outcome (B) Using Central City Residence (C)

	Models	Likelihood Ratio Chi-Square	DF	p
M1	CB	0	0	0
M2	C B	14.75	1	.00

Effect Parameters and Standard Values for Best Fit Model: M1

Variables	Lambda	Std. Value
Central City Residence	.13	3.81

Neighborhood Characteristics. Since half of the cases for the neighborhood watch variable are missing, we had to enter the neighborhood characteristics into the model in two stages. First, we entered neighborhood nuisances and neighborhood disorganization along with central city residence. The results, which are shown in Table 2, indicate that none of the models fits the data at an acceptable level. However, we can still examine the saturated model to determine whether specific variables need to be included into subsequent model specifications. When neighborhood nuisances and neighborhood disorganization are added to the model, the individual effect of central city residence drops to zero. Likewise, the effect parameters for neighborhood nuisances and neighborhood disorganization are not statistically significant. However, the two-way interaction between central city residence and neighborhood disorganization is statistically significant (lambda=.15, std. value=2.42) and positively related to burglary outcome. It appears that households in central cities and in neighborhoods with high levels of disorganization are more likely to have a completed burglary.

Next, we retained neighborhood disorganization and central city residence and added the variable for neighborhood watch into the model. As shown in Table 3, Model 3 is the most parsimonious model.

Table 2
Log Linear Model Predicting Burglary Outcome (B) Using Central City Residence (C), Neighborhood Nuisances (N) and Neighborhood Disorganization (D)

	Models	Likelihood Ratio Chi-Square	DF	p
M1	CNDB	0	0	0
M2	CNB CDB NDB	3.65	1	.06
M3	CB NB DB	10.03	4	.04
M4	C N D B	87.87	10	.00

NOTE: All models include the (CND) term.

Effect Parameters and Standard Values for Best Fit Model: M1

Variables	Lambda	Std. Value
Central City Residence x Neighborhood Disorganization	.15	2.42
Central City Residence	-.00	-0.00
Neighborhood Nuisances	-.06	-0.97
Neighborhood Disorganization	.11	1.74

Table 3
Log Linear Model Predicting Burglary Outcome (B) Using Central City Residence (C), Neighborhood Disorganization (D), and Neighborhood Watch (W)

	Models	Likelihood Ratio Chi-Square	DF	p
M1	CDWB	0	0	0
M2	CDB CWB DWB	1.91	1	.17
M3	CB DB WB	7.73	4	.10
M4	C D W B	35.55	10	.00

NOTE: All models include the (CDW) term.

Effect Parameters and Standard Values for Best Fit Model: M3

Variables	Lambda	Std. Value
Central City Residence	.06	1.09
Neighborhood Disorganization	15	2.05
Neighborhood Watch	-.03	-0.44

Table 4
Log Linear Model Predicting Burglary Outcome (B) Using Neighborhood Disorganization (D), Number of Units in Structure (U), and Unit Visibility (V)

	Models	Likelihood Ratio Chi-Square	DF	p
M1	DUVB	0	0	0
M2	DUB DVB UVB	0.26	1	0.61
M3	DB UB VB	5.26	4	0.26
M4	D U V B	60.99	10	0.00

NOTE: All models include the (DUV) term.

Effect Parameters and Standard Values for Best Fit Model: M3

Variables	Lambda	Std. Value
Neighborhood Disorganization	.15	2.45
Number of Units in Structure	-.13	-2.43
Unit Visibility	.01	0.17

With the inclusion of neighborhood watch, central city residence is no longer a significant predictor of burglary outcome. Further, the interaction effect between central city residence and neighborhood disorganization is no longer significant. While the presence of a neighborhood watch program may hinder target selection, we find no evidence that such a program influences burglary outcome. The effect parameter for neighbor-hood watch is not statistically significant (lambda=-.03, std. value=-.044). The only significant predictor of burglary outcome is neighborhood disorganization (lambda=.15, std. value=2.05).

Unit Accessibility Measures. Table 4 depicts the results of the addition of the accessibility measures to the model. With the inclusion of the accessibility measures, neighborhood disorganization remains statistically significant (lambda=.15, std. value=2.45). The number of units in a structure also is significantly related to burglary outcome. Households in one unit structures are more likely to have a completed burglary than households in the suburbs or in rural areas. Although burglars say they prefer a target that is easily accessible from major roads and that has poor visibility from the street and neighborhood properties, we find that the relationship between unit visibility and burglary outcome is very weak and not statistically significant (lambda=.01, std. value=.17).

Unit Safety Measures. The effects of unit safety measures on burglary outcome are shown in Table 5. When safety measures are added to the model, the number of units in structure is no longer statistically significant (lambda=-.08, std. value=-1.27). Neighborhood disorganization is still statistically significant (lambda=.18, std.value=2.85). Safety measures have a weak relationship with burglary outcome. The effect parameters for both protective measures (lambda=.04, std. value=.71) and security measures(lambda=-.03, std. value=-0.56) are not statistically significant. Thus, we find no evidence to support the contention that the installation of safety devices prevents burglary victimization.

It should be noted that since our data are cross-sectional and not longitudinal, there may be a problem with the temporal ordering of the safety measures. The installation of inside and outside protective measures may have occurred in response to burglary rather than being in place at the time of incident. In addition, the installation of safety devices does not necessarily mean that these items are used.

Routine Activities. The effect of household occupancy on burglary outcome is shown in Table 6. There is a very strong relationship between household occupancy and burglary outcome (lambda=.34, std.

Table 5
Log Linear Model Predicting Burglary Outcome (B) Using Neighborhood Disorganization (D), Number of Units in Structure (U), Unit Protective Measures (P), and Unit Security Measures (S)

	Models	Likelihood Ratio Chi-Square	DF	p
M1	DUPSB	0	0	0
M2	DUPB DUSB DPSB UPSB	0.40	1	0.53
M3	DUB DPB DSB UPB USBPSB	4.02	5	0.55
M4	DB UB PB SB	23.35	15	0.08
M5	D U P S	153.20	25	0.00

NOTE: All models include the (DUPS) term.

Effect Parameters and Standard Values for Best Fit Model: M3

Variables	Lambda	Std. Value
Neighborhood Disorganization	.18	2.85
Number of Units in Structure	-.08	-1.27
Unit Protective Measures	.04	0.71
Unit Security Measures	-.03	-0.56

value=4.91). The presence of household members at the time of the incident is more likely to result in an attempted burglary. Although still statistically significant, the effect of neighborhood disorganization is slightly diminished with the inclusion of household occupancy (lambda=.13, std. value=2.71).

Discussion

The results of our analysis point to the importance of ecological variables in the determination of burglary outcome. Neighborhood disorganization has a strong and consistent relationship with burglary outcome. Households in communities plagued by signs of disorder such as litter, graffiti, broken windows, and boarded up buildings are more likely to have completed burglaries. These results are consistent with Lynch and Cantor (1992), who found community social disorganization to be an important risk factor in residential burglary. It appears that neighborhood disorganization is important to both in target selection and in entry.

Concerning our finding that forcible entry is associated with dwelling units in disorganized communities, various factors seem to be at work. An attempt is a less salient perceptual event than a completion, and there may be factors in disorganized communities that reduce the likelihood of attempts being noticed and reported. The presence of signs of disorder may to offenders be an indication that the residents either do not care about their community or have lost control of it; such neighborhoods may be perceived by offenders to present less risk of capture resulting from the actions of the police or concerned neighbors. Alternatively, offenders in such neighborhoods perhaps may be more likely to live in or near the area and more familiar with victims and targets, and thus to be more confident of their ability to anticipate developments during the burglary and deal with them as they arise. It is also possible that the offenders in such neighborhoods may be in some way different from those in other types of neighborhood, perhaps more hardened, more familiar with the criminal justice system and less afraid of it, more driven by drug dependencies, etc., and thus less concerned about risk.

Our analysis also lends support for the importance of routine activity variables within opportunity theory. The presence of a household member had a very strong relationship with burglary outcome. For Lynch and Cantor (1992), occupancy was a factor only at night; perhaps because in the target selection phase signs of occupancy are more discriminable at night than in the daytime. Lynch and Cantor (1992) found that neighbors watching each others' houses was a protective factor while we did not; it may be that offenders discount this factor once a dwelling has been selected as a target.

Table 6
Log Linear Model Predicting Burglary Outcome (B) Using Neighborhood Disorganization (D) and Household Occupancy (H)

	Models	Likelihood Ratio Chi-Square	DF	p
M1	DHB	0	0	0
M2	DB HB	0.97	1	.76
M3	D H B	33.02	3	.00

NOTE: All models include the (DH) term.

Effect Parameters and Standard Values for Best Fit Model: M2

Variables	Lambda	Std. Value
Neighborhood Disorganization	.13	2.51
Household Occupancy	.34	4.91

The protective and security measures of unit characteristics that we examined were not significantly related to burglary outcome. It appears that target hardening does not play a role in determining burglary outcome once the entry phase has commenced. In studies using burglars as informants, only the least experienced are likely to say that they are deterred by security hardware. Information about the presence of security measures is usually not available from a distance, so that by the time a burglar is aware of it, he has already selected the house as a target, has already committed trespass on to the property, and is ready to initiate the entry process. Many burglars, for example those studied by Krainz (1988), stated that they were very aware of risk factors when choosing a target, but that once they started breaking in they would persist until they found a weak spot and got in. Burglars tend to disregard information about protective and security measures that is not received by them until the point where they are ready to force entry. This kind of process has been modelled by psychological studies of "cognitive dissonance". Economists similarly speak of "sunk cost": the process whereby additional investment (of time, money, energy, etc.) in a course of action is more likely the greater the level of prior investment in it.

It is nonetheless possible that many burglaries were thwarted because of unit protective and security measures, but did not leave the traces that would lead them to be reported as "attempts" in this data set. There is in the literature some ethnographic evidence for the additive effect of security measures, e.g., secure locks at all openings plus high visibility, etc., (Hakim and Buck, 1991; Wright and Decker, 1992). Moreover, our confidence in our own negative findings is compromised by the sequential-order problem we mentioned earlier: installation of security devices may have been a response to burglary victimization. The NCVS now has additional items on security devices and Neighborhood Watch, so the sequential-order problem can perhaps be clarified in some future study.

Concluding Remarks

This research focused on residential burglary outcomes in order to examine the effect of environmental variables on burglar decision making as a sequential process. Our data set was imperfect for these purposes, in that burglary attempts in particular were probably under-reported. However, our findings are not at variance with other research on the subject. Moreover, the way we have conceptualized the burglary process appears to be a useful approach. And it is unlikely that we will ever have a fully satisfactory measure of residential burglary attempts.

The study produced some findings with implications for crime prevention. One factor found to influence burglary outcomes was whether a resident was home or not during a burglary. Given the two-earner family, and the fact that burglary is increasingly a daytime phenomenon, the typical case will be where the dwelling is unoccupied because the adults are away at work, the children at school. Burglary prevention programs that rely on citizen"eyes and ears" to observe and report suspicious activity will presumably be less effective in such neighborhoods. Police need to learn how to make full use of the "eyes and ears" that are available during the day, such as retirees, full-time homemakers, delivery personnel with radios, etc.

The same community disorganization variables that we have found to be associated with successful burglar entry have been found by others to be associated with a neighborhood's slipping into a pattern of loss of confidence, disinvestment, out-migration, and decay (Schuerman and Kobrin, 1986; Skogan, 1990; Taub et al,1984). The ultimate fate of neighborhoods may be established early; Taub et al (1984) find that neighborhoods as they age are less likely to be selected for investment if they are poorly located with respect to nuisances and pollution sources, are heavily impacted by vehicular traffic, possess few amenities, and have a housing stock that is dull and poorly constructed.Environmental designers and urban planners can encourage designs that avoid these built-in problems and that are more resistant to deterioration, graffiti, litter, and disorderly activity.

Except as noted above, the land use and building regulations that public officials control -- land use plans, zoning, subdivision regulations -- and the factors that these controls influence --setback, density, visibility, accessibility, etc. -- do not in our data have a significant effect on the entry phase of residential burglary. Nonetheless, in some of the studies reviewed herein and in Shover (1991), as well as in ethnographic studies of burglar decision making, these factors have been associated with the risk of burglary victimization. Our sense of the situation is that these crime prevention recommendations possess sufficient face validity and empirical support that it would require further

research evidence than we have today for us to recommend discontinuing these strategies.

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by Marcus Felson

Security: There's lots of crime prevention out there

Crime in parking areas is a widespread problem. Such crime occurs in many types of parking areas, including those which are owned by public and private organizations, and which are open to public access or not; including parking lots and structures, above ground and below. Parking area crime includes theft of cars, contents and accessories, as well as personal attacks upon people going to and from cars. Such crime fits into the broader classification of auto-related crime, prevention of which has been surveyed by Clarke and Harris (1992).

Several studies find that large parking lots are especially favorable for car theft Poyner and Webb, 1987; Liddy, 1987; Mancini and Jain, 1987; Saville and Murdie, 1988). Improved security for a large lot has the potential to design out a major crime opportunity without displacement. Geason and Wilson (1990) note that the use of a concrete barrier around such a lot reduced car thefts from 179 to zero. In studying a large parking garage in a town center, Poyner (1991) showed that car theft was reduced 85 per cent by a package of measures: lighting, wire mesh to prevent climbing in, restricting pedestrian access from the street, and a well-located office for a 24-hour taxi office. No deflection to nearby parking lots was found. Although thefts from cars were not affected in this example, open-air parking lots reduced thefts from cars by 50 per cent with the use of closed circuit television cameras.

The purpose of this paper is to organize a variety of suggestions about parking area crime prevention into a single scheme. The suggestions were drawn from the Crime-Free Environments study, funded by National Institute of Justice grant # 91-IJ-CX-KO21, and carried out at the University of Southern California during 1992 and 1993. This research project interviewed approximately 500 people in many walks of life about their crime prevention efforts. The snowball sample was not based upon the usual random sampling techniques but rather upon an effort to gather suggestions and ideas about crime prevention through environmental design (CPTED). Thus we deliberately sought out respondents who would have suggestions to make and avoided respondents who would not have such suggestions. We began by taking lists of national and regional umbrella organizations representing a large number of local organizations. Included were various segments of the United States business or public sectors, such as drug stores, liquor stores, home improvement stores, wholesalers, warehouses, theaters, state and national parks, downtown associations, etc. Each segment of society was

selected based upon the likelihood of substantial crime problems. For example, the umbrella organizations for the liquor industry would be contacted by phone to ask about crime problems and crime prevention within that industry. We requested from the initial contacts the name of the person or persons responsible for security or crime prevention in that umbrella organization, whether an employee of the organization itself, a committee member from the general membership, or any other source. Such individuals were interviewed and then asked for suggestions of others to interview. The questionnaire began by asking about the specific crime problems faced by the industrial segment in question, then quickly shifted to asking numerous specific questions about efforts to design out crime.

In the process of these interviews, several hundred responses mentioned crime problems in parking areas and efforts to design solutions. After removing clear repetitions, we arrived at 51 crime prevention suggestions for parking areas. These are presented in Table 1.

The 51 suggestions are summarized into seven categories:

1. Change rules to foster safer parking areas
2. Construct and design better parking areas and relationships to the larger environment.
3. Increase visibility in parking areas.
4. Route traffic effectively.
5. Select the right fences.
6. Improve parking lot surveillance and contact with visitors.
7. Apply electronic techniques intelligently.

We might call the above list a general strategy for preventing parking area crime. The items within the categories represent specific "tactics" for putting that strategy into practice. Together, strategy and tactics can help in designing out crime in parking areas.

Note that many of the tactical ideas are quite interesting in their own right. For example, item 4, assigned parking stalls, fits the general principle that assigning people to space produces accountability and hence less crime. Item 20 is interesting because constructing buildings to face parking produces not only less crime but also a more "organic design." This raises T. Crowe's (1991) general argument that good planning and good prevention are one and the same. Item 34 is interesting because building see-through fencing avoids the fortress-feeling while providing security. That solid walls tend to backfire is a reminder: crime prevention can be subtle and moderate. Finally, for many of the tactics offered by respondents, reasoning was included; this indicates that many people have a strategic sense of how to prevent crime and incorporate that sense in developing and applying prevention tactics.

Just as people have used prose all their lives without calling it that, practical administrators may be using CPTED without naming it so. A repertoire of crime prevention tactics and strategies exists in the practical world. We need to continue gathering that repertoire and sharing to help people build simple and low-cost crime prevention into everyday life.

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Table 1

Parking area crime prevention experience drawn from respondents to the Crime-Free Environments Project: 51 suggestions

A. Change rules to foster safer parking areas.

1. Give night workers were designated parking close to the doors where they and their cars can be seen from people inside the buildings.
2. Permit only residents to park in lots. Ticket any cars parking without a permit to increase control of the lot. Give police officers in the area lists of which cars belong where. Do not let teens loiter in the parking lot. Put up "absolutely no loitering" signs and enforce them.
3. Establish a municipal building code for parking structures requiring security measures, including extra lighting, mirrors in strategic places, observation of blind spots, phones, and location of stairways for surveillance.
4. Instead of one big unassigned lot, assign parking stalls to specific tenants; limit each to one or two vehicles, and require visitors to have special passes. Post signs stating rules and tow vehicles which do not comply.
5. Offer tenants approved gathering places away from parking lots.
6. Prohibit parking at night too close to doors to avoid blocking view of parking area from building.
7. Encourage people to park in a lot adjacent to a busier street to increase visibility, both from traffic and from regular police patrols on the street.
8. Differentiate often-used from seldom-used parking areas. Fill the former first and close off the latter except when needed.
9. Require log-ins for access to parking spaces. Or set up access to parking lots via security stand or receptionist.

B. Construct and design better parking areas and relationships to the larger environment.

10. Design parking structures to eliminate places where a criminal can hide.
11. Build glass into store doors enlarged to increase surveillance of parking lots. Replace 2nd floor walls of offices with glass so people can oversee entire complex.
12. Build parking garages on slopes so those walking can see into all levels.
13. Attach parking garages to buildings to increase surveillance.
14. Avoid angular parking design in lot. Arrange so people driving by can see into the parking aisles.
15. Have one ground-level parking area in front of the store, with customers and employees using the same parking for better surveillance.
16. Give stairwells in parking structures glass walls for visibility.
17. Put security shack into parking lot and mark it as such.
18. Design electronic card access control to parking area.
19. Arrange parking structures with one way traffic in and out. Place security gates at entries so visitors are announced before they even drive onto the property. Give visitors access only to a small area.
20. Build buildings to face parking.
21. Avoid subterranean parking; when present, use extra access control.

C. Increase visibility in parking areas.

22. Paint garage walls white.
23. Design parking areas with clear lines of sight. Be careful not to block the sight lines for people getting out of their cars. People should see and be seen in parking areas.
24. Trim landscaping between parking lots and buildings. Landscape with high-branch trees or low hedges.
25. Arrange gas pumps at gas station to permit clear line of sight into parking area.

26. Place strong lighting in parking areas, but take care to avoid blinding surveillance with too strong a glare. Direct lighting carefully.
27. Establish open, lighted, space between parking facilities, roadways and buildings. Use day lighting in parking garages.
28. Maintain visibility from store into parking area. Keep entry of store close to parking lot.

D. Route traffic effectively.

29. Channel walkways to other buildings channeled parking areas to increase natural surveillance.
30. Only lobby doors should be open for entering parking structure.
31. Route all incoming pedestrian and vehicular traffic alongside a manned booth.
32. Post proper signs to guide customers through parking areas. Organize flow of traffic so people won't get lost.
33. Place parking lot entries in well-traveled areas.

E. Select the right fences.

34. Build iron fences around parking lots, since they are more difficult to remove, break through or climb over. Or use other see-through perimeter fencing to cut down on escape routes without blocking visibility.
35. Close off staff parking with fences during the day.
36. Fence off dumpsters and back parking lots so nobody can hide there.
37. Close off driveways with gates.

F. Improve parking lot surveillance and contact with visitors.

38. Get employees to take their breaks looking onto parking area. Install picnic tables or employee lunch area to face parking area.
39. Improve surveillance on the ramps of parking structure.
40. Have an employee talk to everyone who enters the parking area.
41. Pay special security attention to parking lots to the back of a store.
42. Have security patrols check the parking lot more frequently.
43. Arrange for security guards to patrol parking areas on foot, on carts, on bikes, or even (for downtown areas) on horses.
44. Use elevated guard booths to help guards see and be seen. Paint "security" sign on guard structures.
45. Establish radio or intercom communication among guards and or employees in large parking areas.
46. Do not cover windows overlooking parking areas with signs.

G. Apply electronic techniques intelligently.

47. Set up closed circuit television cameras (CCTV) to view aisles between parked cars. To avoid blinding levels of lighting, use infrared cameras. This permits natural surveillance and camera surveillance simultaneously. Cameras at garage entrances give greater perimeter control.
48. Discourage people from hanging around with fake television cameras.
49. Play loud classical music so youths do not hang around, or use high-vapor sodium lights at night.
50. Use sensors on and around fences to alert security to parking area intrusions.
51. Place security phones, intercoms or panic buttons in parking areas.

Source: Compiled from anonymous respondents interviewed by the Crime-Free Environments Project at the University of Southern California, 1992-1993, funded by National Institute of Justice Grant # 91-IJ-CX-KO21.

by Carolyn Rebecca Block

STAC hot spot areas: A statistical tool for law enforcement decisions

The last ten or fifteen years have seen a quiet revolution in criminology and criminal justice. There has been a vast improvement in the quality and quantity of data, and in the availability of that data to decision-makers. Sufficient information is now available so that basic indicators related to criminal justice issues can be measured with a degree of precision that was not only unknown a few years ago, but was even unanticipated. Contrary to conventional wisdom, we are not plagued by a dearth of information in criminal justice (Block, 1989). The problem is just the opposite. There are often so many pieces of information that it is impossible for the human mind to assimilate them, to sort them out, and to use them for tactical or crime analysis decisions before the window of opportunity has passed.

Even more recently, another revolution has not only precipitated a surge in the amount of information available, but also enlarged the nature of that information to include two-dimensional space. This technological revolution, computer mapping, has generated a need for analytical methods and techniques to make spatial information a foundation for answering practical and policy questions. One of the most common spatial analysis questions asked in law enforcement is: where are the densest concentrations of incidents or events on the map? The Hot Spot Area capability of the STAC (Spatial and Temporal Analysis of Crime) software program was developed to answer that question.

This presentation is an overview of the STAC approach to finding and describing Hot Spot Areas. It begins with a review of cluster analysis techniques as they have been applied to law enforcement. It then describes Hot Spot Area analysis in STAC, and provides an example of a Chicago violence-reduction project that uses Hot Spot Area analysis to identify street gang violence crisis areas.

Computer Mapping: A Technological Revolution in Law Enforcement

Computer mapping technology, coupled with the technology necessary to store and organize vast amounts of geocoded data, has expanded extremely rapidly in recent years, and there is no end to the expansion in sight. Only a few years ago, the only mapped information available to most police departments was limited to cardboard pin maps and colored plastic pins. Digitizing was (and still is) so expensive that the development of their own

computerized street map was beyond the reach of most departments.[1] Cities that did have mapping capability usually housed it centrally, outside the police department (in City Planning, for example), because mapping software and hardware was complex, requiring experts to use it, and too expensive for scattered-site applications. In these cities, police access to mapping was indirect, often cumbersome and time consuming. In addition, maps developed for other city uses did not always meet law enforcement needs. (For example, we do not send a squad car to a Census tract to answer a call, but to an address.)

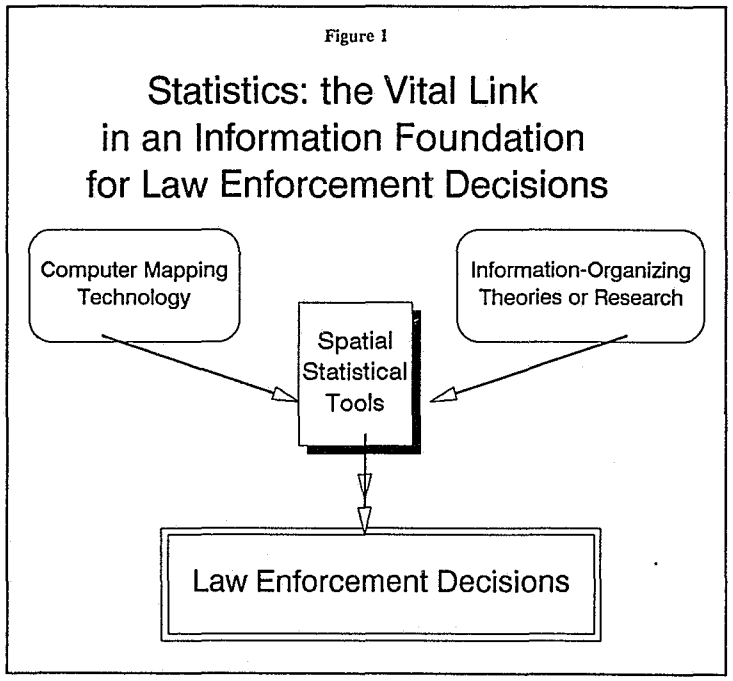
With the advent of accessible mapping software, PCs that can handle it, and the Census TIGER files, all this has changed. As presentations at this workshop demonstrate, the technological revolution in computer mapping means that spatial crime analysis is now a possibility, even for small police departments and neighborhood-level police districts. Mapping entrepreneurs, people with the vision to see the potential worth of automated mapping and the spirit and initiative to overcome any obstacle that might be in the way of realizing that potential, have sprung up in departments across the continent and around the world. Many of those people are with us here today.

By its very success, however, this technological revolution has generated a "data overload" of unprecedented proportions. Mapped databases can quickly grow to contain much more information than a police analyst can possibly assimilate and use for timely decisions. Computer mapping technology, no matter how sophisticated, is not enough by itself to organize the vast amounts of spatial and other information generated by the reality of daily interaction in city neighborhoods, and to summarize that information so that it can support tactical deployment, investigation, early identification of crisis situations, and development of successful intervention strategies.

As Roncek and Maier (1991) argue and Maltz, Gordon and Friedman (1991) found in their pilot study of computer mapping in police departments, the successful analysis of spatial patterns of crime requires that empirical mapping tools be guided by theory that can link place to crime, can unravel the spatial characteristics of different types of crime, and can provide explanations for the high vulnerability of some neighborhoods or demographic groups. In other words, we must link computer mapping technology to an information-organizing framework that encompasses both law enforcement and community information. The appropriate tools for a job such as this are statistics. Statistical tools (Figure 1) can summarize enormous amounts of information and organize that information to answer specific, practical questions. They can provide a way to link mapping technology and information-organizing hypotheses.

We need statistical tools to control and manage data overload, so that law enforcement and community information can become a foundation for tactical, crime analysis and policy decisions. However, as the next section will show, statistical methods for using and interpreting mapped data, especially methods applicable to practical criminal justice situations, are still in their infancy. The development of statistics for geographic analysis has been outpaced by the creation of geocoded datasets and the software to map them. Methods for identifying "Hot Spot Areas" (the densest clusters of incidents on a map) have been particularly problematic.

Figure 1



Attempts to Identify Hot Spot Areas

Maps, even a single map of one type of event in one time period, contain a huge amount of information, data that may be interpreted very differently by different observers with differing perceptions of spatial reality (cognitive maps).[2] The answer to a question such as whether or not the events within a certain area on the map are densely clustered, or just one permutation of random distribution, depends on

the eye of the observer. In such situations, when the amount of information is overwhelming, a quick, efficient and objective summary of reality -- in other words, a statistical analysis -- can provide a useful guide to interpretation. Unfortunately, however, spatial analysis statistics have lagged behind the revolutionary expansion of hardware and software technology.

What statistics are available for finding and defining a Hot Spot Area -- the densest area on a map, an area that reflects the pattern of actual events, even if these natural clusters cross a boundary (police district or Census tact boundaries, for example) or extend along a boundary (a street, for example)? Two approaches have been commonly used to find dense clusters: analysis of density within predetermined boundaries (areal analysis), and analysis of relative frequency of occurrence at specific places or addresses (pin map frequency distributions).[3] Either may be useful for answering certain other questions, but both suffer from serious limitations as methods for identifying and mapping a Hot Spot Area.

Areal analysis. Statistical methods for the analysis of crime density within arbitrary areal units, such as police districts, political wards or Census tracts, have been available in automated systems for some years, but they all suffer from serious problems in interpretation, such as aggregation bias. (See Brantingham & Brantingham, 1984:15-18 for a review of these problems; examples of misinterpretation can be found in Pyle, 1974; 1976 and Kohfeld & Sprague, 1990.) Analysis within arbitrary boundaries cannot deal with a reality in which actual dense areas may cross boundary lines, occur along a boundary line, or occur in only a small but concentrated area within the arbitrary boundary. Aggregations to arbitrary areas are thus subject to what may be called an "area-unit fallacy," which is analogous to the ecological fallacy. In the ecological fallacy, area-level characteristics are mistakenly applied to individuals. In the area-unit fallacy, the aggregate characteristics of an overall area are mistakenly applied to each section or neighborhood within that area.

Even though aggregate data within arbitrary boundaries are not an appropriate basis for an analysis of event clusters, sometimes the only data available may be area-level. To handle this situation, techniques have been developed to approximate clusters of points with aggregate area information. In small area analysis, the areas analyzed are so small relative to the scale of the map that they begin to lose their two-dimensional aspect, and seem to the observer to become points instead of areas. However, this begs the question; even if the small areas are seen as points, there is still no systematic way to identify clusters of these "points."

Crime gradient mapping (see Joelson & Fishbine, 1980: 251-255, and Rengert or Rossmo, elsewhere in this volume) is another technique to deal with area-unit data. Crime gradients are isopleths calculated by connecting the centroids of areas with similar rates.[4] Currently-available software such as SYSTAT and Idrisi make it easy to produce topographical (three dimensional) maps of crime gradients. However, because they are based on area data, these maps suffer from the limitations just discussed. They do not really represent clusters of points, but rather the characteristics of the aggregated points within each area boundary.

Both the isopleth maps developed by Curtis (1974:119-158) and studies of "population potential" (Choldin & Roncek, 1976; Felson, 1986) use area rates to define central points (centroids) on the map, which are then linked. However, because the centroids are based on rates calculated within arbitrary spatial boundaries, not on specific address or pin distributions, such methods are subject to the same problems in misinterpretation and potential area-unit fallacy faced by all area-unit data.

In addition, topographical representations of clusters have a number of disadvantages from the point of view of reader perception. The peaks and valleys make it difficult for the audience to see multiple hot spot areas, because a secondary peak may be hidden behind a larger primary peak. It is also difficult for a map reader to perceive the relationship between the topographical distribution and the position of other mapped objects (streets, buildings, parks). Topographical clusters of two separate variables (for example, abandoned buildings and drug offenses) are almost impossible to show clearly on the same map.

Pin map analysis. Pin map data, such as the locations of offenses, traffic accidents or known offender addresses, can provide a wealth of information, and statistical methods exist to organize that information into a useful form. Presentations at this workshop show how it is possible to analyze flow from one point to another (such as the distance from an offender's address to the site of a burglary), to identify high-activity "nodes" that attract a certain type of activity (such as a tavern or a dangerous intersection), and to rank-order locations according to frequency of activity (such as addresses with extremely high calls for service). None of this can be

done with area-unit data.

However, frequency distributions of pin map or address data, by themselves, cannot define a particularly dense hot spot area. A single address with more crimes than any other address may, or may not, be located within the highest-density crime area on the map. Although it is an increasingly common practice (Joelson & Fishbine, 1980:256; Pierce, 1987; Sherman et al., 1989; Uchida, 1990; Linnell, 199 1) for crime analysts to define a single high-crime address as a "hot spot," and this designation may be useful for some applications, a hot spot address is not necessarily a Hot Spot Area.

In general, though areal and pin map analysis can provide answers to many other questions, neither can satisfy the basic requirement of Hot Spot Area analysis -- to identify high-density areas without regard to artificial boundaries. The predefined, arbitrary boundaries of areal analysis are an obstacle to the identification of such real high-density areas. On the other hand, the unit of analysis in a pin map is so detailed that "area" takes on a qualitatively different meaning, and density could reflect some unique characteristic of the particular location. Just as the use of arbitrary area boundaries as the unit of analysis may hide spatial patterns that cross those boundaries, the use of addresses as a unit of analysis may hide patterns of density that occur across groups of contiguous addresses.

Building non-arbitrary areas from pin map data. As Joelson and Fishbine (1980:250) suggested over a decade ago, we need to overcome the limitations of arbitrary area boundaries by utilizing "address-level aggregations." In other words, we need to find a technique for building non-arbitrary summary areas from pin data. There have been some attempts to do this.

Methods based on pin map information include the Nearest Neighbor significance test for the clustering of events within a boundary (Brantingham & Brantingham, 1984:222-223; Boots & Getis, 1988), Selden's (1976) use of the PATTER program to define a point that is the shortest distance from all other points as a "hot spot," and in general, centrographic analysis (Stephenson, 1980: 146-155; LeBeau, 1987; Ebdon, 1977), which can be used to find the imaginary point on the map that is closest to all events on the map (the mean center). These approaches begin with pin map data, but they also end there. None of them yields a summary, bounded, area that is calculated from individual points.

At least three research projects have explicitly confronted the problem of turning point data into area data. Joelson and Fishbine (1980:257-262) describe a project in which they drew isopleth maps based on assaults per square mile in concentric circles around a specific site in Minneapolis (Moby Dick's Bar). While this produced a bounded summary area from pin map information,it did not necessarily target the densest area on the map. Linnell (1991), Weisburd, Maher and Sherman (1991) and Maltz, Gordon and Friedman (1991:41) examine the proximity of address-level "hot spots" (address where a relatively high number of events occur), but do not develop an objective rule for combining them into hot spot areas.

Two of these studies, Weisburd, Maher and Sherman (1991), and Maltz, Gordon and Friedman (1991:4 1) rely on the judgement of experts to link together closely spaced hot spot address locations. In the Weisburd study, the expert was a member of the research team, who stood at the location of a hot address and recorded the physical characteristics of the area one block in every direction. In the Maltz study, people knowledgeable about the community were asked to draw freehand lines on a map around areas they considered to be high-crime or drug markets. Both methods defined hot spot areas according to the given expert's cognitive map, not according to the actual clustering of events.[5] Cognitive maps can provide valuable information, but they are not tools for summarizing information about spatial clustering.

In summary, the available spatial statistics for finding and defining the densest area on a map -- a Hot Spot Area -- do not measure up to the need for an automatic, objective tool that turns points into areas. In general, analysis methods based on relative crime density within arbitrary areal units suffer from aggregation biases, serious problems in interpretation, and are subject to the area-unit fallacy, while available analysis methods based on pin map data cannot identify particularly dense areas. The following section describes a spatial statistical tool that was developed in Illinois to answer the need to identify Hot Spot Areas.

STAC Hot Spot Area Ellipses

When Illinois police jurisdictions first began to use computer mapping in the mid-1980s, they realized that they needed an objective and quick way to summarize mapped information. Several

Figure 2
Location of Lattice Points

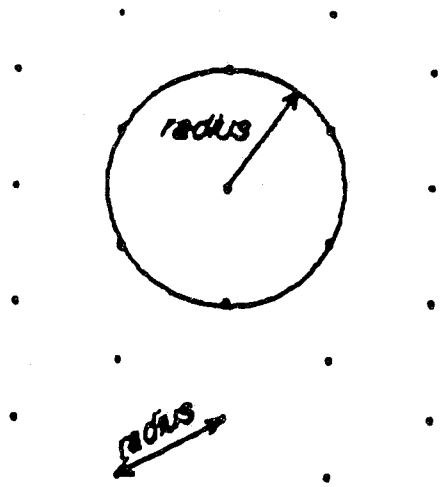
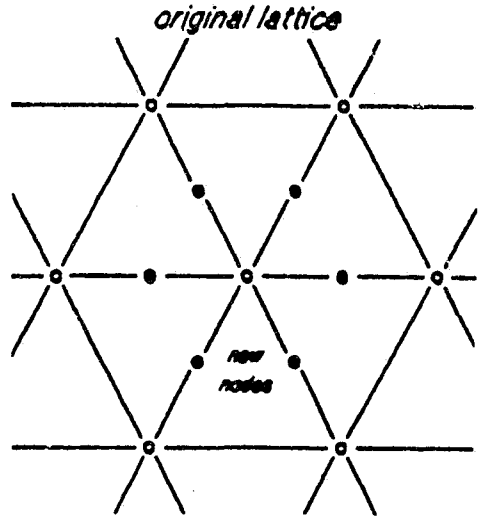


Figure 3
Location of New Nodes Relative to the Original Lattice



departments asked the Illinois Criminal Justice Information Authority for an automated, reliable method for identifying "hot spots" (the densest concentrations of incidents on a map).[6] In response to these requests, the Authority developed the STAC (Spatial and Temporal Analysis of Crime) package, a spatial statistical toolbox for law enforcement.[7] The initial development of STAC was carried out by Samuel Bates, under the direction of Associate Director Ed Maier, and was supported by a grant from the Bureau of Justice Statistics (BJS) of the U. S. Department of Justice (Garry, 1985).[8]

Although the current STAC package contains a number of statistical tools for spatial analysis, the Hot Spot Area was the original STAC capability, and is still the most used.[9] In one of the first public presentations of STAC Hot Spot Areas, to the board members of the Authority, Executive Director J. David Coldren showed examples of Hot Spot Area maps and commented (Coldren, 1986):

One of the more promising techniques is what we've been calling our hot spot procedure. This is a procedure designed to look at all the crimes within a given area (such as a town) and search for the place of highest crime density, or where most of the crimes occurred. This is the so-called hot spot.

The initial STAC Hot Spot Area was not an ellipse, but a circle. The STAC Hot Spot program was an iterative search routine that identified one "hot circle," the densest circle on the map. Sam Bates's algorithm began by superimposing a grid over a study area, the boundaries of which were defined by the user. The grid could be rectangular or triangular. A circle, the radius of which was also defined by the user, was drawn around each node of the grid (Figure 2). The nodes of the grid were spaced at one-half the radius, so that the circles overlapped, helping to assure that no cluster would be overlooked. The number of events in each circle was counted, and the circles were ranked by this number.

Then a new grid was created, the nodes of which were a distance of half the radius from the initial nodes, and the process of drawing overlapping circles and counting events within the circles was repeated for this grid (Figure 3). The second list of rank-ordered circles was added to the first, and the circle having the greatest number of events was chosen as the hot spot (hot circle.) This initial hot spot routine was tested with data on several types of offenses, over a number of months, from five Illinois police departments (Bates, 1987). [10] The current STAC Hot Spot Area algorithm has been enhanced, but it is still based on this basic foundation developed by Sam Bates.

The potential of STAC seemed clear. However, there were two major drawbacks: it was a mainframe program, and it had never been tested in a police environment. Another grant from the Bureau of Justice Statistics (BJS) supported the translation of STAC from a mainframe to a PC program (written in C++), and testing in the Evanston, Illinois, Police Department.[11]

In addition, extensive testing of STAC by Sam Bates and the current author with data from the five test departments raised additional questions about the interpretation of the hot circle as the "densest area on the map.[12] Empirically, this seemed to be true -- STAC's hot circle always met the criterion of being denser (in incidents per square mile) than the rest of the map as a whole. However, every STAC hot spot search would find a hot circle, even in maps that were purposely constructed so that there was no real clustering. To demonstrate this, we created two kinds of maps with no clustering: maps in which the incidents were uniformly dispersed throughout the study area and maps in which the incidents were scattered randomly over the study area (using a program written by Sam Bates). In the random maps, the density of incidents in the hot spot circle found by STAC was always greater that the density outside of the hot circle (see Bates, 1987).

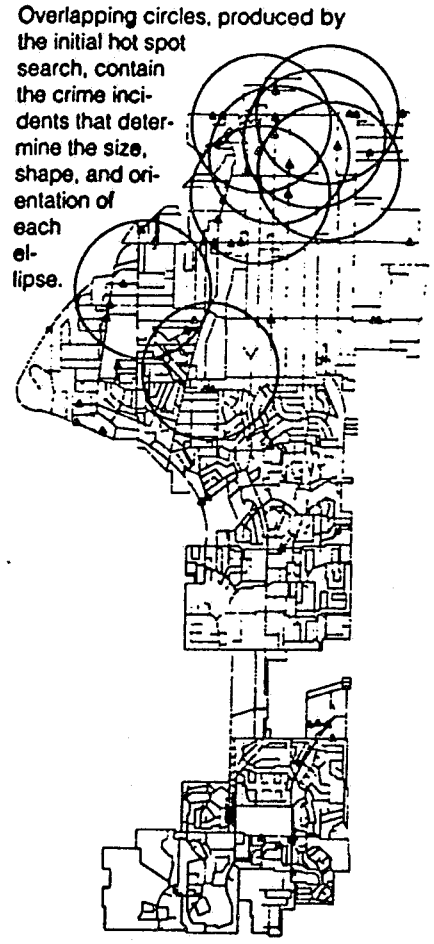
By definition, we knew that the higher density of hot circles in uniformly-dispersed or randomly-scattered maps represented only one permutation of random error. But this situation raised an important question: in general, when we do not know whether the incidents are really randomly distributed, how can we tell whether STAC's hot circle represents an area that is really more densely concentrated than other areas? Clearly, we needed a method to distinguish between "random" clustering and "real" clustering.

James Spring, a geographer who worked on the STAC project under the second BJS grant, realized that Nearest Neighbor Analysis (NNA) provided exactly such a significance test for spatial clustering, and added an NNA capability to STAC (see Spring, 1987).[13] Our advice to STAC users is to first test a dataset for significant clustering using NNA, and then, given clustering, use STAC to locate and define where the clusters are.[14] This is analogous to statistical significance versus association. STAC can describe where clustering occurs, assuming that it is occurring. However, NNA determines whether or not the clustering is significantly non-random. (For details of the "how hot is hot" question and the use of NNA in STAC, see Spring and Block, 1987, 1988a, 1988b, 1989.)

Several problems in STAC interpretation still remained. First, the hot circle would commonly overlap and share the same incidents with other circles, and ties in the rank order of circles were not unusual, making the choice of a single circle as "hottest" somewhat arbitrary. Second, while a circle was sometimes an accurate description of the real shape of a dense cluster of events, often the actual shape was irregular or elongated and not well described by a circle. To solve both problems, James Spring elaborated the original hot spot circle to produce the Hot Spot Ellipse. Beginning with the iterative search routine described above for hot circles, the ellipse algorithm first determines whether or not any of these hot circles overlap each other. If they do, all the incidents occurring in a group of overlapping hot circles become a "hot cluster" (Figure 4). All the incidents occurring in any hot circle that stands by itself are also a hot cluster. These clusters are ranked by the number of incidents (an incident that occurs in two or more overlapping circles is counted only once).[15] Then STAC calculates the best-fitting standard deviational ellipse (Hsu & Tiedemann, 1968; Scot, 1975; Stephenson, 1980:151; LeBeau, 1987) for each cluster (Figure 5).

Figure 4
Hot Clusters

The initial hot spot search

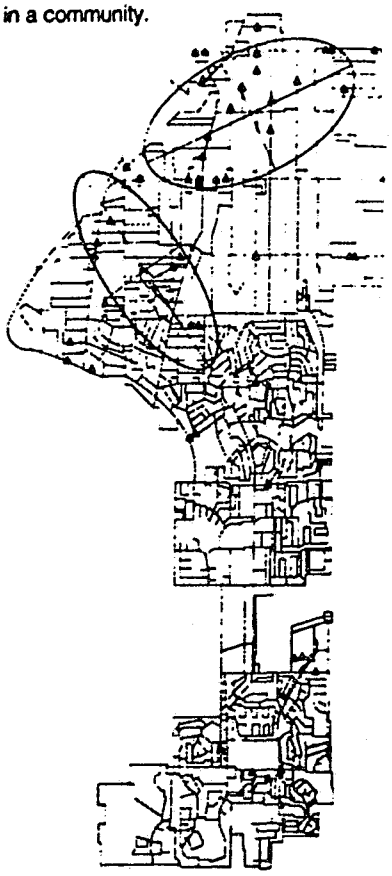


At this point in STAC development, we felt that we needed feedback not only from users in the field, but also from experts in statistics and computer science. We were concerned about whether we could really say that the area encompassed by a STAC Hot Spot Ellipse was denser than any other possible ellipse, whether the STAC hot circle was really "hotter" than any other circle that could possibly be drawn on a given map. Helmut Epp, chair of the Computer Science Department at DePaul University and an expert in artificial intelligence, and two faculty members, volunteered to read through all the documentation on STAC, and to tell us if the methodology was appropriate to answer the questions at hand. After evaluating the STAC package, this team of experts concluded that the Hot Spot Ellipse is an appropriate method to locate and define the densest area(s) on the map. They pointed out that it is not a simple statistic but more like an artificial intelligence interactive procedure. STAC should be used to summarize and search for patterns, not as a parametric statistic. They also suggested that we continue to pursue the development of another tool for the STAC toolbox, the Isocrime (Poethig, 1989).

Figure 5
Hot Spot Ellipses

The ellipse hot spot

The ellipses define the areas of densest crime activity—the hot spots—in a community.



Compared to a circle, an ellipse can approximate much more closely the actual shape of a cluster of events. However, ellipses still cannot describe irregular clusters (L-shaped, for example). Another limitation of Hot Spot Ellipses is that they should not be compared across maps; each ellipse must be interpreted relative to a given hot spot area search, with a certain configuration of incidents within a certain border.[16] This is because the Hot Spot Ellipse algorithm considers all the incidents within the study area border when it identifies each hot spot area. High density is relative to the overall scatter of all these incidents. Therefore, the densest Hot Spot Area on a map in which most incidents are widely scattered may not be as dense as the densest Hot Spot Area on a map in which most incidents are clustered together.

To handle both problems (irregular clusters and map-to-map comparisons) we added another tool to the STAC toolbox -- the Isocrime (see Bates, 1987; Spring & Block, 1988a, 1988b).[17] The Isocrime describes a Hot Spot Area as a set of isopleth lines, each encompassing a given proportion of the total number of incidents on the map.[18] For example, an inner isopleth might enclose the densest 10 percent of incidents; a surrounding isopleth, the densest 20 percent; and an outer isopleth, the densest 30 percent. Isocrimes can take any shape, and can be compared from map to map. Two "Isocrime 10% lines" on two different maps mean exactly the same thing.

Hot Spot Isocrimes also have some disadvantages, compared to Hot Spot Ellipses. It is more difficult to compute their area than the area of an ellipse, which means that density (incidents within the hot spot boundary per area of the hot spot) is more difficult to obtain. Also, searches for multiple Isocrimes are not as straightforward as searches for multiple ellipses.[19] The Hot Spot Ellipse and the Isocrime, therefore, provide complementary perspectives to help the user locate and define Hot Spot Areas. Each is particularly appropriate in different situations, and answers different questions. To get the most accurate picture of a given map, the user should utilize the information provided by both.

STAC Hot Spot Ellipses were Beta tested by Wally Briefs in the Sunnyvale, California Department of Public Safety, Philip R. Canter in the Baltimore

County Police Department, and Richard Block of Loyola University. These tests showed the potential of Hot Spot Area identification for crime analysis. For example, the Baltimore County Police Department produced Hot Spot Area maps of Halloween vandalism in the previous year, and passed them out to district officers, so that they could target prevention strategies in the current year (see Canter, 1993). However, STAC still was limited by input requirements that made it awkward to use, and by its dependence on plane geometry, which conflicted with the requirements of some mapping software for longitude/latitude data. Also, drawing STAC ellipses on a map was still awkward, because each was defined by only four points.

In addition, two difficulties in STAC interpretation began to be apparent. Extensive testing by James Spring of Hot Spot Ellipses of the same offense and the same area over time found cases in which the hot spot location suddenly moved to the other side of the map. These were not instances of displacement, but occurred because there was really more than one hot cluster on the map. A slight change in spatial configuration had caused the second-densest cluster to become the densest cluster. A more realistic procedure, we realized, would identify and plot all of the hot clusters, not just the densest. Also, field tests of user perception of Hot Spot Area maps found that people tend to think that larger ellipses indicate denser clusters of incidents than do smaller ellipses. (Actually, empirical testing indicates that the opposite is often the case.) We realized that to avoid misinterpretation, two enhancements would be necessary for STAC: the ability to find and plot multiple hot spots, and the calculation of Hot Spot Area density (per area and per population).

In 1991, therefore, Graham Taylor, the STAC analyst who succeeded James Spring, worked with programmer Terese Brand to make the following modifications and enhancements to STAC:

- Data entry requirements were made friendlier. STAC now could accept comma delimited data.

- A package that translates state-plane to longitude-latitude data (and vice versa) was incorporated into STAC.[20] This meant that STAC could be used easily with the TIGER files and packages using them.

- The Hot Spot Ellipse module was revised so that more than one hot ellipse could be identified and mapped (the densest, second densest, and so on). The program now told the user how many Hot Spot Areas it has found, and the user then could choose how many of these to map.

- The capability of drawing a complete standard deviational ellipse for every Hot Spot Area, instead of plotting only four points of the ellipse, was added to STAC.

Density by area unit became possible after Graham Taylor wrote a program to calculate the area of a Hot Spot Ellipse. It also could be calculated by using mapping software such as MapInfo to determine the area within a Hot Spot boundary. A technique to calculate density per population or other Census block data was developed by Richard Block (see Block and Block, 1993).

In 1992, STAC won a finalist award from the Ford Foundation/J.F. Kennedy School of Government, Harvard University, Innovations in State and Local Government Program. Part of that money was used to hold a workshop, and another part was used to publish *STACNews*, but about half of the grant award was used to enhance STAC. Under the Innovations grant, we were able to hire Yunus Mohammed, a student in computer science at the University of Illinois at Chicago, to improve the accessibility of STAC to the average user. We also were able to upgrade our computer mapping software to support Mr. Mohammed in his efforts. The following are the changes made to STAC under the Innovations grant:

- Menus have been added on top of STAC. There are two menus, a main menu and a spatial analysis (SPACE) sub-menu.

- Coordinate conversions, which had been external to STAC, have now been incorporated into the STAC product. Before the enhancement, STAC required a user to run a separate "batch" program to prepare the data to run STAC. Now, this conversion process is "transparent" to the user. It is automatically done, without any thought or action on the user's part.

- A multiple-run facility has been added to STAC. Users now can bring more than one input file in at a time, without having to start STAC again from the beginning. However, all input files must be in the format: Identifier, x-coord, y-coord.

- Every STAC run now generates an audit trail -- a report of the files analyzed, statistical parameters requested, and results (including number of incidents, number of Hot Spot Areas identified, location and density of each area). With these reports, it will be easy to document and reproduce

Hot Spot Area maps.

There are many things that still could be done to make STAC more useful, more accurate, and more accessible to users. As resources permit, we plan to make the following improvements to STAC:

- The STAC program should be modularized (in other words, each sub-routine in the program should be individually documented and related to each other sub-routine). This is necessary so that the Authority staff can support STAC and narrow the search for bugs. In addition, we need more detailed documentation of the C++ code in STAC.

- We must correct bugs in the current Beta version of STAC, as modified by Yunus Mohammed. For example, the Beta version does multiple hot spot searches, but writes over files when it does so.

- All STAC programs and functions should be accessible through menus. Now, only some of them are.

- More information is needed for the audit trail.

- The user should be able to specify the location of fields. File formats should allow for the reverse of x and y coordinates, to agree with geographic practice.

- The current Beta version is user-friendly for some applications, but not for others. The new version should improve ease of use for all applications.

- The maximum number of cases for the hot spot search is 15,000; the maximum number of cases for NNA is 400. It should be possible to override these defaults.

- NNA, which is now written in FORTRAN, should be integrated into the C++ program.

- The algorithm for Isocrimes should be standardized and automated more completely.

- More ellipse print options are needed. It should be possible to print Hot Spot Areas in order of their density (incidents per area of the ellipse) or in order of the number in the cluster. Also, the user should be able to specify a minimum number of incidents per Hot Spot Area.

- Finally, we must address the border problem. That is, we should introduce a weight in the iterative search routine, that gives more weight to circles in which part of the circle is across the outer border (and about which nothing is known). Boots and Getis (1988) describe such an algorithm.

These enhancements and improvements, completed and planned, will make STAC easier to use and easier to interpret, and therefore more accessible to officers, crime analysts, and community problem-solvers. However, since STAC is more of an interactive artificial intelligence tool than a cut-and-dried statistic, its use and interpretation is more an art than a science. The quality of STAC analysis, particularly analysis in real-life tactical and problem-solving situations, therefore, depends to some extent on the quantity of analysis. That is, the more STAC (or any other spatial statistical tool) is used to solve a practical law enforcement problem, the more it will be used, and the more effectively it will be used. Users will support each other with hints, war stories, and practical advice.

Most of the early users of STAC concentrated on the analysis of property crime, such as burglary, automobile theft or vandalism. To demonstrate the possibility of using STAC as an "information foundation for violence reduction," the Authority and the Chicago Police Department applied for and received a grant from the Bureau of Justice Statistics to develop such an information foundation for the identification of street gang violence crisis areas in Chicago. In the following section, we outline how STAC and a GeoArchive of law enforcement and community information have been combined to target an escalating high-risk situation, while there is still time to intervene and save lives.

An Example of STAC at Work: The Early Warning System Project

The Early Warning System for Street Gang Violence, a joint project of the Chicago Police Department and the Illinois Criminal Justice Information Authority, is now underway in Chicago's Police Area Four, an area containing some of the riskiest neighborhoods for street gang violence in the city. The purpose of the project is to develop an automated early warning system for law enforcement, which will identify potential neighborhood crisis areas, areas that are at high risk for suffering a "spurt" of serious street gang-related violence and homicide. This early warning system will be based on a statistical model, which consolidates spatial information obtained from a variety of community and law enforcement sources. The model is organized in a GeoArchive, and then uses automated Hot Spot Area identification and other geographic statistics as tools to target crisis

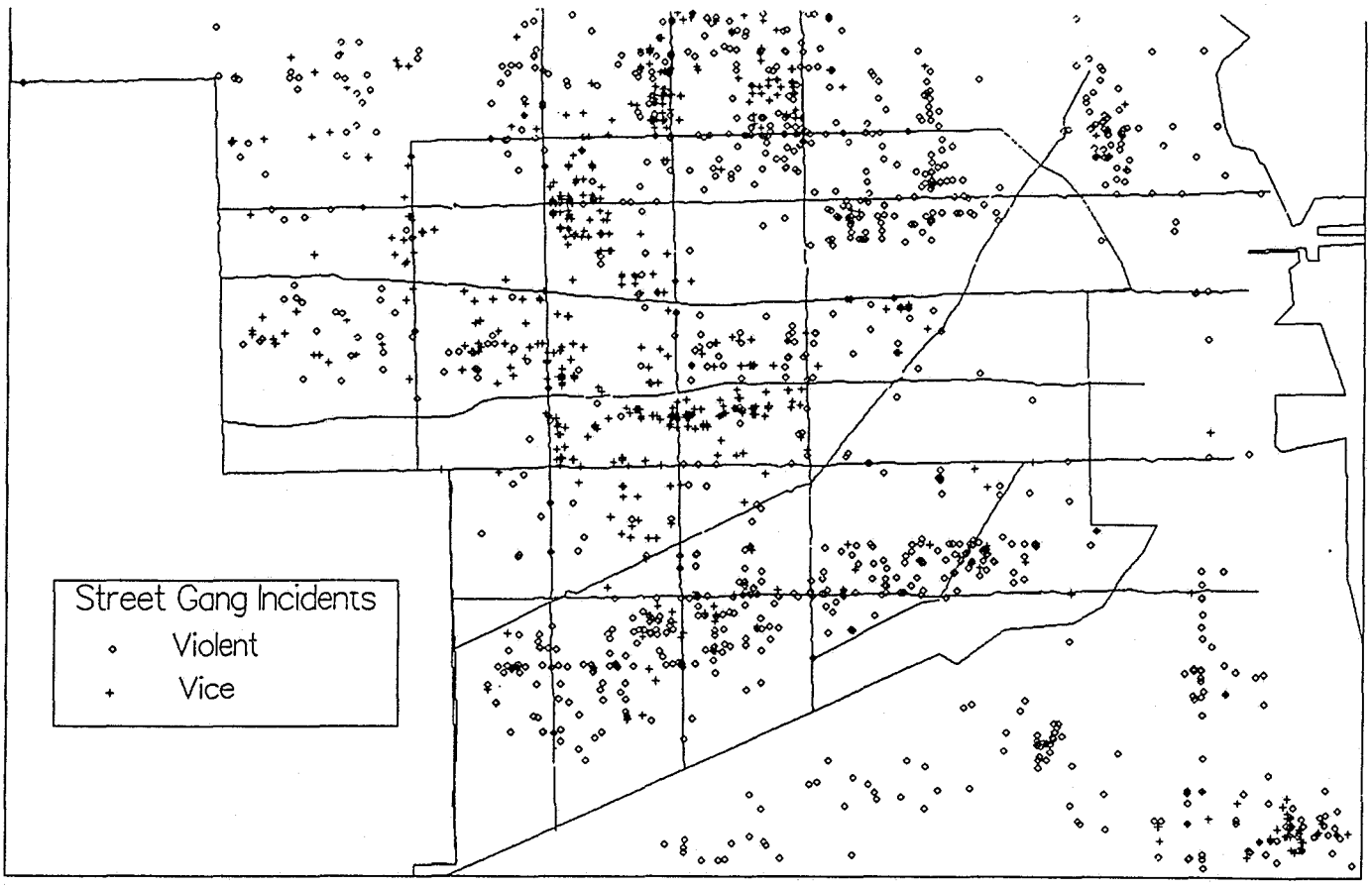
neighborhoods.[21]

The Early Warning System project is founded on the premise that, since street gang violence is spatially anchored and occurs as the culmination of escalating incidents of revenge and retaliation, information compiled by community and neighborhood organizations, as well as by law enforcement, could be used to develop an "early warning system" of neighborhoods in crisis (see Spergel & Curry, 1990). Continuing escalation would then be prevented by crisis intervention and dispute mediation, using both internal community influences and external police support. Such a program has shown success in two pilot projects, in Chicago's Humboldt Park and in Philadelphia (Spergel, et al., 1984; Spergel, 1986), but requires the strong support of neighborhood agencies, churches, community groups, and the police department.

The Early Warning System project uses automated Hot Spot Area identification as a targeting tool. One of the most important defining characteristics of street gang violence is territoriality. However, the territorial unit most likely to become the site of serious violence is not a large or predefined area like a police district, but a smaller area defined by the gang (Suttles, 1972:187-201). In addition, violence changes over time, following patterns of escalation, retaliation and revenge, often across a spatial border that may also change over time (see Weisburd, Maher & Sherman, 1991:20). Therefore, a quick, objective statistical tool like the Hot Spot Area ellipses is vital, to target specific neighborhood areas that are at high risk of becoming a violence crisis area, so that crisis intervention, heading off the cycle of retaliation and retribution, is possible.

The datasets in the GeoArchive provide the basis for analysis of patterns in the study area. For example, the map in Figure 6 shows street gang-related criminal incidents in Area Four in 1992. Drug (vice)

Figure 6
Street Gang-Related Incidents, by Type
Vice Incidents and Violent Incidents

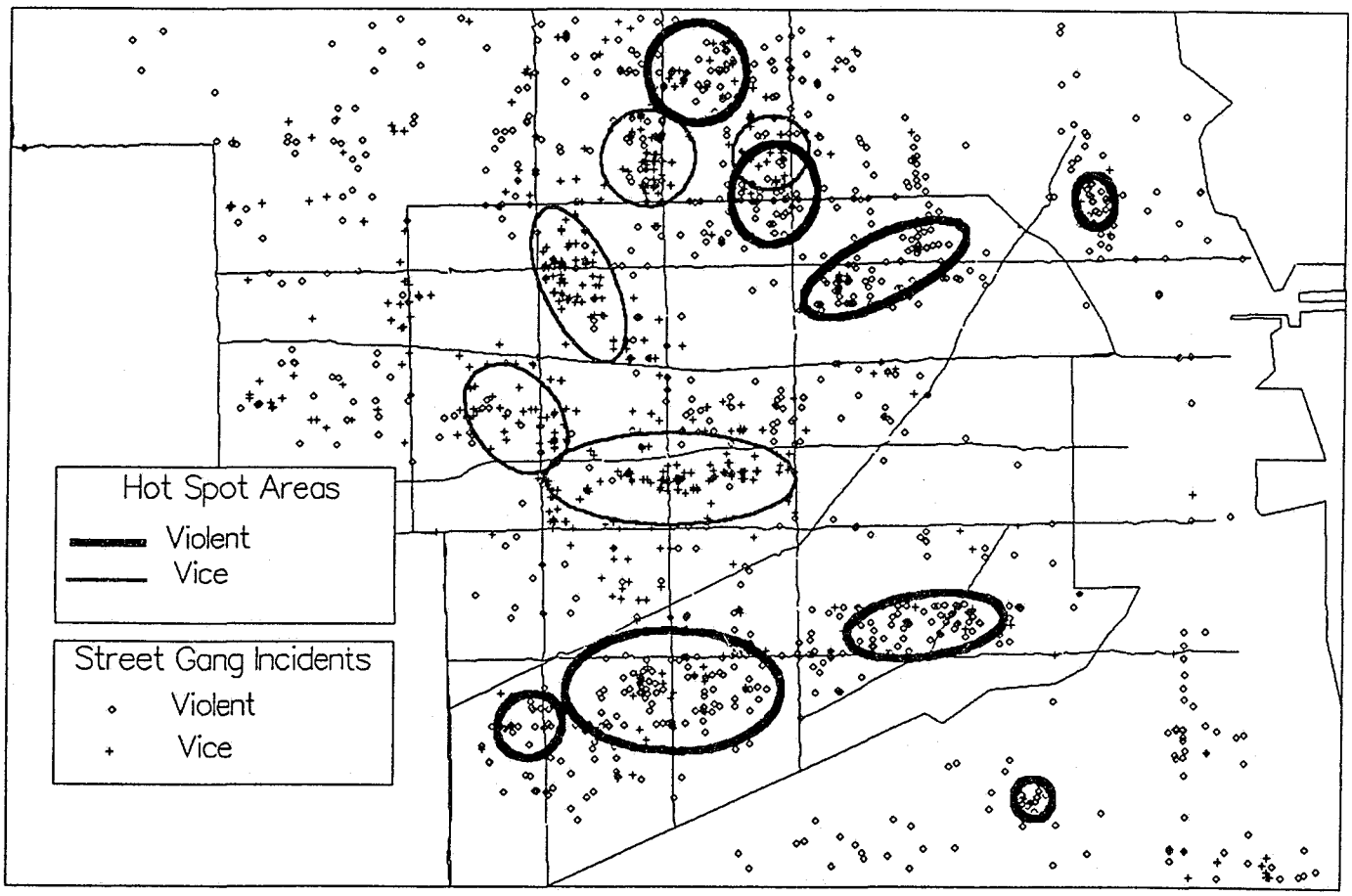


offenses are shown as "+" and violent offenses are shown as "o". The densest concentrations of street gang-related drug incidents are shown as light-line ellipses in Figure 7, and the densest concentrations of street gang-related violent incidents are shown as heavy-lines ellipses. This analysis shows that some neighborhoods have a Hot Spot Area of street gang-related drug offenses, others have a Hot Spot Area of street gang-related violent offenses, and still others have both. However, drug hot spots and "turf battle" hot spots are not necessarily in the same place (see Block & Block, 1993). If we are to develop a successful intervention strategy for street gang activity, we first must find out what kind of activity exists is a specific neighborhood. A city-wide program aimed at drug offending would have little impact in neighborhoods in which the preponderance of street gang-related incidents are not drug offenses, but violent offenses.

No matter how successfully we can develop an Early Warning System predictive model, however, it will not save lives unless there is a program that can use that information, and intervene in a potential crisis situation to save lives. Fortunately, the Gang Violence Reduction Program has been established in District 10 of the Area Four study area, to do just that (CPD, 1993). The goal of the program is to reduce street gang-related violence by a collaborative multi-agency and community-law enforcement approach. The GeoArchive and STAC are being used as an information foundation for developing intervention strategies and responding to crisis situations.

The long-range goal of the Early Warning System project is to develop a computer- assisted Early Warning System for neighborhoods in crisis, which will be transferrable to other police departments and communities throughout the country. Because of the importance of transferability of this project, the GeoArchive and computer-assisted Early Warning

Figure 7
Hot Spot Areas



System are being be set up so that they can be updated, maintained, mapped, and analyzed by police analysts within the Area headquarters. We hope that the project will become a prototype for other neighborhoods and cities in developing similar automated systems for Hot Spot Area identification.

In summary, STAC is a database-driven, objective statistical tool that begins with individual pin map data and builds areas. STAC Hot Spot Areas reflect the actual scatter of events on a map, not arbitrary boundaries or predefined areas. Such statistical tools are necessary to control the "data overload" of law enforcement and community information, so that this information can become a foundation for community problem-oriented policing and other neighborhood-based problem-solving strategies. With a GeoArchive database of current, local level law enforcement and community information, a theoretical framework and a statistical toolbox to organize this information, and cooperative community and law enforcement resources to intervene in a problem or crisis situation once identified, we can not only reduce levels of property crime, but also reduce the risk of injury and death from violence.

Notes

1. Digitizing is the development of a map, such as a city street map, in which features (streets, rivers, expressways, and so on) have x-coordinates and y-coordinates for automated mapping.

2. See Smith and Patterson (1980) for a discussion of cognitive maps.

3. In the nomenclature of cartography, maps based on areal units are referred to as "choropleth" maps. This presentation substitutes the less technical term "areal" where possible. It also uses "pin map" or "point" as synonyms for address-based information, because many of the events that must be mapped in a law enforcement application do not occur at addresses. For example, the location of the body of a homicide victim may be in a river, underneath a viaduct, along railroad tracks, or in the middle of a large park or parking lot.

4. Isopleth maps define spatial similarities, and enclose them with a boundary on the map. For example, weather maps often include isobars, a line connecting points having the same barometric pressure.

5. For a study comparing cognitive hot spots to Hot Spot Areas of officially-recorded crime, see the presentation by George Rengert elsewhere in this volume.

6. The departments requesting hot spot capability were users of the Authority's PIMS (Police Information Management System), who were using the computer mapping software developed by PIMS and running on the HP 3000 mini-computer.

7. Responding to such requests is one of the functions of the Authority's Statistical Analysis Center (SAC). SAC staff help people use data. To do so, they search for, test, document, adapt, and if necessary develop, statistical tools that are applicable to practical criminal justice situations.

8. Paul White, the Bureau of Justice Statistics grant monitor for the two STAC projects and for the Early Warning System project, had the vision to see the potential of STAC at its infancy. His enthusiasm about STAC, and his moral support, encouragement and advice were invaluable. Without Paul White, STAC would not exist.

9. STAC currently has two modules, TIME and SPACE. SPACE currently includes Nearest Neighbor Analysis, Mean Center, radial searches around an address or other location, and another perspective on clustering, the Isocrime. For more information about STAC, see the newsletter, *STACNews*.

10. For testing, "flat files" were created by downloading data for a given month and offense type from the PIMS management system.

11. Sharyn Barrington-Carlson re-wrote STAC in C++.

12. For a full discussion of this issue, with examples from the test departments, see Bates (1987).

13. James Spring's NNA program is written in FORTRAN. One of our priority STAC projects, given the resources, is to re-write it in C++ and integrate it with the rest of STAC. For more information on NNA, see Boots and Getis (1988).

14. The NNA capability is currently limited in the STAC program to 400 cases. We hope to remedy this in the next version of STAC.

15. The current version of STAC ranks Hot Spot Areas by the number of incidents in the cluster. In the enhanced version now being developed, the user

will have a choice of alternative ranking criteria, including density (incidents per area of the ellipse).

16. Although STAC identifies the densest areas on a map regardless of arbitrary boundaries within the study area, the outer border around the study area is still a factor. A cluster of events that crosses this outer boundary may not be identified as a hot spot area as readily as a cluster within the study area. This border problem has been generally recognized in spatial point pattern analysis, but is so far unsolved (see Boots & Getis, 1988:49-45 for their discussion of "edge effects").

17. The process of drawing Isocrimes is not yet fully automated in STAC. We expect to add it in the next version.

18. To identify Isocrimes, we first find the most tightly clustered 30 percent of events within the study area (using Nearest Neighbor Analysis), and determine the mean center of these events (an imaginary point that is closer to all of these events than any other point). An enclosed irregular line is then drawn around the 10 percent that are closest to the mean center. Subsequent lines enclosing 20 and 30 percent may be drawn in other colors. Reader perception is improved if the inner (10%) isopleth is drawn in red, and the outer isopleths in cooler colors.

19. A secondary Isocrime cluster can be identified by re-running the Isocrime routine on the remaining incidents after the first 30 percent have been eliminated from the dataset. To identify more than two Isocrimes on the same map, the 30 percent criterion should be changed to 20 percent or less. However, users need to document the criterion they use, because the centroid of the tightest 10 percent often differs from the centroid of the tightest 20 or 30 percent.

20. After a long but unproductive search by STAC staff, STAC user Richard Block finally found this package, a public-domain program published by the U.S. Bureau of Land Management (BLM). Graham Taylor then wrote a "shell" program in C++, which took geocoded longitude/latitude data through the BLM translation to State/Plane, ran STAC, then returned 64 points defining each ellipse boundary to the BLM translator to produce longitude/latitude coordinates for mapping. Richard Block further modified this program, so that the dataset containing the points defining the ellipses is in the proper format for MapInfo boundary files. All of this is invisible to the user, who simply runs STAC and sees the results appear as ellipses on a map.

21. A GeoArchive is a database containing address-based data from both law enforcement and community sources, linked to computer mapping capability, and set up so that it can be updated, maintained, mapped, analyzed and used by those who are developing and implementing strategies of crime reduction in the community. It is an "Information Foundation for Community Policing."

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by James L. LeBeau

The temporal ecology of calls for police service

Introduction

In its original format this presentation involved fifty color slides most of which were images emanating from a raster based geographic information system (GIS) known as IDRISI. Because of the prohibitive costs of reproducing and printing color images and the technical problem of losing important information and effect from converting color images into gray scale images this presentation is a drastically modified and reduced version of the original.

The original presentation demonstrated how raster based GIS, three dimensional diagrams, and spectral analysis are combined to illustrate how different types of calls for police service vary geographically and temporally across a city, and how different types of calls for service occurring in specific ecological areas exhibit distinctive temporal rhythms. The data for this presentation emanated from the computer aided dispatch records of the Charlotte, North Carolina, Police Department.

The data for this presentation are calls for service involving domestic disputes during the years 1986 and 1990. The geographic unit of analysis is the police response area which is smaller than a census tract and larger census block groups. The number of response areas is 499. The temporal unit of analysis used in the spectral analysis is the number of individual three hour periods for a year, there are 2,920 three hour periods.

Raster GIS, Gridded Data, and Spectral Analysis

A geographic information system is any manual or computer based set of procedures used to store and manipulate geographically referenced data (Aronoff, 1989). Computer based geographic information systems represent digital data in either vector or raster formats. In the vector format geographic features or boundaries are represented by a series of coordinate points and lines referenced by some form of grid system, e.g., xy Cartesian coordinates, longitude - latitude. In the raster format the geographic surface to be mapped is divided into a row column matrix or grid lattice. Therefore, identifying a feature or boundary involves allocating a particular value or color shading to the cells containing the feature or boundary (Eastman, 1992).

Both systems have their advantages and limitations. The raster format is very data intensive and presents storage problems. The vector format is very good for data base management, storage, and producing attractive maps. The main advantage of the raster format is that it has much more analytical power than the vector system (Eastman, 1992). Thus, vector systems produce pretty maps while raster systems are more amenable to geostatistical analysis.

Related to the raster format is gridded data or grids which describe a surface taken at regular intervals. Gridded data are location based and describe what exists at a location given a specific map scale (Langran, 1992). A major drawback of gridded information, like raster, is that it is difficult to determine the perimeters, shapes, and the contiguities of different features (Langran, 1992).

Spectral analysis is the appropriate technique for isolating significant temporal rhythms. The technique is used to breakdown a stationary and detrended time series into uncorrelated cycles (Brantingham & Brantingham, 1984). In other words, spectral analysis is an analysis of a time series in the frequency domain. A cycle is basically when a phenomenon goes from it highest point-to its lowest- and back to it highest point. "Each cycle is a sinusodial function of time and its frequency represents the fraction of the cycle completed in a given time unit. The period is the reciprocal of frequency and represents the number of time units required for the completion of the cycle" (McPheters & Stronge, 1974). High or fast frequency phenomena have a higher proportion of the cycle completed per unit time. While low or slow frequency phenomena have a lower portion of the cycle completed per unit of time. The essential part of spectral analysis is the calculation of the spectral density estimate which is relative importance of each frequency in terms of its relative contribution to the variance of the entire time series (Parkes & Thrifte, 1980). The highest spectral densities for particular frequencies are what constitute the rhythm.

In the IDRISI raster format the 165.68 square mile area of Charlotte, North Carolina was represented by a 300 x 300 matrix or 90000 cells. The forthcoming three dimensional diagrams of Charlotte utilized gridded data of a 21 by 21 matrix or 441 cells. Therefore the area covered by each cell in the later data set encompasses more area than the raster format. This means that the number of domestic disputes in a specific cell or grid is an average of several contiguous response areas.

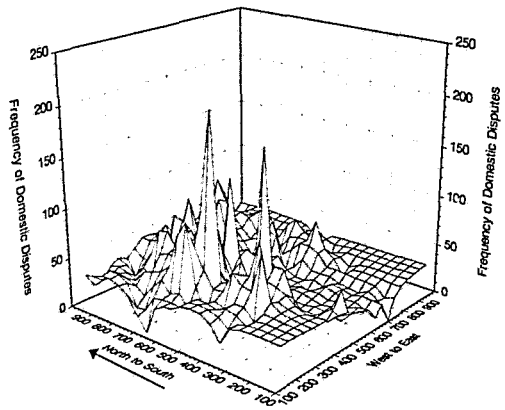
Domestic Disputes, 1986 and 1990

During 1986, the Charlotte Police responded to over 20,875 calls for service pertaining to domestic disputes. Figure 1 is a block diagram depicting the grid locations and the frequencies of domestic disputes. The southern portions of the city are relatively inactive compared to the central, northern and western sections. Some of the grids recording the higher frequencies of domestic disputes have large public housing projects located in them. If we examine the point on the *Frequency of Domestic Disputes* axis where the grids appear level or uniformly equal we can see that approximately during 1986 the average number of disputes was near 30.

During 1990, over 30,000 domestic dispute calls were received by the police (Figure 2). The average level of calls rose to almost 50 for each cells. The same areas that were high during 1986 were high during 1990 (compare Figures 1 and 2). Moreover, the central east section of the city appears to increase dramatically (Figure 2). As previously mentioned, one of the advantages of using raster or grid data is enhanced analytical capabilities. Thus, if one wants to examine the changes in the distribution and quantity of a phenomena over time all that is required is the mathematical manipulation of identical rasters or grids.

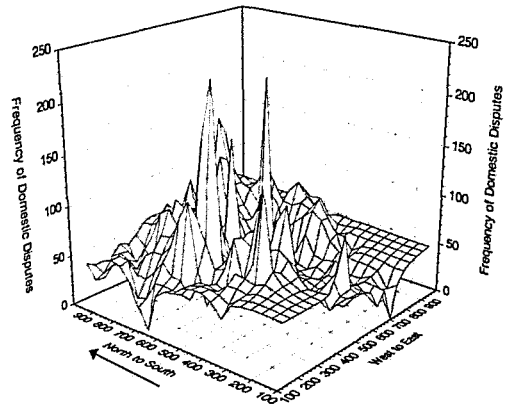
In Figure 3, the 1986 value in each grid was subtracted from the 1990 value to produce a block diagram of the differences in domestic disputes. As we can see some of the highest areas during 1986 experienced further dramatic increases during 1990. Furthermore, the increases in central eastern portion of the city suggested from the comparison of Figures 1 and 2 is confirmed by Figure 3. In the original presentation, the differences in domestic disputes was displayed on a two dimensional image with colors denoting the changes. Brighter colors indicated areas experiencing increases in calls while the darker tones indicated decreases. The utility of examining calls for service in this matter is that it is an aid for strategic decision making especially in regards to matters pertaining to workload analysis.

DOMESTIC DISPUTE CALLS: Charlotte, N.C., 1986



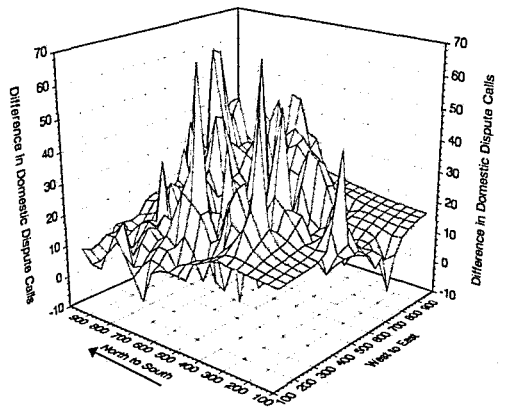
Scale 1 inch = 5 miles

DOMESTIC DISPUTE CALLS: Charlotte, N.C., 1990



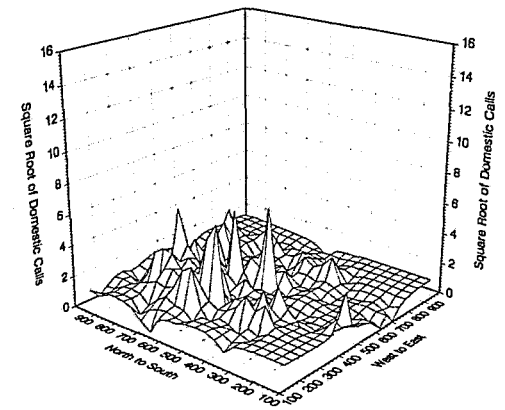
Scale 1 inch = 5 miles

DIFFERENCE IN DOMESTIC DISPUTE CALLS: 1986 - 1990

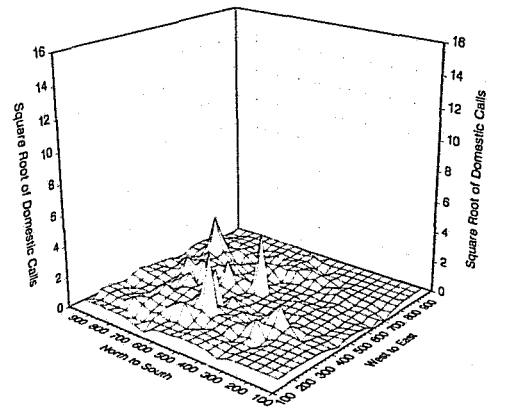


Scale 1 inch = 5 miles

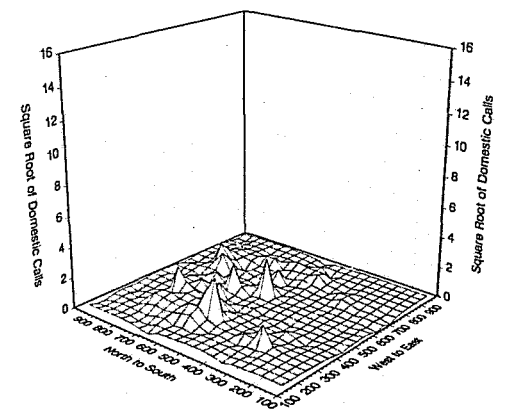
DOMESTIC DISPUTE CALLS: SATURDAY, 01:00
CHARLOTTE, N.C., 1986



SATURDAY, 04:00



SATURDAY, 07:00



Domestic Disputes Calls On Saturdays

During 1986, 19.97 percent of the 20,835 domestic dispute calls occurred during Saturdays. The following eight figures depict the square root of the frequency of domestic dispute calls for every three hour period on Saturdays during 1986. The three hour periods emanate from another study which examined domestic dispute calls with the oscillation of the temperature-humidity index. The three periods corresponds to the temporal unit used for recording weather data (LeBeau, 1994). The three hour period on each figure represents the midpoint of the interval. For example, the period 01:00 represents events occurring between 23:31pm to 02:30 am.

The 01:00 period was the second highest period recording domestic disputes calls with 782. The distribution of calls is depicted in Figure 4. The highest areas at 01:00 during Saturday reflect the highest areas for the whole year (Figure, 1986). The southern and east sides of the city are relatively inactive compared to the west, central, and northern sections of the city. The highest areas or grids are those containing large tracts of public housing.

During 04:00, 351 domestic disputes occur in Charlotte (Figure 5). While a majority of the grids or areas are inactive many in the center of the graph which is also near the center of the city are relatively active. Furthermore, the same areas active during 04:00 are active during 07:00 (Figure 6). The 07:00 period is the least active with 236 calls. As a matter of fact this hour is pivotal or the trough of a cycle. In other words, the number of domestic disputes from 01:00 bottom out at 07:00 and increase during subsequent hours achieving its zenith at 22:00.

The disputes recorded during 10:00, numbering 358, indicate more activity on the west side of the city, but still many of the areas that were active during 04:00 and 07:00 are active during this time (Figure 7). The early afternoons (13:00) on Saturday produces 419 calls (Figure 8). The distribution shows an increase in calls in the areas that are active during the morning hours (04:00, 07:00, 10:00). The 16:00 period during Saturday yields 483 calls (Figure 9). Still the distribution mirrors those occurring after 01:00.

The 19:00 period produces the third highest number of calls with 732. Still this distribution mirrors the other periods (Figure 10). There is, however, a major difference in the distribution in that the frequencies in some areas are becoming radically different or more pronounced from others. The differences between areas are intensified during 22:00 (Figure 11). During this period 800 calls were received. The major of the high domestic dispute areas are the central, western, and northern portions of the city. The highest area during 22:00, with almost 144 (12) calls is census tract 39 which is contiguous to the airport with a majority of the residential land use in the tract public housing.

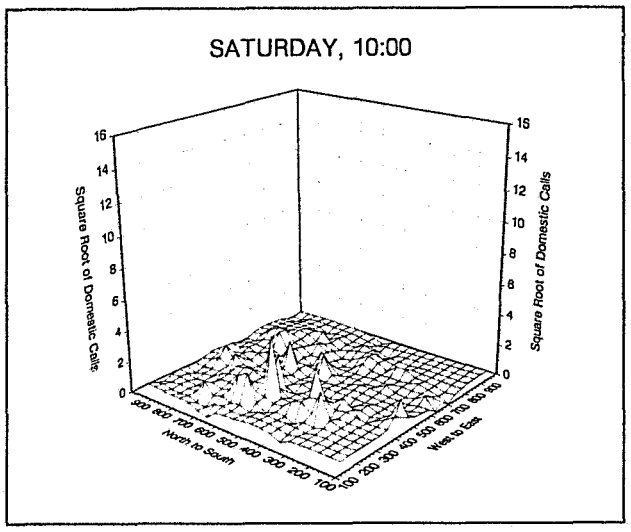
This exercise and the associated graphics have illustrated how a particular type of call for service oscillates or varies through out a day. This methodology would useful for monitoring the spatial and temporal distribution of particular calls or types of problems, thus providing the baseline for measuring the effects of any intervention strategies.

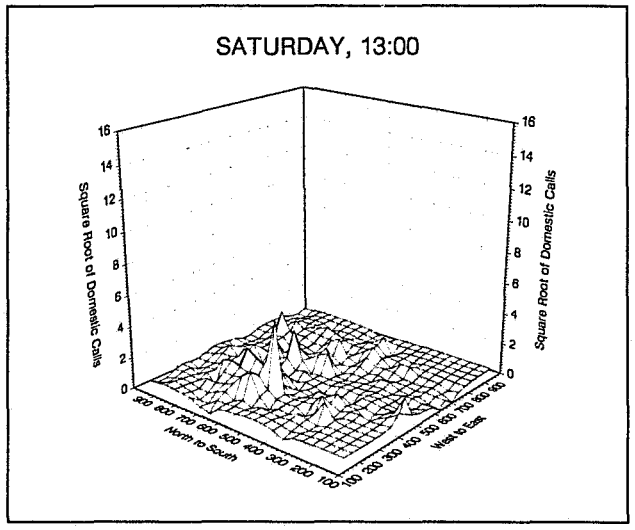
The Temporal Rhythms of Domestic Disputes

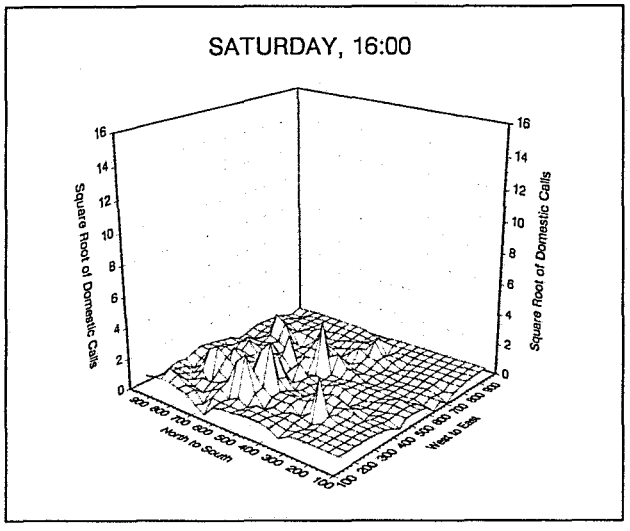
The previous discussion have demonstrated how domestic dispute calls for service vary across space and time. This discussion focuses solely on the time or temporal dimension of the domestic disputes occurring in two census tracts. Both tracts are predominantly public housing projects. In terms of demographic, racial, and socio-economic status the tracts are similar. One is more populated, hence explaining a greater number of disputes. Yet the temporal rhythms for the two tracts are different.

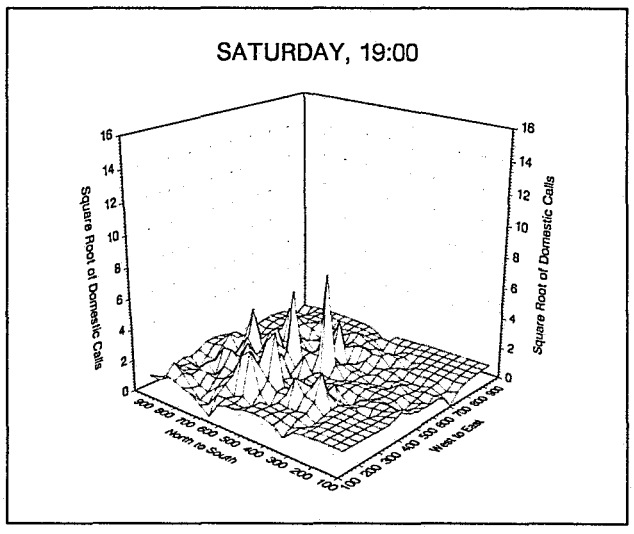
Figure 12 shows the number of calls occurring every three hours in tract 39 during 1986. The were 1408 domestic disputes during 1986 for an average of .48 every three hours. The graph indicates that tract 39 experiences more domestic disputes during the spring and summer than during the other seasons.[1] Figure 13 is the frequency of disputes in tract 50 which totaled 968 during 1986. Conspicuously absent from this graph is higher frequencies of disputes during the warmer months. This evidence implies that the timing of domestic disputes between the two tracts is different.

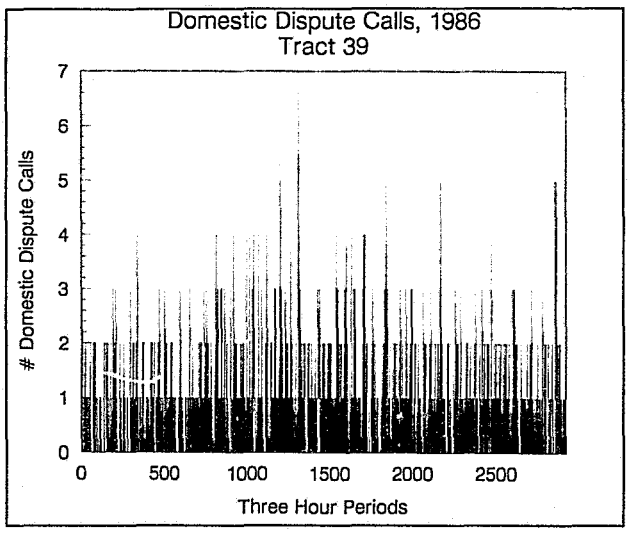
The time series of domestic disputes for both tracts were submitted to a spectral analysis in order extract the significant cycles or rhythms. Figure 14 shows the spectral analysis for tract 39. The x axis is the number of cycles per three hours. Thus the far right figure on the x axis is interpreted as .5 cycles per 3 hours. This position on the scale indicates a six hour rhythm, since in order complete a full cycle there must be two three hour periods. Moving towards the left on the x axis at .25 cycles per three

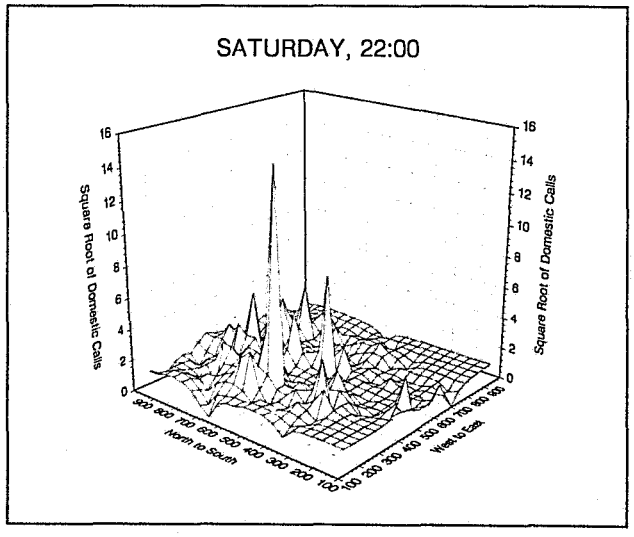

SATURDAY, 10:00
Square Root of Domestic Calls
Square Root of Domestic Calls
North to South
West to East


SATURDAY, 13:00
Square Root of Domestic Calls
Square Root of Domestic Calls
North to South
West to East


SATURDAY, 16:00
Square Root of Domestic Calls
Square Root of Domestic Calls
North to South
West to East


SATURDAY, 19:00
Square Root of Domestic Calls
Square Root of Domestic Calls
North to South
West to East


Domestic Dispute Calls, 1986
Tract 39
Domestic Dispute Calls
0
1
2
3
4
5
6
7
0
500
1000
1500
2000
2500
Three Hour Periods


SATURDAY, 22:00
Square Root of Domestic Calls
Square Root of Domestic Calls
North to South
West to East

hours is the 12 hour rhythm since there must be 4 three hour periods to achieve one full cycle. The large spike on the x axis at .125 cycles per three hours is the daily cycle, since it takes 8 three hour periods or 24 hours to obtain one cycle. As one moves to the right on the x axis the faster the rhythms and to the left the slower the rhythms. The y axis indicates the spectral density or the strength of the rhythm at a particular frequency or cycles per three hours.

The 24 hour (.125 cycles) and the 12 hour (.25 cycles) rhythms are the strongest in tract 39. Moreover, there are many other significant faster rhythms to the right of 24 and 12 hours. The distinguishing characteristic which separates this tract from the other lies in the lower or slower frequencies to the left of the 24 hour rhythm and the 2.5 day rhythm at .05 cycles per three hours. Tract 39 has significant slower rhythms corresponding to the week, month, and at .00138 cycles per three hours (not visible on the graph) which is 90.57 days. The latter rhythm corresponding roughly to a seasonal cycle.

The spectral densities for tract 50 are presented in Figure 15. Like tract 39 this one has significant 24 hour (.125 cycles/three hours) and 12 hour (.25 cycles/three hours) cycles as well as many other faster cycles. However, the difference between the two tracts lies in the rhythms to the left of 24 hours (compare Figures 14 & 15). Tract 50 does not have the longer cycles like tract 39 with very pronounced spectral densities at around 90 days or a month. Tract 50's longer cycles are between 2.5 days (.05 cycles per three hours) and 24 hours (.125 cycles per three hours) (Figure 15). Thus, it appears from the graphs that tract 39 has a seasonal rhythm where tract 50 does not.[2]

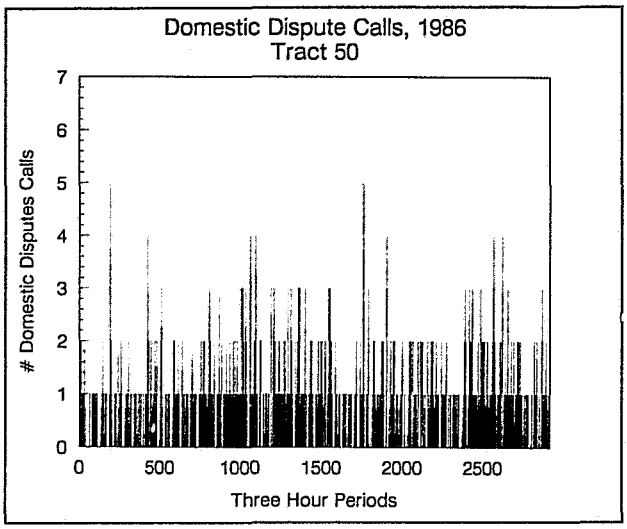
Several reasons can explain the temporal differences between the tracts. The fact that one had more disputes than the other is a possible explanation. Significant differences may exist between the populations of the two tracts. However, difference in the locations of the tracts may explain the different rhythms. Tract 50 is situated in the northern portion the city. The boundaries of the tract consist of major highways and interstates. Tract 39 lies on the west side of the city and was by far the most active one area during Saturdays at 22:00 (Figure 11). Adjacent to the housing projects in tract 39 is the airport. The activities of this land use may have an influence on the rhythms of domestic disputes in the tract.

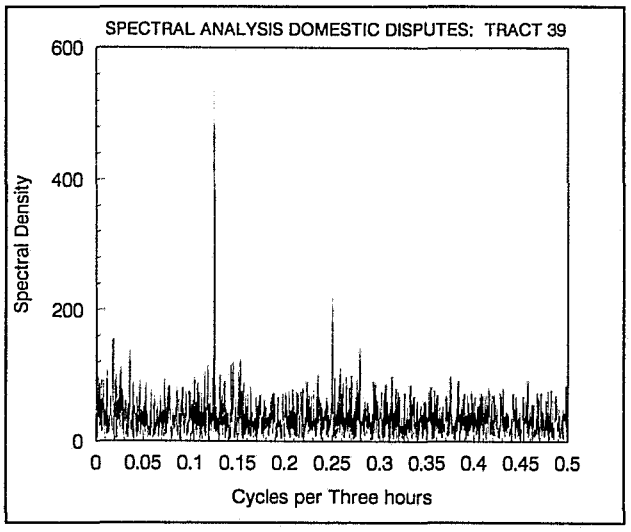
Research on temporal cycles and rhythms reveals that rhythms of one phenomenon may influence the rhythm of another. A zeitgeber, which is cyclic, is the rhythm forcing agent which entrains or adjusts the cycles of another rhythm (Parkes & Thrift, 1980; Halberg & Katinas, 1973). This situation may be occurring in tract 39 with the rhythm of airport activity influencing the seasonal or longer cycles of domestic dispute calls for service. As we all the know during the spring and summer the days become longer and the weather is warmer. Many public housing units lack air conditioning, therefore, leaving the windows open is one of the few, yet marginally effective, measures for coping with heat discomfort. If airline traffic follows a seasonal cycle with more business during the summer than other months this means more traffic and noise near the housing projects in tract 39. Seeking relief from the heat may involve increased consumption of alcohol while increased exposure to the noise may induce sleep deprivation.[3] Annals of The Association of American Geographers 74: 590-604(1984). The presence of these factors present the opportunities for exacerbating existing disputatious relationships and for spawning new ones.

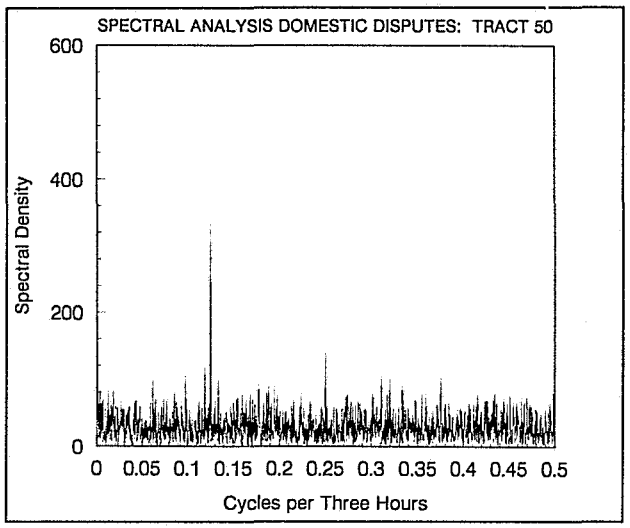
It will require additional research to assess the validity of the previous proposition. However, this exercise serves to illustrate how the interaction among space, time, and the content of place produces distinct rhythms.

Conclusions

Fine tuning this methodology has many practical implications for police planning. As previously stated examining the spatial patterns and the temporal rhythms of different types of calls for service is useful for workload analysis and estimating the impacts of interventions. However, isolating the zeitgebers that are entraining the rhythms of a particular type of call or crime has implications for problem oriented policing. It may be possible to control or modify the entraining rhythm thus exerting some control over the rhythm of the call or crime problem in question.







Notes

1. For your reference time period 10:00 - 22:00, May 5; 15:00 - 10:00, July 7; 20:00 - 22:00, September 7.

2. There are many other tests which can be used to determine if rhythms are significantly different. See

D.R. Brillinger (1975), Time series: Data analysis and theory. New York: Holt, Rinehart and Winston, Inc.

3. For a discussion of the interactions among the type of neighborhood, heat stress, alcohol consumption, and assault see Harries, Stadler and Zdorkowski (1980), Seasonality and assault: Explorations in inter-neighborhood variation, Dallas.

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by Patricia L. Brantingham
and Paul J. Brantingham

Crime analysis using location quotients

Overview

Crime complexity. The study of crime is inherently complex. *Crime* has many meanings. Measuring crime, under any definition, is difficult. There is no single type of crime and no single way to analyze crime, however it is defined. Murder is not equivalent to burglary; burglary is not equivalent to shoplifting; one time offenders are different from multiple offenders; legal definitions of crime are not necessarily equivalent to personal or social definitions of crime. Even crimes that fall within the same working definition and category are not identical in legal, behavioral or social seriousness, either to society in general or to subgroups within society. Nonetheless there are similarities and commonalities among crimes.[1] There are persistent patterns in criminal behavior. The study of crime involves developing methods to discover or uncover the regularities, commonalities and similarities among crimes. The development of such methods is difficult and tends to evolve slowly. Only a few ways of looking at crimes quantitatively have been developed in the last century. This paper explores the use of a technique used in regional science, the **Location Quotient**, as a potentially useful measurement tool for the analysis of crime. The location quotient has primarily been used to measure the relative economic specialization of areas within some arbitrarily defined geographic region. Although the size of regions under study may vary, the location quotient measures how subareas differ in patterns, not volumes or rates, of some measure of economic activity such as employment. It is a relativistic or conceptual measure. Its application to the study of crime could, potentially, give us some very different understandings of crime patterns.

Difficulties in Measuring Crime. Many different measures have been developed to describe crime as an event. They might be most easily divided into two categories: aggregate measures and individualistic measures. *Aggregate* measure techniques were pioneered by cartographers of crime such as Guerry (1833) and Quetelet (1842) and have been used by most criminologists since. The are used primarily to look at the amount of crime in some summary unit. The summary unit may be a group of people; a country; a state, province or region within a country; a city or something else that makes empirical and theoretical sense. Such aggregate measures may take the form of incident count totals or may be expressed as some type of ratio such as crimes per 100,000 population or burglaries per 1000 dwelling units. *Individualistic* measures are used in both criminal justice system operations and in research to identify

what is happening either to or at some specific location; or in some specific type of situation. The individualistic measure might take the form of the number of crimes at ten specified bars or the crimes that occur at a specific parking lot or within a specific family. The measures for the specific units might be sums or ratios or risk measures, but the focus is on specific situations or sites. As the size of the specified individual unit increases, individualistic measures begin to merge with aggregate measures, but at the extremes they are different in their focus.

Whether the researcher is looking at aggregate or individualistic measures, there are several major problems. The problems are related to the purpose of the research. As is frequently discussed,[2] when the purpose of the research is to obtain a count of the actual number of violations of some specific law, official data generally provide an undercount.[3] Victimization surveys, on the other hand, probably produce an overcount. These surveys telescope crimes into incorrect temporal frames and count personal perceptions that crimes have occurred, not legal evaluations of the events in question. When the purpose of the research is to explore a crime problem in a specified small geographic area, victimization surveys are fraught with difficulties. Victims move; the persons interviewed may forget or telescope or be unaware of victimizations of others living at the same residence; sample sizes must be enormous and consequently cover long periods of time; the area under study may also change, making the data difficult to analyze. Police data tied to other archival data are probably better than victim survey data for spatial analysis of crime as long as there is no reason to assume that the spatial patterns are altered by variable reporting or recording patterns for which adjustments cannot be made.[4] So long as the analysis is searching for patterns of events rather than enumerations of unknown events official data may be used with reasonable comfort.

Another major problem area, originally discussed by Boggs (1960), involves the difficulty in using ratio measures. She explored the problems with how patterns change as the denominator in a ratio changes. For example, auto theft rates based on residential population, a popular ratio, produces a very different picture of high and low crime areas in a city than the picture produced when the rate is calculated using the number of cars present at different places at different times. Bogg's work has been carried many steps further by Harries (1991). Both show the interesting variability in what is seen when different denominators are used to calculate crime rates.

They and others also discuss the statistical problems in the analysis of crime. For example, when rates are used in parametric statistics, the independent variables usually have denominators equal to or highly correlated with the denominator used for the dependent variable. Results may be tied to the types of measures used. Similarly, in analysis for varying regions problems occur when no adjustments are made for the size of the regions or for spatial auto correlation.[5] Other problems appear when point data are used. For example, while current methods are being developed and extended to address some of these problems, available statistical packages do tend to use simple measures of distance between points and do not make it easy to adjust analysis routines to fit actual urban and human contexts when similarity and dissimilarity are not necessarily measurable or even conceivable in simple Euclidean distance measure (Brantingham & Brantingham, 1993a).

Most measures static; Backcloth variable. Overall, the largest problem may be that most of the measures of crime used by criminologists are *static* while the sites and situations of crimes commonly vary. For example, crimes for some city such as Vancouver or Chicago or Miami may be identified by address, aggregated to some areal unit and analyzed as a rate with a fixed denominator such as number of persons resident or square feet of commercial space or number of licensed bar stools. The denominator is fixed, but in actual daily living the background of crime is always changing. Bar assaults probably relate to variable usage of bar seats; auto thefts are related to traffic flows and parking patterns; burglary probably relates to the varying presence or absence of persons at home (Cromwell, et al., 1991). The address location of a criminal event is also fixed, yet the crime may be the end result of some active search pattern on the part of the offender (or sometimes on the part of the victim). Information about the steps in the offender's search decision process is not available from baled information about the spatial end point of that process. Inferences may be made, of course, but for most crimes direct measurement is difficult, if not impossible. Dealing with both the variability in the situational backcloth and the decision processes employed by offenders in seeking out targets requires conducting both interviews and simulation exercises with offenders. Such research is difficult to undertake, is fraught with ethical issues, and must be done with care (e.g., Bennett & Wright, 1984; Rengert & Wasilchick, 1985; Sherman, et al., 1989; Cromwell, et al., 1991).

Regional science has always been plagued by some of the same analytic problems as criminology. Regional scientists want to explore how areas grow, how they change and why. They are interested in analyzing change and in exploring patterns within some local regional context, but normally have only fixed point data. Trend and movement pattern data inferred from fixed point data for use in time series analysis is fundamental to regional science research.

Regional Science Measures

Background. Regional science and the related field of regional planning have always looked for ways to compare activity at metropolitan and regional levels of aggregation. The primary purpose is frequently to find a reasonable way to make predictions about future economic activity. In some cases the best predictor may just be the average value of that which is being studied, but in regional science there is an underlying interest in developing predictions based on theoretical assumptions about how a metropolitan or regional economy functions. Using results of research based on these assumptions, regional economists and planners propose changes in the underlying infrastructure in order to effect changes in regional economic activity. Usually the intended changes are supposed to improve the stability of the underlying income generating base and improve individual incomes in the region.

Basically in this type of analysis each metropolitan area or small region is seen to depend on its own resources, on surrounding resources, on transportation links to other areas (rivers, roads, rail lines, airplane routes) and on economic demands of local and surrounding areas and regions. For example, a metropolitan area may be a manufacturing, commercial and trade area such as Jacksonville or it may be an institutional area with governmental agencies and universities such as Tallahassee or Gainesville or it may be a combination area with many different economic activities such as Miami or Tampa Bay. What happens in a metropolitan area and its surroundings is not independent of larger regions, the country or the world economy, but neither is it totally dependent on what happens in larger regions. From another perspective, metropolitan areas or regions are not necessarily identical and consequently not necessarily easily compared. For example a city in Maine or Iowa may be a commerce and service center, but will be much smaller than New York or Los Angeles, which are large commercial and service centres. Comparisons are possible but, as in criminology, depend on the measures being used.[6]

Regional science and planning approaches tend to try to divide economic activities into categories. The categories most frequently seen by people outside these disciplines are formed by the division of goods or services into those which represent the last step in a process, that is the final purchase, and those that are intermediary economic steps necessary to the final purchase. The purchase of food that is eaten by the purchaser is the end of a process of agricultural actions and harvest, intermediate transport and packaging. There may be many steps in such a process. Tied with this is the concept of *value added.* At each step in the process, effort, work or marketing may add to the cost or value of goods or services. It is generally found that a city or region that has a mixture of final and intermediate activities with value added at most steps is more stable economically as the diversity of its economy increases and as the value added through economic process is used to purchase more goods locally. In general, primary extraction regions (those specializing in mining, forestry or farming, for instance) are at more risk of being effected by economic changes outside the region than other types of areas. There is some local economy, but most products are exported from the region, value added at different locations, and high value added goods purchased from elsewhere. Service centres (those places with economies heavily weighted to banks, insurance services, schools, government offices, real estate agencies, restaurants), particularly those with a mixture of intermediate manufacturing activities have more potential stability. In fact, services are replacing manufacturing and primary industry as the base for much western economic growth.

The notions of final versus intermediate goods and of value added to goods are analytic frameworks used in regional economics and planning that suggest the use some analogous research measures for criminologists. For instance, measures of unequal distribution of wealth or income among individuals, such as the *Gini index*, have been applied by criminologists to consideration of the role played by income inequality in shaping aggregate violent crime rates (e.g., Loftin and Hill, 1974; Braithwaite and Braithwaite, 1980) More recently, Barr and Pease (1990) have used the Gini index as a method for assessing the equality of victimization risk experienced by different types of neighborhoods in England. Barr and Pease also used *location quotients*, the main focus of *this* paper, to assess concentrations of different types of crime in different

types of neighborhoods. As we hope will become clear in what follows, we think that such borrowing of regional science techniques by environmental criminologists is likely to prove fruitful. Moreover, we think that the utility of these techniques is much greater than even Barr and Pease have so far suggested.

Crime could be considered as part of the economy. For example, some crimes can be treated as final production steps, but some (perhaps most) are intermediary. Murder and theft of goods are different. Theft frequently involves more than one step before its objective is reached. Stolen goods are sometimes consumed or used by the thief, but are frequently sold for cash or exchanged for other goods such as drugs. In fact the sale may actually be several sales. For example, when a wallet is stolen cash is taken. Credit cards may also be used or sold to others. The identification papers contained in the wallet may also be used by the thief or sold to others. We experienced a personal theft of a wallet within the last six months that illustrates the steps that may be involved in this kind of theft. One of us had a wallet stolen from the office at the university. Cash was, of course, used. While credit cards were immediately canceled,[7] there was an attempt to use them. More important for the analogy, identification cards in the wallet were modified (a new picture added and home address changed on some) and used to open at least ten, but probably twenty different bank accounts. As is common practice in many banks, a small number of coded checks were issued by each bank branch where an account was opened for the convenience of the new "customer" while a supply of customized checks was being printed. These interim checks were used by the thief to purchase large quantities of goods from merchants all over the city during the short time it took for the checks to begin bouncing. Most of these fraudulently purchased goods, ranging from $500 worth of meat from a large supermarket to $300 worth of linen from a department store to a $1,000 professional lawn mower, were fenced to a superintendent of an apartment building who in turn sold them to a variety of customers. Assuming that many of the goods were probably sold to small store owners, value was added as the goods were sold to the general public. On the other hand, some types of shoplifting are single steps. Teenagers may simply steal goods they want to use personally. When this happens the theft is just one step. Murder may be considered a final step in most situations, but in extremely rare cases it is an intermediate step in some larger process.

The wallet theft just described is an indication of what is usually called the *multiplier* effect. One purchase (crime) leads to another purchase (crime). Good economies produce high multiplier effects; weak economies do not. Conversely, crimes that generate more crimes create increasingly bad situations. Unique crimes, with no multiplier effects, are preferable. In his research on crack houses, George Rengert shows a local multiplier effect. Burglaries follow the crack houses; or, put in multiplier terminology, the crack houses commit crimes (dealing in illegal drugs) that have a multiplier effect in the neighborhoods in which they locate, raising the burglary and theft volumes in their vicinity as customers raise the money to buy the drugs. One of the reasons that street walking prostitutes are seen as so objectionable is that their activities have crime multiplier effects in the neighborhoods in which they operate. These additional crimes range from relatively trivial offences such as illegal parking and littering (albeit with used condoms and disposable hypodermic needles) to more serious offences such as wallet thefts and robberies to very serious offences such as beatings and serial murders (usually of the prostitutes themselves).

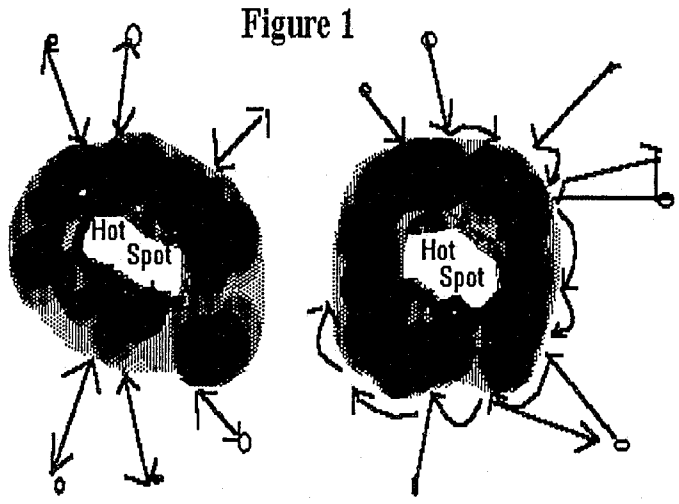
At a broader level, hot spot analysis of crime in cities (Illinois Criminal Justice Information Authority, 1989; Sherman, et al., 1989; Block, 1990) may be tied to several types of multiplier effects. A hot spot may be generated, as in Rengert's studies, because those committing one crime commit other crimes in the same area. Hot spots may also be generated as a by-product of what is called an agglomeration economy. In business, some stores do well when they are separated from their competition, spaced a good distance apart. Others do better when they are grouped close together. The classic example of this is the location of car dealerships. When a car dealership is located far away from other dealers the business may do well if other dealerships are so far away as to be inaccessible, or if the car being offered is unique (a Lamborghini or a Rover Defender). Otherwise, the car dealer does better when located close to other dealers. Shopping for a car usually involves comparison shopping. When all dealers are close together, they jointly attract a larger set of potential customers who visit more dealerships than they would otherwise. This translates directly into more sales for all the dealerships than they would have experienced if they had been widely separated in space. That is why the multidealer auto mall has become a North American commonplace over the past decade and why there are still car dealer strips in most North American cities.

Agglomeration economies work for many different types of businesses. It is why we can see theater districts in London and New York. Department stores and shopping malls also represent agglomeration economies that produce increased volumes of opportunistic purchases. A person who goes to a shopping mall for one purpose, but buys other things because they are there and on display is caught up in the agglomeration effect.

The natural tie between the effect of agglomeration economies and opportunistic crime should be clear. Opportunistic crimes and opportunistic purchases are relatively similar. A suitable target (a good) is on display and is seen by a potential offender (customer) who would not have seen it but for the agglomeration effect. Sight of the target (good) triggers the desire to have it and a simple theft (assuming a suitable situation) by the offender replaces an impulsive purchase by the customer. This also explains something about the persistence of shoplifting: these thefts are a by-product of store agglomerations and displays of goods intended to trigger impulse purchases. The application of a number of security techniques that would reduce shoplifting would also almost certainly reduce the incidence of impulse buying by customers. Many department stores and malls tolerate some level of shoplifting as a cost of realizing the increased sales that come from agglomeration economies.

In crime hot spots there may be a location that attracts many types of offenders for many types of crime or a location that attracts one group of people who commit many crimes or many types of crime. Figure 1 provides a visual image of this pattern. The hot spot may have agglomeration economy impacts and/or a high multiplier effect.

Figure 1



Offenders come, commit an offence, and leave

Offenders come, commit several offences, and leave

Location Quotient

The *location quotient* is a simple measure used in regional science and planning. It forms the base of many more complex measures used for examining agglomeration effects, value added effects and multiplier effects. It is used to explore the relative specialization of an economic region or sub-region within the context of activities that surround the area of study. For example, a shopping center in a small town may be, for that town, a major center of activities and a major attractor of people, but would be a relatively small activity centre and people attractor if it were situated within a large city. Similarly in criminology, a crime hot spot in a small town might not even be seen as a crime node in a large city, but within the context of the two situations both crime concentrations could constitute empirical hot spots.

The location quotient measure as used in regional science is quite straight forward. The basic notion is that over some standard geographic area a certain "normal" proportion of a particular good under study is produced and consumed. The proportion of the good produced and consumed in a smaller study region is compared to the "normal" proportion characteristic of the "standard" area. While this sounds like a repetition of simple parametric statistics, if the region being studied exhibits the same proportions as the "standard" region then it is thought that the region is producing enough to satisfy its own local demand and is neither exporting nor importing that particular good. Employment data are typically used as the measure of activity in a particular industrial sector. Sales information, value added data or information on other types of economic activity could easily be used in place of employment data when available. Employment data are most commonly used because they are most commonly available.

The standard region is usually the meta-region (the country, the state, the county, the city) within which subareas are analyzed to see which are importers, which exporters;[8] and, ultimately, which experience agglomeration effects or multiplier effects. Equation 1 is the usual form of the location quotient when used to looking employment. When the ratio is greater than *1* the industry in the region is presumed to be an exporter. When the ratio is less than *1*, the region is seen to be an importer.

1.

$$\frac{\frac{E_{R_j}}{E_R}}{\frac{E_{N_j}}{E_N}} \lessgtr 1$$

where
N is the nation (or meta-region)
R is the region
j is the industry
E is the no. of persons employed

The equation is reformulated with variations depending on the purpose of the research. The standard output or basic region may vary depending on the industry under study or the availability of information. When location quotients are used for relative analysis, national averages often are taken as the norm. (This is similar to regression being used to determine whether independent variables give better estimates of the dependent variable's value for each data point than the dependent variable's mean value does.)

While there are obvious problems with the location quotient (all measures have weaknesses), it does offer some strength when used in comparative analysis. When the economy is broken into a finite and reasonable number of sectors, it is possible to see which regions appear to have a similar mix of employment and which ones specialize in one or more sectors. Similarity and specialization are relative measures based on the overall measure for the agglomerations of regions. But based on the relative nature of the measures it is possible to identify specialization within low activity areas. This has a natural carry over transformation when used in criminological analysis.

Location Quotient Use in Criminology

Some areas seem to be centers for violent crimes; some for property crimes. Some are centres for robbery; some for burglary; some for all types of crime. Relatively low crime regions can have high crime sub-areas, perceptual hot spots. High crime areas have low crime sub areas. The relative mix of high and low crime areas varies as the cone of resolution changes (Brantingham, et al., 1976; Barr and Pease, 1990). Some areas attract those who commit a broad range of crime types, that is, some areas have high multiplier effects. Some only attract one type of offender. When ecological, a location quotient can help identify relatively high and low crime areas and, since it represents a measure of the relative mix, it can serve as an indicator of potential agglomeration and multiplier effects.

Equation 2 is the transformation of equation 1 into a crime measure.

2.

$$\frac{\frac{C_{R_j}}{C_R}}{\frac{C_{N_j}}{C_N}} \lessgtr 1$$

where
N is the nation
R is the region
j is the type of crime
C is the number of crimes

The numerator in equation 2 is the ratio of the number of a specified type of crime to the total crimes for the separate region of interest such as the state or the city or the census tract. The denominator is the ratio of the number of reported crimes of the specified type to the total crimes for the overall agglomeration of regions such as the nation or the state or the city.

For example, the United States could be analyzed at the state level and for all index offences. There would be a location quotient for each offence and for each state. Those location quotients would make it possible to identify which states had disproportionately more or less of a specific offence than the country as a whole.

Location quotients could also be calculated for counties within a state in comparison to the entire state; or for blocks or block groups within a city in comparison to the city pattern. The advantages of a location quotient are two: [1] The lack of need to identify a denominator as has to be done in calculating a rate;[9] and, [2] The relative nature of the measure making crime mix is the main focus. The major disadvantages relate to how an area is divided into regions for analysis (a general problem in most research) and the associated problem that the denominator ratio will be dominated by the crime mix in the highest crime regions. The values of location quotients, however, provide another view of crime patterns from that we obtain using crime rates.

Example A. Location quotients may be used at any specified spatial level. To provide an example of what crime location quotients can do, we calculated them for all the provinces and territories in Canada (n=12) for 1991 using the "actual offences" counts[10] found in the *Canadian Crime Statistics* (Canadian Centre for Justice Statistics, 1992). We also calculated the crime rates using a population denominator. The following major crime categories were used in this exercise:

- Homicide (which includes murder, manslaughter and infanticide)
- Attempted Murder
- Sexual Assault (which includes the behavior defining the old crime of rape)
- Assault (which includes common assault and two forms of aggravated assault)
- Other Sex Crimes
- Abduction
- Robbery
- Breaking and Entry (which is similar to the American UCR *burglary*)
- Motor Vehicle Theft
- Theft over $1000
- Theft under $1000
- Possession of Stolen Property
- Fraud
- Other Criminal Code Offences

Table 1 presents the location quotients for the provinces and territories. Values around *1.0* for a particular crime represent provinces where the proportional mix of that crime in relation to the other reported offences is close to the national mix. Provinces with location quotient values well below *1.0* have relatively less of that type of crime than would be expected based on the national mix. When a location quotient value is well above *1.0*, that jurisdiction has a disproportionately high number of that type of crime. Table 2 presents crime *rates* for each jurisdiction for each type of crime.

Table 1 shows some extreme differences between the provinces and territories. For example, the location quotient for sexual assault is highest in Newfoundland (2.81). Robbery, breaking and entry, and motor vehicle theft are relatively highest in the province of Quebec. In contrast, robbery is relatively rare in Newfoundland (0.13), in Prince Edward Island (0.11), in the Yukon (0.25) and in the Northwest Territories (0.13).

Table 2 shows crime rates based on population. Rates compare the relative volume, not the relative mix of offences. Different patterns are shown by the rates and the location quotients. For example, violent crimes have relatively low rates in Newfoundland, but when viewed in relation to the full set of crimes through the location quotient, it becomes apparent that violent crimes make up a very large proportion of all the offences reported to the police in that province. In contrast, British Columbia has high rates[11] of violent crime, but the location quotient shows that violent crimes make up a relatively smaller proportion of all the crimes that occur in the province. The traditional way of making comparisons between jurisdictions, through population based rates, tells us that British Columbia has *the* critical Canadian problem with violent crime (see, e.g., Brantingham, 1991), but the location quotient tells us that any particular crime that occurs is more likely to be a violent crime in Newfoundland than in British Columbia. In that sense, it is Newfoundland rather than British Columbia that has the problem with violent crime.

Table 1
Location Quotient for Offences by Province

	NFLD	PEI	NS	NB	PQ	Ont	Man	Sask	Alta	BC	Yukon	NWT
Homicide	1.10	0.70	0.90	1.19	1.19	0.93	1.35	0.71	0.98	0.95	0.00	0.67
Attempted Murder	0.29	0.00	0.40	0.25	1.59	0.92	1.54	2.07	0.57	0.67	1.40	0.96
Sexual Assault	2.81	1.27	1.16	1.74	0.62	0.95	1.21	1.26	1.06	0.89	1.77	2.47
Assault	1.84	0.96	1.05	1.13	0.79	1.09	1.14	1.02	0.98	0.92	1.56	2.17
Sex Offences Other	1.03	1.60	0.44	0.70	0.96	1.14	2.33	1.36	0.73	0.69	0.75	0.47
Abduction	0.96	0.72	0.62	0.87	0.68	1.30	1.43	2.11	0.91	0.58	0.45	1.07
Robbery	0.13	0.11	0.45	0.30	1.92	0.85	0.99	0.41	0.79	0.83	0.25	0.13
Property	0.82	0.82	0.90	0.84	1.13	0.98	0.97	0.93	1.00	0.99	0.70	0.53
Break & Enter	0.98	0.85	0.87	0.84	1.47	0.84	1.06	1.01	0.88	0.90	0.57	0.76
Vehicle Theft	0.42	0.56	0.46	0.61	1.70	0.77	0.62	0.66	1.06	0.99	0.80	0.69
Theft > $1000	0.50	0.43	0.58	0.55	1.11	1.13	0.67	0.64	0.85	1.07	0.53	0.41
Theft < $1000	0.83	0.88	0.98	0.89	0.93	1.01	1.04	0.92	1.07	1.09	0.77	0.40
Have Stolen Goods	0.57	0.42	0.61	0.64	0.40	1.43	0.53	1.41	1.15	0.93	0.70	0.51
Fraud	1.05	1.02	1.30	1.08	0.92	1.18	1.00	1.09	1.00	0.68	0.77	0.54
Other Criminal Code	1.10	1.39	1.20	1.27	0.78	1.03	1.00	1.14	1.00	1.05	1.44	1.61

Table 2
Provincial Crime Rates

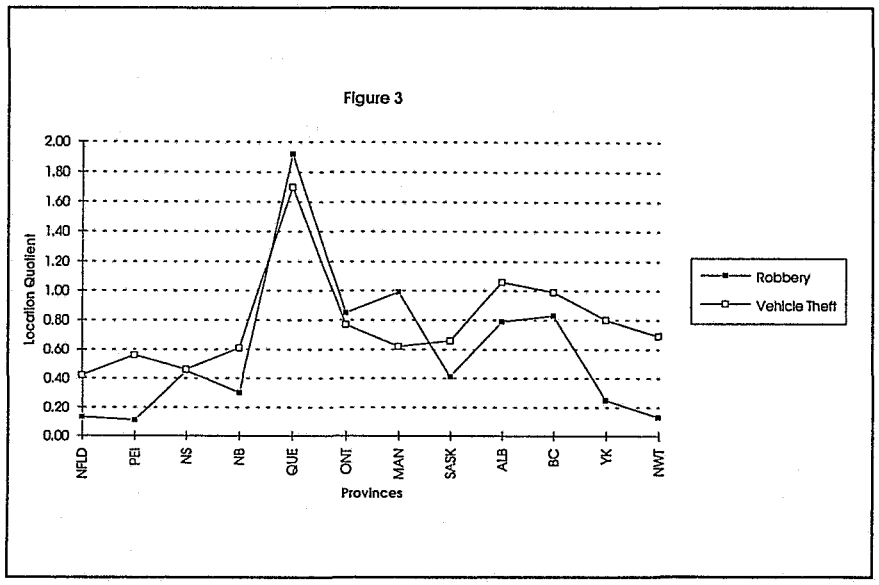
	NFLD	PEI	NS	NB	PQ	ONT	MAN	SASK	ALTA	BC	YK	NWT
Homicide	1.92	1.53	2.33	2.34	2.63	3.56	3.93	2.11	3.33	3.95	0	5.47
Attempted Murder	0.7	0	1.44	0.69	4.88	4.89	6.22	8.55	2.7	3.82	11.15	10.95
Sexual Assault	205.06	116.3	125.25	142.84	57.16	151.98	147.27	157.34	150.93	154.45	423.79	844.89
Assault	968.61	636.57	822.34	666.94	526.26	1254.17	1004.02	913.68	1008.88	1141.81	2695.17	5352.19
Sex Offences Other	9.42	18.36	6	7.16	11.1	22.82	35.58	21.13	13.04	14.91	22.3	20.07
Abduction	2.44	2.3	2.33	2.48	2.18	7.26	6.04	9.15	4.48	3.51	3.72	12.77
Robbery	9.76	10.71	51.63	26.17	187.71	143.48	127.15	54.02	118.66	151.13	63.2	47.45
Break & Enter	993.55	1084.16	1302.8	954.13	1875.8	1866.87	1788.88	1747.48	1729.61	2143.11	1888.48	3611.31
Vehicle Theft	134.96	229.53	220.19	222.87	697.01	548.39	332.97	363.98	669.27	758.61	843.87	1047.45
Theft > $1000	135.31	149.2	234.18	168.87	383.5	675.3	304.43	297.38	454.31	690.01	475.84	525.55
Theft <= $1000	1663.6	2219.59	2912.39	2019	2362.9	4428.58	3498.35	3166.2	4191.41	5163.43	5055.76	3748.18
Have Stolen Goods	44.64	41.32	71.4	56.47	39.78	248.58	69.43	190.34	177.62	174.49	182.16	187.96
Fraud	332.17	408.57	613.59	386.91	369.84	823.52	529.18	588.93	618.88	511.82	806.69	804.74
Other Criminal Code	2228.4	3549.35	3628.36	2911.6	2005	4592.4	3381.91	3969.42	3978.47	5037.38	9579.93	15350.4

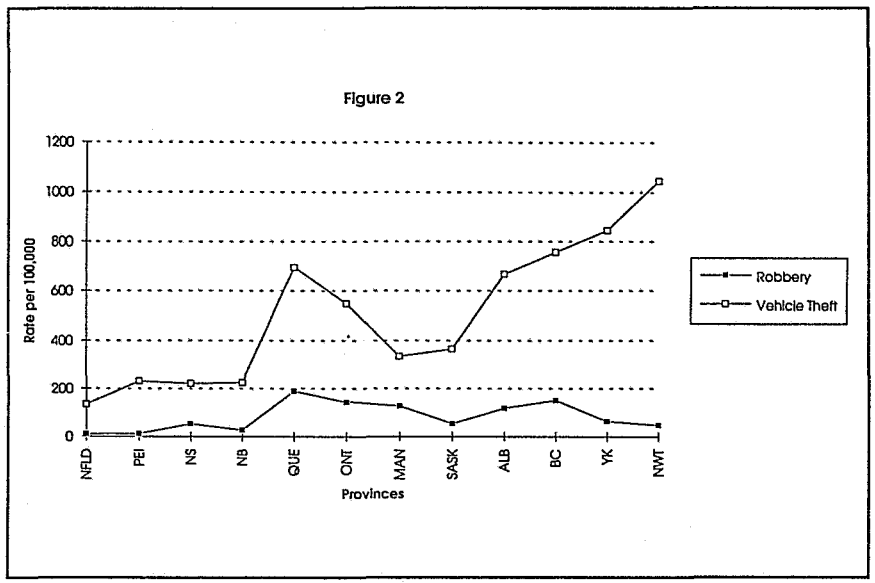
Table 3
Provincial Crime Rates
Correlation Coefficients

	Homicide	Att Murd	Sex Aslt	Asslt	Oth Sex	Abduct	Robbery	B&E	MVT	Theft Ovr	Theft Und	Have St Gd	Fraud	Oth Crim
Homicide	1.00	0.14	0.35	0.40	0.21	0.60	0.38	0.66	0.38	0.46	0.21	0.28	0.21	0.33
Att Murd	0.14	1.00	0.67	0.71	0.58	0.71	0.18	0.76	0.72	0.50	0.56	0.60	0.70	0.74
Sex Aslt	0.35	0.67	1.00	0.99	0.21	0.69	-0.28	0.79	0.64	0.29	0.28	0.39	0.58	0.97
Asslt	0.40	0.71	0.99	1.00	0.26	0.72	-0.17	0.85	0.71	0.39	0.37	0.45	0.65	0.98
Oth Sex	0.21	0.58	0.21	0.26	1.00	0.52	0.24	0.37	0.22	0.29	0.43	0.34	0.42	0.28
Abduct	0.60	0.71	0.69	0.72	0.52	1.00	0.00	0.79	0.48	0.41	0.33	0.64	0.64	0.69
Robbery	0.38	0.18	-0.28	-0.17	0.24	0.00	1.00	0.30	0.45	0.67	0.48	0.27	0.13	-0.16
B&E	0.66	0.76	0.79	0.85	0.37	0.79	0.30	1.00	0.86	0.67	0.54	0.57	0.63	0.84
MVT	0.38	0.72	0.64	0.71	0.22	0.48	0.45	0.86	1.00	0.79	0.70	0.61	0.61	0.75
Theft Ovr	0.46	0.50	0.29	0.39	0.29	0.41	0.67	0.67	0.79	1.00	0.87	0.81	0.66	0.45
Theft Und	0.21	0.56	0.28	0.37	0.43	0.33	0.48	0.54	0.70	0.87	1.00	0.81	0.74	0.47
Have St Gd	0.28	0.60	0.39	0.45	0.34	0.64	0.27	0.57	0.61	0.81	0.81	1.00	0.83	0.52
Fraud	0.21	0.70	0.58	0.65	0.42	0.64	0.13	0.63	0.61	0.66	0.74	0.83	1.00	0.71
Oth Crim	0.33	0.74	0.97	0.98	0.28	0.69	-0.16	0.84	0.75	0.45	0.47	0.52	0.71	1.00

Table 4
Provincial Crime Location Quotients
Correlation Coefficients

	Homicide	Att Murd	Sex Asslt	Assault	Sex Oth	Abduct	Robbery	Break In	Car Theft	Thef More	Thef Less	Have Prop	Fraud	Oth Crim
Homicide	1.00	-0.15	-0.21	-0.33	0.31	0.20	0.48	0.67	0.13	0.34	0.44	-0.12	0.34	-0.66
Att Murd	-0.15	1.00	-0.26	-0.07	0.30	0.54	0.44	0.34	0.38	0.26	-0.02	0.29	-0.18	-0.25
Sex Asslt	-0.21	-0.26	1.00	0.91	-0.20	0.01	-0.71	-0.40	-0.57	-0.73	-0.72	-0.31	-0.27	0.60
Assault	-0.33	-0.07	0.91	1.00	-0.25	0.00	-0.58	-0.44	-0.42	-0.59	-0.84	-0.26	-0.47	0.64
Sex Oth	0.31	0.30	-0.20	-0.25	1.00	0.50	0.17	0.31	-0.15	-0.02	0.32	-0.03	0.23	-0.28
Abduct	0.20	0.54	0.01	0.00	0.50	1.00	-0.04	0.19	-0.23	-0.02	0.04	0.55	0.24	-0.13
Robbery	0.48	0.44	-0.71	-0.58	0.17	-0.04	1.00	0.78	0.84	0.82	0.48	0.02	0.03	-0.82
Break In	0.67	0.34	-0.40	-0.44	0.31	0.19	0.78	1.00	0.59	0.47	0.32	-0.18	0.18	-0.77
Car Theft	0.13	0.38	-0.57	-0.42	-0.15	-0.23	0.84	0.59	1.00	0.71	0.19	0.00	-0.30	-0.55
Thef More	0.34	0.26	-0.73	-0.59	-0.02	-0.02	0.82	0.47	0.71	1.00	0.60	0.44	0.05	-0.78
Thef Less	0.44	-0.02	-0.72	-0.84	0.32	0.04	0.48	0.32	0.19	0.60	1.00	0.38	0.55	-0.76
Have Prop	-0.12	0.29	-0.31	-0.26	-0.03	0.55	0.02	-0.18	0.00	0.44	0.38	1.00	0.25	-0.24
Fraud	0.34	-0.18	-0.27	-0.47	0.23	0.24	0.03	0.18	-0.30	0.05	0.55	0.25	1.00	-0.37
Oth Crim	-0.66	-0.25	0.60	0.64	-0.28	-0.13	-0.82	-0.77	-0.55	-0.78	-0.76	-0.24	-0.37	1.00





The difference between rates and location quotients can also be seen by comparing the intercorrelation matrices for both measures (Tables 3 and 4).

As can be seen from Table 3, which shows the intercorrelation of crime rates, even with a limited number of cases there are many significant high value correlations. The broad distribution of values and the tendency of a province with high rates in one crime to have high rates in all crimes creates this pattern. Table 4 contains the intercorrelations for location quotients. The pattern is quite different from that seen in Table 3. The location quotients measure crime mixtures, not crime volumes. The values for location quotients (LQ) are limited with an associated reduction in significant correlations, but present some correlations that support some common etiological assertions in criminology. Most notably, the sexual assault LQ is positively correlated with the assault LQ but negatively correlated with most property offences. All of the intercorrelations among crime rates in Table 3 are positive. The LQ supports the view that sexual assault (including rape) may be an indicator of a general violence pattern.[12] Table 4 also supports the idea that, situationally, robbery is really more like a property offence and that it ought to be so classified.[13] The LQ for robbery is highly positively correlated with property offences but is negatively correlated with assault and sexual assault. Robbery rates are not significantly correlated with any other crime rates.

As a final indication of the difference between what is shown through rates and what is shown through LQ values, we graphed the LQ's and rates for robbery and motor vehicle theft as shown in Figures 2 and 3. The *rates* shown in Figure 2 vary by province. The motor vehicle theft *rates* are low in the eastern provinces and show a tendency to rise in the western provinces and the territories. Robbery *rates* tend to be low in the eastern provinces and in the territories. This produces a low correlation between the offence rates across jurisdictions. Yet the LQ's shown in Figure 3 exhibit a much stronger relationship. When, compared to national crime mixes, a province has a disproportionately high or low share of robbery it also has a similar disproportionate share of motor vehicle theft.

Conclusions

Location quotients may well be a good first step in looking at relative mix of crimes, providing a measure that shows dissimilarities from province to province. Calculation of crime location quotients leads, quite naturally, to consideration of relative "hot spots" at both large and small levels of aggregation. At lower levels of aggregation, LQ's may be indicators of where more detailed analyses of multiplier effects and agglomeration economies of crime are in order. Location quotients may prove to be a bridge between attempts to develop areal comparisons based on crime rates and the operational analysis of the nodal crime patterns commonly called "hot spots" based on actual numbers of recorded crimes that is critical to modern ideas of community policing and situational crime prevention.

Notes

1. If there were not, we would never realize that a *type* of behavior exists and ought to be studied.

2. ad nauseam. See *any* criminology text for the main points.

3. The well known exception is homicide offences, where a combination of rarity, the characteristics of dead bodies and the complex social information networks that track people in modern society bring most such offences to official notice.

4. See the intense debate between Lowman and Mawby on this issue.

5. Analysis of spatial auto correlation on the other hand is a good research technique. The presence of such auto correlation may reduce the value of the parametric statistics, but does point toward underlying spatial connectivity. It may in fact address the concerns raised by Harvey (1974).

6. Regional science models have occasionally been used by criminologists. Different regional mixtures of economic activity appear to predict different regional mixtures of crime. See Ogburn, 1935; Wilks, 1967; Brantingham & Brantingham, 1980.

7. This personal experience leads us to advocate the use of a comprehensive single source credit card cancellation service of the sort offered by most of the major credit card companies as a prudent and effective loss reduction strategy.

8. On crime import and export models for areas within cities, see Pyle (1974); Hakim & Rengert (1981).

9. Reducing some of the problems in rate calculation identified by Boggs (1965) and Harries (1991). We note that Barr and Pease (1990), in the only use of location quotients by criminologists of which we are aware, construct location quotients of crime rates based on object-at-risk denominators.

10. This count is found in data column 3 of Table 6 in the annual crime statistics. It represents a count of offences reported to the police less those reports which the police concluded were unfounded.

11. For Canada, that is.

12. Note that this is said with caution in order to avoid the ecological fallacy.

13. Rather than being classified as a violent offence, as it is in most uniform crime reporting systems and in most victimization survey systems.

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by Kate Painter

Street lighting as an environmental crime prevention strategy

Environmental Design, Darkness and Crime Prevention

Darkness is generally associated with fear, vulnerability and, depending on the physical and social context of the environment, cognitive impressions of a place as dangerous (Warr 1990). Darkness, physically and psychologically, alters the spatial and social characteristics of the built environment and the publics' image and usage of it. To the extent that physical design and structure, social usage and darkness interrelate to provide opportunities for crime to occur, lighting can have a significant role to play in preventing it.

The last statement rests on a number of assumptions, borne out by research, especially with regard to offender behaviour. First, it is assumed that offenders make rational choices, when deciding to commit a criminal act. The rationality involved may be extremely limited, even crude, but some estimation of the relative rewards, risks, efforts and opportunity of committing an offence will be made in most situations (Cornish and Clarke 1986; Clarke 1992). Second, for many offences, environmental cues are relevant to how offenders choose the site or target (Taylor and Gottfredson 1986; Jeffery et al. 1987) with visibility and surveillability ranking as among the most important (Bennett and Wright 1984; Feeney 1986; Cromwell et al. 1991; Clarke et al. 1991).

A potential offender's image of a suitable crime site within a neighbourhood is constructed from social and physical factors which are intertwined. Pertinent social factors would be level of policing, routine activities and behaviour patterns (of potential victims and offenders), volume of pedestrian traffic, sociodemographic characteristics, and offender's knowledge of the area and previous criminal experience. Physical characteristics of particular relevance to this analysis include ease of access and exit to the site, availability of targets (residential, commercial, pedestrian) and signs of physical disorder. Dark alleyways, poor or badly maintained street lighting and design features such as shrubbery or concrete structures aid concealment of criminal activity and have a part to play in the construction of a neighbourhood image out of which a suitable crime site will be selected by an offender. Together, social and physical factors affect the offender's overall perceptions of the relative opportunities, rewards and risks of crime at particular locations.

The case for lighting as an environmental crime prevention strategy is somewhat obvious but may be worth stating explicitly. Visibility is known to affect the potential risks to the offender of being recognised and detected (Bennett and Wright 1984; Cromwell et al. 1991). Research has established that offenders prefer to remain unidentified and unrecognised on their journey to and from the criminal act and at the moment of committing it. Locations which are dark and unobserved will be attractive for certain offenders because of the element of concealment that they provide. As a physical intervention, lighting can act as a deterrent by improving visibility and surveillance, thereby influencing the offender's perception as to the likely risk of being identified and apprehended.

Offenders are known to be deterred by the actual or potential presence of the public (Mayhew et al. 1979). Where lighting improvements encourage public use of streets after dark, informal surveillance is heightened through an increase in the number of potentially capable guardians. From the offender's perspective, this increases the hazards of being interrupted in the process of committing a criminal or anti-social act. But lighting upgrade may also function to promote a subliminal message about the particular night time environment. Good visibility and surveillance imply high levels of social control and lighting improvements may signal to potential offenders that crime in such environments is generally more risky or difficult. In short, alteration of one of the most obvious signs of environmental neglect, poor or broken street lighting, can change potential offenders' and victims' images of the night time environment.

Even so, the role of visibility and surveillance in the commission of crime needs to be conceptualised in relation to other environmental cues and physical design, since they do not have a stand alone effect in creating a safe or unsafe environment. For example, the best lit subway will be avoided by the majority of women in favour of a poorly lit street; there will be circumstances where good lighting levels are conducive to the commission of crime after dark, such as theft from vehicles (Painter 1991b) and some types of vandalism and graffiti. The darkest sites in a particular neighbourhood will not necessarily be the most dangerous because they are likely to be avoided by the public and hence, given the lack of targets, by potential offenders. The best lit car park or industrial estate may still constitute a suitable target by the offender, if there is little possibility of surveillance.

If theory and commonsense suggest a crime preventive role for lighting improvements after dark, empirical evidence has been weak and inconsistent (Mayhew 1976; Tien et al. 1979). Previous research into the relationship between street lighting and crime had been carried out in the USA. A thorough review of the 103 projects revealed that only 15 provided appropriate evaluative information. Each of these was criticised for the heavy reliance on recorded crime to evaluate impact, insensitive and unbefitting impact measures of crime and fear, lack of methodological rigour, incomparable project design and methods and an inadequate appreciation of the effects of different types and levels of lighting on crime (Tien et al. 1979).

Although empirical evidence regarding lighting as a crime prevention strategy was inconclusive, the authors stressed that it would be impossible to make a definitive statement about lighting and crime because of the inadequate conceptual and methodological approaches of the various studies. In view of these shortcomings, the report recommended that further research should be undertaken, and that in order to "insure the existence of a systematic and uniform set of single project evaluations, it [would be] necessary to develop a model evaluation that could be used as a guide and reference (Tien et al. 1979, p. 98). This recommendation remained unheeded for more than a decade.

Recent Developments in the United Kingdom

In the United Kingdom a number of studies have been conducted over the past seven years to examine the impact of street lighting on crime, fear of crime and quality of life. In an incremental fashion, the individual studies have attempted to address some of the methodological defects of previous research on the topic. The purpose of this paper is to review the findings of a coordinated evaluative programme of research carried out by Painter between 1987 and the present. Space precludes a full discussion of a Home Office funded study of lighting on crime in London (Atkins et al. 1991) but for an overview of the methodological deficiencies see Painter (1993).

The starting point for the exploratory programme was to deal with one of the methodological problems encountered in previous attempts to evaluate the effectiveness of relighting schemes, namely, to isolate and assess the independent effect of lighting improvements from other 'extraneous' influences on crime and fear. At the design stage it was considered

that such conditions would best be accomplished by carefully controlled before and after experiments at specific sites which were badly lit but had some social usage after dark, and thereby offered opportunities for crime to occur. The intention was to look for the most situationally risky sites where the effects of lighting improvements could be effectively controlled and monitored.

Methodological considerations aside, the rationale for the choice of settings was greatly influenced by empirical and theoretical research in the area of environmental criminology which had identified such locations as having the physical layout, mixed usage and social characteristics of transience and mobility that lend themselves to opportunist offending (Jacobs 1961; Newman 1972; Brantingham and Brantingham 1984; Stark 1987; Brantingham et al. 1990; Felson et al. 1990).

The major aims of the exploratory programmes were to demonstrate a reduction in crime and disorder, and fear of crime, in the six weeks following lighting improvements. An additional aim was to increase the number of people using the street after dark. The local crime prevention officer in each area was asked to identify a street or walkway which was thought to generate fear or had an identifiable crime problem. Additionally, the design and layout were important. The site had to be poorly lit, clearly demarcated and be an essential pedestrian thoroughfare leading from a residential area to transport, leisure or commercial facilities. Stripped down to the bare essentials, each study was designed to be crime specific, time specific and strategy specific.

The Edmonton and Tower Hamlets Projects

The first project was sited in Edmonton, North London. It comprised two thoroughfares leading from, and adjacent to, three, high density multi-storey, council owned, tower blocks. The two routes converged at a point leading under a railway bridge, thence onto the railway station entrance, public telephone box, snooker club, public houses, shops and launderette.

The second project was sited in Tower Hamlets, an extremely deprived area, in the East End of London. A rail entrance/exit led onto the street. Property along the street was partly boarded up but also included high density, dilapidated, council owned accommodations. The street also connected the main arterial East End Road at one end with high quality, private housing at the other. Located nearby was a Salvation Army hostel for the homeless. The street was also used by nurses and night staff as a route to a large hospital situated near the main arterial road.

The focus of analysis was the amount of crime which occurred after dark, in the thoroughfare, six weeks before and six weeks after relighting. Property crimes included vandalism and theft of, and from, vehicles. Interpersonal offences included physical and sexual assault, theft from the person and social signs of disorder, or 'incivilities', e.g. drunkenness, youths hanging around, graffiti, verbal abuse, and sexual and racial harassment.

The short term duration of the study was to facilitate control over 'other' environmental influences. A multi-agency approach involving the police, local authority and the research team was used to monitor any extraneous influences within the environment which might have had an impact on crime or street usage (e.g. changes in police patrols, building works, alterations to existing facilities such as the opening or closing of clubs or public houses etc). Even with multi agency cooperation this was difficult enough to attain over the relatively short 3 month research period.

The projects used a multi method and measurement approach which combined quantitative and qualitative data:[1]

1. A pedestrian survey asked respondents about their experience of crime within a five minute walk of the interview point (a) after dark and during daylight over the previous twelve months; and (b) after dark during the six week period prior to the interview. Lighting was installed one week following the interviews. Six weeks after lighting improvements, pedestrians using the thoroughfare after dark were interviewed in comparable circumstances at comparable seasonal times, i.e., before the change to British Summertime, using the same combined methods and identical core questions.

2. Interviewers kept a log and mapped the events they witnessed throughout the evening with the aim of providing supplementary evidence to aid interpretation of programme impact.

3. Pedestrian counts were taken throughout the pre- and post- test interview periods to provide a further, behavioural measure of impact of lighting improvements on night time street usage. Maps were also used to monitor crime in, and immediately around, the experimental thoroughfare.

The impact on crime and fear of crime. In Edmonton, 21 incidents were recorded along the routes in the six weeks before relighting. In the six weeks after improvements, there were 4 reported incidents. Similarly, in Tower Hamlets, 18 incidents were reduced to 4.

Alongside the reduction in crime there was a marked reduction in fear of physical attack and a corresponding increase in personal safety at both locations. As shown in Table 1 there was a 30% reduction in the number of women fearing attack in Edmonton (21% reduction in Tower Hamlets). Fear of sexual assault among the women interviewed reduced by 22% in Edmonton and 27% in Tower Hamlets. Although there was a 10% reduction in the number of women worrying about being threatened and pestered in Edmonton, there was no change in Tower Hamlets with just over half the women admitting to being afraid of harassment before and after lighting improvements. Ironically men, who were less fearful of victimisation after dark before lighting improvements, felt even more confident afterwards. The reductions in the percentage of men fearing attack went down 22% in Edmonton and 33% in Tower Hamlets.

Pedestrians were then asked,"Why do you feel safer in this road?" The majority of pedestrians said they did not know why. This might indicate that in some contexts, lighting improvements has a subliminal influence on personal safety, even if the improvements have not been consciously noticed.

An interesting finding was that in both locations women were far more likely than men to notice lighting improvements. (82% women compared to 63% men in Edmonton; 80% women compared to 59% men in Tower Hamlets) This suggests that because of their physical and sexual vulnerability, women were more sensitive to environmental cues denoting safe and unsafe places to traverse, after dark. The surveys also indicated that precautionary behaviour among women was widespread. The pedestrian survey in Edmonton revealed that 1 in 3 women carried some object to protect themselves against crime. Apart from the objects observed, other items reported as being carried for protection, were knives, scissors, bleach in hair spray bottles, pepper and chili powder.

There was convincing evidence that womens' association of darkness with potential danger affected the manner in which they used public space. Observational data showed that, prior to relighting, women were running rather than walking through the streets, walking in the middle of the road rather than on the pavement and carrying objects, presumably as a precaution against crime. Interviewers observed women carrying sticks, a metal bar, 'over a foot long', keys or umbrellas, 'even on dry nights'. Following lighting improvements, interviewers noted that women had altered their demeanour and the pace at which they walked. They used the pavement rather than the road, walked normally rather than ran, and generally appeared more confident.

Indirect effects on public perceptions of crime and the environment. Relighting had more far-reaching impact on pedestrians' attitudes towards crime and their image of the environment. In both locations respondents thought that assaults and threatening behaviour had decreased, with over a third stating there had been a decrease in vandalism. Not only did people feel safer personally, they had a sense that crime problems, generally, had been ameliorated.[2]

In both locations the majority of pedestrians thought that the number of people using the streets after dark had increased, a perception borne out by the pedestrian flow counts. There was a marked increase in the number of people using the streets in both locations after dark, but the change in Edmonton was dramatic. At this site, the mean number of pedestrians increased from 33 throughout the evening in the pre-test period to 50 in the post-test period (rounded). The proportionate increase in men and women was about equal; the mean number of men increased from 18 to 27 and the mean number of women increased from 14 pre- to 22 post-test. As mentioned earlier, pedestrian density and flow have long been regarded as crucial aspects of crime control and the exploratory projects provided strong indications that lighting improvements not only increased visibility, but also the amount of informal surveillance by potential guardians, throughout the evening.

Implications. The experimental projects were sited in what were judged to be the most situationally risky, badly lit, pedestrian thoroughfares, where lighting improvements were likely to have most impact, and in conditions where the impact of the programme could be isolated, monitored and controlled. The rationale for this is obvious: if lighting improvements had not had an impact in the most propitious circumstances they would be unlikely to work anywhere and there would be little point in embarking on a costly, large scale project over a longer time period.

Table 1 **Fear of Attack at Night, by Gender**								
Do you worry about the possibility of the following things happening during the night when walking through here?	Edmonton % Yes				Tower Hamlets % Yes			
	Before		After		Before		After	
	M	F	M	F	M	F	M	F
Attacked	50	87	28	57	49	79	16	58
Pestered	17	51	10	41	22	55	8	55
WOMEN ONLY:								
Sexually assaulted		86		64		77		60

Compiled from Painter 1988; 1989

In both projects there was evidence that the programme achieved all or most of the major outcome goals, with some additional benefits which had not been foreseen at the design stage. There were reductions in crime and disorderly behaviour and fear of crime in both thoroughfares. Fear of specific crime after dark was reduced and feelings of personal safety were increased. In Tower Hamlets, however, women's fear of harassment remained unchanged. Relighting also increased the amount of pedestrians using the streets after dark in both locations and positively affected public perceptions of crime problems.

There are some important methodological points such as 'telescoping', short term effects and displacement, to be considered when interpreting the results and these will be discussed subsequently. The third project, however was set up to deal with two methodological issues. First, the extent to which the results of the exploratory projects could be replicated and sustained over a longer period of time. Second, to build in a stronger, more controlled, individual measurement of effect by using panel interviews with householders in the pre and post test conditions.

Hammersmith and Fulham: The Impact of Lighting Improvements on Pedestrians and Elderly People

The third study was located in West London in a badly lit roadway which ran from privately let mixed residential dwellings, through a sheltered housing complex, inhabited by elderly people (65 years+), to shops, bars, etc. In this study, householders and pedestrians were interviewed at various points. Pedestrians were surveyed before and six weeks after lighting improvements, using the same questionnaire and methods described above. Pedestrian counts were included and incidents were mapped.

Additionally, a quasi-experimental evaluation of lighting improvements on householders living on or adjacent to the thoroughfare were completed. Interviews lasting up to one and a half hours were conducted on a panel basis so that the same people were interviewed, at three points, over a twelve month period.[3] The first interviews were completed six weeks before upgrading the lighting, and six weeks after with follow up interviews completed twelve months later.

Pedestrian survey: Crime and fear of crime. There were only two incidents recorded against pedestrians in the six weeks period before relighting so it was not possible to draw any conclusions about the impact of relighting on crime and disorder among the sample of pedestrians. Nonetheless, the maps indicated that incidents at the junction of the roadway, with a main arterial road, reduced from 19 to 4. One explanation for this is that the increased usage of the street affected anti-social behaviour on roads around the experimental area. This provides some evidence of 'free rider' effects (Miethe 1991) following ligl ting improvements.

The findings on fear and personal safety and the increase in the number of people using the street after dark mirrored those of Edmonton and Tower Hamlets. Thus, 67% felt safer in the relit street and there was a remarkable reduction (68%) in women's fear of sexual assault. More women than men noticed the lighting improvements and they were twice as likely as men to volunteer the information that lighting had increased their personal safety.

Paradoxically, this study indicated that the impact on fear had a 'spillover' effect on fear of crime during daylight hours. One explanation might be that if the environment is no longer perceived as dangerous at

night, because of enhanced visibility and surveillance, their is little reason to fear for personal safety during the day.[4]

The positive, indirect effect on perceptions of crime problems was again in evidence, with pedestrians perceiving that threatening behaviour (82%), assault (70%) and vandalism (48%) had decreased. Equally, pedestrian counts showed a striking increase in the number of people using the walkway. There was a 100% increase in the number of men and a 71% increase in the number of women using the street after dark. Overall, the number of pedestrians using the street almost doubled, from 1042 to 1944, in a six week period.

One hypothesis, based on routine activity theory, was that any increase in street usage could actually increase crime and disorder because it could bring more potential offenders and targets into the same place. This did not happen and possibly one explanation this, was that, as in the Edmonton project, the density of pedestrian flow was constant throughout the evening. The following quotes illustrate the rather obvious point that householders and pedestrians felt safer in the well lit, well used street than they had done when it was dark and empty:

"Feels safer in her home because there's less chance of burglary. Less people hanging around at night. Has stopped men using her porch as a toilet."

"She feels safer as more people are using the road as a short cut."

"People don't seem to walk in the middle of the road... people are more confident since the new lights. It looks less intimidating."

"Its obvious people feel safer and its had its effect on crime -if you can see people they are less likely to attack you."

The household survey: Crime, disorder and displacement. The household survey of elderly people showed an immediate and marked reduction in the amount of disorderly and obscene behaviour to elderly householders and their property. A total of 35 incidents were reduced to 3,, over a six week period. Moreover, this reduction was sustained over the twelve month research period.

The household survey revealed that in the 12 months before relighting, half (53%) of the elderly people had been subjected to some type of crime, nuisance, indecent or threatening behaviour. Almost half had witnessed men exposing themselves to urinate in the gardens, porches or on the street. One in three had witnessed other forms of disturbance which ranged from seeing a youth brandishing a knife and slashing property; domestic disturbances, fires in dustbins; witnessing and hearing assaults.

Much of the disorderly behaviour was attributable to a public house sited near the sheltered housing complex. In brief, men returning from the pub turned into the badly lit road to urinate and vomit in the gardens and porches. Disorderly conduct has a tenuous legal status and is regarded as being of a less serious nature, than crimes such as burglary and robbery. But it is important to unravel exactly why the incidents constituted such an unpleasant aspect of life and why they caused such high levels of fear. In other words, in evaluating crime seriousness it is necessary to put crime, fear and the impact of relighting in a specific social, spatial and temporal context.

Disorderly events were occurring frequently, after dark, at a specific location. It was the frequency of incidents, at night, that contributed to the general belief that the immediate area was a dangerous and intimidating place to live. The social and psychological impact on a physically vulnerable group of elderly residents was severe. Thus, the majority of elderly residents were afraid to walk approximately 30 metres from their door to the leisure facilities which formed part of the complex. They felt vulnerable and powerless. As one elderly woman put it, "I can no longer exercise any control over the little bit of garden outside my flat and that includes my front porch".[5]

Lighting improvements greatly reduced elderly people's concerns and fears about crime. In the pre-test period 6 out of 10 worried 'a lot/quite a lot' about crime. In the post test period only 2 out of 10 worried 'a lot/quite a lot' with 8 out of 10 reporting that they were not worried 'much or at all'. Fears of being burgled, robbed or assaulted in the street showed significant reductions (-77% and -65% respectively).

Impact on behaviour and quality of life. Following lighting improvements, 1 in 3 elderly people said they were more willing to go out after dark and there was a 70% reduction in those stating they avoided the roadway at night. Almost half (44%) thought it had increased their confidence to go out at night; half thought that crime had become less common in the previous twelve months and 61% thought fear of crime in the community had decreased. 94% thought

that the lighting had made it easier to recognise people and that it had improved the look of the area. There was a 65% reduction in witnessed events.

Good lighting not only physically altered space by eliminating shadows and enhancing recognition, it also brought about greater social usage of the street by people and cars. It was evident that many women pedestrians had altered their route to and from home, after dark. The interplay between physical and social processes was evident from comments made by pedestrians to interviewers:

"Now uses this street at night because the lights make her feel safer and she can see people walking towards her."

"Says (adjacent) road is very dark and unsafe, now uses this end because of the lights. Before said she never used it."

"Says she never used this road before because it was so dark and she could not see to the other end. Says she now uses it but she used to take the long way home along the main road."

Comments made by elderly householders also provided explanation as to why lighting had such an effect on safety and quality of life:

"This lady says that the relighting has stopped vandalism to trees... Has stopped dodgy characters hanging around."

"I don't mind going out now and can see my friends and stay with them that bit later than usual. Its really lovely."

"Was one of the women who ***never ever*** *went out after dark before the lights went in. Now goes to bingo with her friend twice a week. She kept stressing what a difference the lights had made to her life."*

As social usage of the street increased after dark, so it seems did informal surveillance and participation in community activities. This had a 'knock on' effect on peoples perceptions of crime problems in the area and, as the effects were consolidated over time, the general ambience, character and public image of the location changed and community safety increased. Even the interviewers fieldwork sheets noted that the street had stopped smelling of urine and vomit in the post test period.

Implications. This study provided further evidence that by improving visibility and increasing informal surveillance, lighting improvements worked to reduce criminal and disorderly incidents in a specific locality. The reduction in fear of crime and the corresponding improvement in quality of life had an undoubted social significance. Nonetheless, any evaluation which attempts to measure change in controlled conditions should also consider the extent to which those conditions (especially the environmental setting and social dynamics) might have influenced the impact of the change effected.

There were some factors specific to the site and the population that helped facilitate the immediate and long term impact of lighting improvements. The existence of a stable homogeneous population which shared organised community facilities, backed by an on site warden, enhanced the positive impact of the relighting scheme. The shared community facilities provided a forum whereby the positive change experienced by certain individuals was shared and reinforced within the community. This increased the confidence of people who might not otherwise have been so positively affected. One example of this was given by an elderly blind woman who used the community facilities during the day:

"It hasn't made much difference to me as I can't see and never go out at night. But I go to the community centre during the day and everyone's talking about what a difference it has made."

The implication is that such positive results might not be achieved in other environmental settings, inhabited by fragmented communities, or where there are not shared community facilities to attract people out of doors and reinforce positive effects. Notwithstanding this caveat, the in-depth evaluation of relighting in a situationally risky location replicated many of the findings of the two previous exploratory projects and it provided more insights into the social dynamics through which lighting effected attitudinal and behavioural change.

These studies were the first to use a quasi-experimental design in an to attempt to isolate the impact of lighting from other extraneous influences which might impact on crime, fear and pedestrians' routine activities. This has been a serious limitation of other research on this topic (Tien et al. 1978; Atkins et al. 1991). The projects used a quasi-experimental design and multi method approach, combining quantitative, survey methods with qualitative data to provide comparable results in similar settings. The intention was fourfold: (1) to increase the strength and validity of interpretation of impact; (2) to aid the process of causal inference

between programme intervention and outcome; (3) to provide appropriate and sensitive indicators of behavioural and attitudinal impact; and (4) to provide a means of searching for negative cases and evidence which ran counter to the initial hypotheses that lighting improvements would reduce crime and fear.

The research was designed to maximise the authority of the programme and minimise the susceptibility to the weaknesses of previous research in the area. The experimental method, built-in monitoring mechanisms and latterly, the panel design, facilitated the isolation and control necessary for establishing a causal relationship between variables. Using survey methods and pedestrian street counts meant that changes could be quantified. The qualitative data in relation to open ended questions on the surveys, maps and observational data provided greater naturalism and authenticity to the accounts given by the people who had been most effected by the intervention. As such, it built into the study, explanation as to **how and why** the measure worked so effectively.

Methodological Limitations of the Programme

It is rarely possible to conduct perfect research and the approach adopted has been subjected to critical review (Ramsey and Newton 1991). In essence the findings of the exploratory projects carried out in Edmonton, Tower Hamlets and Hammersmith and Fulham are deemed by Ramsey and Newton (1991) to have limited value for the development of crime prevention policy, for five reasons:

1. Situationally specific 'blackspot' research. A fundamental criticism of the CPTED approach is that the individual crime sites are so situationally specific, the findings are rarely generalisable to wider areas (Hunter and Jeffery 1991). While there is some truth in this assertion there is a growing body of evidence that the approach works at different levels of analysis, but is particularly effective at the micro spatial level (Taylor and Gottfredson 1986; Hunter and Jeffery 1992).

The sites selected for the lighting program are not representative of other locations, but they do not have to be. There are many more such streets in other towns, and the experience from these exploratory and experimental projects may well be applicable to other settings. Contrary to Ramsey and Newton's assertion that blackspot research is of limited value, the application of small scale, carefully controlled experiments may offer one of the most promising approaches to crime prevention policy.

Just as a small number of offenders are responsible for a large number of crimes, there is increasing evidence that a small number of locations can give rise to a disproportionate amount of crime (see for example, Sherman's work on 'hotspots' 1989; Felson's analysis of crime at subway stations 1990; Brantinghams' and Wong on shopping malls 1990). Identification of these locations means that resources can be targeted where they are most needed using strategies tailored to local conditions.

2. Short term effects. The criticism that the effects on crime might not be sustained over a longer period of six weeks or a year is possible but as Clarke (1992) points out, the fact that preventive measures may have a limited shelf life is not to counsel despair. It is simply one factor among others that must influence the choice among preventive options. Besides, the extent to which lighting effects taper off remains an unknown quantity on present evidence.

It can be argued that lighting interventions are not comparable with other strategies which have been found to have short term effects. Once lighting is installed it requires minimal resources to sustain, unlike other strategies -- police patrols, neighbourhood watch or a variety of social interventions -- that require continued resourcing in terms of time, effort and money to maintain any immediate benefits. There were on the other hand, advantages in using short periods of time to assess effect in the exploratory projects.

3. Telescoping. Ramsey and Newton claim the actual reduction in pre-test/post-test crime has been exaggerated because of the process of telescoping, whereby incidents from an earlier period may have been brought forward, and recalled by respondents as having occurred in the six week pre-test period.

Telescoping, is an ever present danger in evaluative research and it may be that research conducted over short periods of time is not accurate as a result of telescoping. It is, however, equally possible that research conducted over a long period of time is inaccurate as a result of memory failure. It is also possible that the pre-post test reductions at all three sites were merely the result of random fluctuations rather than telescoping. But as Ekblom (1990) points out, it may also be the case that in small

geographically focused initiatives the preventive effect of a particular scheme may be more influential because it is appropriate and adapted to local conditions.

Ramsy and Newton take the twelve month victimisation rate in the Edmonton project, calculate a six week rate from it, and conclude that the reduction of crime from 21 to 3 should in fact be from 10 to 3. Their caculation assumes a constant crime rate throughout the year. With regard to vehicle crime, they calculate that, pro rata, 3 vehicle crimes (theft of/from/ damage to) took place in the six week period, not the twelve as claimed, yet police statistics for the same period show 4 thefts of vehicles (the identical number recorded by the survey Painter 1988, p. 48).

4. Crime versus incivility. The programme of exploratory research is also berated because reductions in all three projects relate more to incivility than crime. Incivilities have emerged as a significant policy issue because of the behavioural, psychological and social consequences they have for large sections of the population and the contribution they make to neighbourhood decline. It is also argued that a developmental sequence may occur whereby social disorder which continues unchecked, escalates into more serious crime, attracts undesirables to the area (Wilson and Kelling 1982; Skogan 1990), heightens fear of residents, and effects the offender's image of the neighbourhood and perception that the risks of being interrupted and apprehended are minimal (Taylor and Gottfredson 1986). If any strategy can lead to a reduction in anti-social behaviour on the street after dark, it has a major contribution to make both to crime control and the inhibition of neighbourhood decline. It should be welcomed, not lightly dismissed.

5. Displacement. Displacement posits a theoretical challenge to most crime prevention strategies. It is a tremendous advance in knowledge to learn that a specific programme can prevent crime against a particular target in place and time. It is another issue to assess whether it was displaced elsewhere. Since in the long history of criminology the issue has not been resolved empirically, it is somewhat severe to castigate an exploratory programme for failing to deal with it.

The Hammersmith and Fulham project did appear to have been justified in providing some evidence of benign displacement, free rider effects and diffusion of benefits (fear), to daytime. Nonetheless, it is accepted that the impact of a physical intervention such as lighting is difficult to assess in that it might simply displace crime in any of the five ways outlined by Reppetto (1976). Thus, in two ongoing research projects, a means of monitoring temporal and spatial displacement was designed into the project formulations (Painter forthcoming).

Estate / Housing Project Level of Analysis: The West Park Estate Survey, North West England

The aim of this study was to produce an in-depth analysis and evaluation of the longer term impact of enhanced public lighting on crime fear of crime and general quality of life over a twelve month period, on a high crime estate.

The estate was made up of three high rise blocks containing 116 dwellings in each (181 of these were empty on the pre test survey). The blocks were surrounded by two storey maisonettes containing 80 dwellings. Out of a total of 247 occupied dwellings, 197 interviews were completed in January 1989. The same households were interviewed a year later (January 1990).

By any standards the estate had a crime problem. The pre-test survey showed that burglary was four times the national average (26% compared to 5% respectively) and street robbery was four times the national average (4% compared to 1%). The rate of repeat or multiple victimisation was high and greatly contributed to the overall incidence of crime throughout the research period.

The project was designed to be a detailed and explanatory evaluation. It is best described as a population study, in that every household was included in the survey. It used a variety of methods to build up a detailed picture of life on the estate. Although the focus was upon one environmental improvement, the research was designed to take a broad and impartial view of crime and social problems. The interviews were wide ranging covering a multitude of issues from crime and fear through to contacts with, and perceptions of, the police, local authority departments and politicians. Perceptions of the neighbourhood and community safety were also included. Following consultation with the Tenants Association all households on the estate were leafleted. The leaflet explained the purpose of the crime survey but no mention was made of the relighting scheme. The study attempted with some

considerable success, by use of a panel design, to control for variations in individuals which might have effected the aggregate results. Thus, 65% of those interviewed pre and post test were the same people.

The household interviews were designed to furnish qualitative as well as quantitative data to facilitate interpretation of cause and effect. On most questions there were spaces left for probes such as, "Are there any other effects?", "Why do you feel unsafe?", "Is there anything else that has not been mentioned?". All pre-coded questions had a category "other" and specific open ended questions were incorporated. Observational data was noted by interviewers on fieldwork sheets, as were informal conversations with local authority staff, community workers, caretakers, and two self proclaimed active burglars, living on the estate.

Greater Manchester Police supplied detailed crime statistics for the estate. These were provided by official crime category, location (individual tower block or maisonette) and time (day/night). Sub-divisional crime figures were also provided to aid assessment as to whether any changes in crime levels on the estate were simply a reflection of crime trends in the surrounding area.

The impact on crime. The post test household survey showed an overall reduction of 27% for criminal offences (excluding incivilities). Personal offences were reduced by 35%; property offences by 25%. The change in different crime types was subjected to statistical analysis. The small number of cases in each crime type means that caution should be exercised in interpreting the figures. Nonetheless, two categories of crime which cause most public concern showed statistically significant decreases. The reduction in street robbery with violence/threat was statistically significant at between the 2% and 5% level (T=2.05) and the decrease in sexual assaults was statistically significant at the 0.1% level (T=4.05). Equally, the increase in thefts from motor vehicles was statistically significant at between the 2% and 5% level (T= -2.28).

The qualitative data gave some explanation of local factors which might explain the increase in theft from vehicles, which is related to the lighting. Respondents reported that more cars were being parked on the estate by residents in and around the study area after lighting improvements. This, combined with the increased visibility seems to have provided more opportunities for theft from vehicles. Theft of vehicles, however, remained unchanged before and after relighting, in line with sub divisional statistics.

The impact on crime was also evident in police recorded crime statistics. These revealed that crime on the estate had stabilised. In fact, police statistics indicated a 1% increase on the estate (53 incidents pre test compared to 54 post test) but this compared favourably with a 22% increase for comparable offences in the surrounding sub-division. Police records also revealed that the proportion of offences committed after dark dropped from 39% in the twelve months before lighting improvements (Jan-Dec 1989), to 26% twelve months after (Jan-Dec 1990). In the first half of the following year there was a further reduction with **no night time** incidents recorded in the period Jan-June 1991. This suggests that the positive effect of lighting on crime continued to gather momentum over the 18 month monitoring period.

Extreme case pessimists might point out that crime has simply been displaced from the estate to the surrounding sub-division, or that the reduction was a random fluctuation that would have occurred anyway. Neither of these possibilities can be completely discounted but it is worth noting that the increase in the local sub-division was in line with an increase in crime across the Greater Manchester area. What can be said with certainty, is that the reduction in crime, evidenced by both the survey and police statistics, coincided with the lighting initiative and neither the police nor the researchers are aware of any alternative explanation for the results obtained.

Impact on fear and risks of crime. The investigation of fear of crime was tackled in a number of ways. Respondents were asked (a) how much they worried about a range of crimes, (b) how safe they felt in their own homes, (c) how safe they felt walking around after dark, (d) whether women, men and the elderly were safe, and (e) what precautionary behaviors they employed.

The study indicated that people's fears of specific offences were grounded in reality and mirrored the increases and decreases in specific types of crime. Survey data show a statistically significant decrease in respondent's assessments of the likelihood of victimisation for women going out alone after dark, for men and for elderly people. This corresponds to reductions in fear of robbery, vandalism and sexual assault (in line with the recorded decreases in these crimes).

Although 40% of respondents were no longer afraid to go out after dark, a greater percentage of people felt unsafe in their own homes on the post-test survey than the pre-test. The qualitative and quantitative data indicated that these fears were related to the worries about burglary. Fear of burglary remained unchanged (in line with the survey and police statistics, which showed that burglary continued to be a problem). The survey data indicated a decrease in successful burglary (from 46 to 25 incidents) but this was offset by attempted burglary which showed little change pre-/post-test (respectively, 53 to 51 incidents).

Impact on perceptions of neighbourhood decline. It is now well documented that fear of crime is greatly influenced by disillusionment with the physical aspects, facilities, services and atmosphere of a neighbourhood (Skogan 1990). Consequently, respondents were asked various questions about neighbourhood problems before and after lighting improvements. One of the indirect, or 'halo' effects of the lighting intervention is that respondents perceived that their community was less troubled in various ways. There was a 24% reduction in people believing crime was a problem, that being pestered and insulted was a problem, that lighting of stairs and hallways was a problem (in fact this remained unchanged) and an 82% reduction in those believing street lighting was a problem.

This was matched by a 63% increase in the number of people believing that crime on their estate was now less than that on other estates. There was also a marked increase in those believing the estate conditions had improved, and a reduction in those believing it had got worse, on the pre-test survey.

Fear of crime can be exacerbated by the belief that those in authority do not understand, or do not care, what happens to them or their area. Such perceptions leave people feeling more helpless and demoralised in the face of what can be seen as impotent and uncontrollable political forces. Respondents were asked on pre- and post-test surveys whether local authority staff, local councilors, the police and their member of Parliament understood the problems faced by residents on the state. Following lighting improvements there was a 50% increase in those believing local councilors, and a 27% increase in those believing local authority officials, understood problems on the estate.

The relighting initiative was also coincident with an increase in reported crime and social problems.[6] Contacts with the police (especially crime-related reporting) increased from 30% pre-test to 40% post-test and contacts with the housing department increased from 36% pre-test to 60% post-test. Relighting is seen as tangible proof of investment in the fabric and future of the estate and this has acted to counteract perceptions of previous neglect. It also seems to have communicated to residents that the neighbourhood is improving and is capable of further improvement.

Inner City Area Level Analysis: Birmingham

This study was located in the Moseley and Showell Green area of Birmingham, an area of about two square miles located approximately 2 miles to the South of Birmingham City Centre. The project was designed to examine the differential effects of lighting improvements across an inner city area.

The area contained 3,588 dwellings and some 68 commercial premises. It was selected on the basis that it had a diverse housing and ethnic mix and included leisure and commercial activity. It was thought that because of this diversity, information derived from the survey would be applicable to a range of similar types of inner city areas. Consequently, useful comparative findings would be obtained regarding the effectiveness of improved lighting in streets with different types of dwellings and population at a 'meso' level, as opposed to the 'micro' level.

Surveys of residents, businessmen and pedestrians were undertaken before and twelve months after the street lighting was upgraded. The design and methods were more sophisticated than previous projects and included:

- a 10% random sample of households across the area (N=359) with before and after interviews conducted on a panel basis.

- a further random sample of 25% of households in three streets, identified by police statistics as representative of high, medium and low crime areas.

- pedestrian surveys and counts in three locations; two within the experimental area and one pedestrian survey and count in a control area.

- business and crime survey of all commercial premises.

■ police recorded crime statistics for the area.

Space precludes a detailed account of survey results, but there were marked differences. In particular, pedestrians were much more critical of the lighting and council services, before and after lighting improvements, than was the case with the household and commercial premises surveys.

Crime, fear and disorder. There was a marked variation in crime within the community (between businessmen and householders) and between different areas of the district.[7] The household survey indicated that people's experience of crime varied enormously from one street and sub area to another. Indeed, over 50% of all crime reported on the household survey came from two of the six sub-areas.

Nonetheless, the post test survey indicated a 53% reduction in crime to households (364 incidents down to 170). There was a 60% decrease in burglary, 50% decrease in stolen vehicles and a 71% decrease in theft from vehicles. Residents reported that problems with drunken and disorderly behaviour decreased after relighting. Disturbance problems (noise late at night, fighting, arguing when drunk, rowdy and abusive behaviour) showed definite and statistically significant reductions ($p<0.01$). Conversely, police statistics indicated a 50% increase in crime, most of which related to theft of and from vehicles. Many of these were committed against people visiting the area; because of off street parking they may have been less effected by improvements to street lighting.

Crime against business increased in the twelve months after relighting. However, it is important to note that between the pre- and post-test surveys, a third of the commercial premises had closed. The increase in crime may be indicative of displacement from households to commercial premises. Businessmen, however, attributed the increase in crime to increased unemployment and the fact that there were fewer commercial targets in the area which were, and continued to be, repeatedly victimised on the pre- and post-test periods.

Crime to pedestrians changed little before and after lighting improvements and reported harassment doubled from 23% to 48%. This was a negative outcome and may suggest that the increase in pedestrian traffic has increased antisocial behaviour to pedestrians. It was interesting that pedestrians did not notice the improvements to lighting as much as in previous studies. One possible explanation for this is that the change in lighting levels was not sufficiently marked to impact on crime and safety to those using the streets after dark.

The household survey revealed considerable reductions in worries about all types of crime and a reduction in those who felt unsafe in their homes after dark. There was no change in householders' sense of safety in the streets but note the comment made earlier in relation to pedestrians fears and lighting levels. The relighting improvements had little impact on business peoples' fears of crime. This is unsurprising given their actual experience of crime and lifestyle. Nor were there any noticeable changes to pedestrians sense of personal safety or fear of crime.

Pedestrian counts were taken at three locations. Two were in the relit area and one in a control area (lighting unchanged before and after. There was an overall increase of 98% in the relit area with only a 14% increase in the control area. Once again relighting appears to have encouraged more people to use the streets after dark.

Implications. The impact of any measure will have variable impact across, and within, an area depending on the social and physical context and the efficacy of programme implementation. The surveys of pedestrians and businesses suggested that the lighting levels in this area of Birmingham had not been as effective as anticipated. As the council lighting engineers have refused repeated requests for the exact measurements achieved in the post test period, this must remain a matter for conjecture.

Crime to householders was reduced and people felt safer in their homes, though not in the streets. Residents in the area were much more likely to have noticed improvements and to have been positively affected than were pedestrians or business people. One possible explanation is that residents would be more aware of the lighting being installed (excavation work for laying cables, erecting lighting columns etcetera) and living in the area they would be more likely to notice the changes. In contrast, none of those running businesses in the area actually lived within it, or walked through it especially at night. It should also be pointed out that businesses tended to have installed good lighting in and around their premises for security reasons. In these circumstances it is unsurprising that business people were relatively unaffected by the improvements.

On-going Research

Two studies currently under way have more sophisticated designs. Both have utilised a pre-post test experimental designs with non-equivalent control areas. In addition to household and pedestrian surveys, young people between the ages of 12 and 17 years of age were interviewed to examine their experiences, worries and reactions to the lighting. Not only are this section of the population likely to spend more time on the streets after dark, but they are also likely to contain a greater proportion of potential offenders and victims. One project has also included a multiple victimisation survey to facilitate interpretation of differential impact on victims. Both studies are empirically addressing the issue of temporal and geographic displacement.

Conclusion: The Benefits of Lighting Improvements

The UK programme provides data of the impact of relighting at different locations and at different levels of analysis. The data has the advantage of being comparable and consistent, since the core questions on crime, fear and neighbourhood quality of life were standardised across the different projects.

As might have been expected the impact of lighting improvements varied in different physical and social contexts and at different levels of analysis. It has had most effect the more focused the lighting improvements were in time and place. The strongest effects were evident where street level crime sites were analysed in relation to their physical characteristics and social usage after dark. Badly lit streets which were essential through routes from residential premises to night time leisure, transport, communication and commercial facilities provide eminently suitable targets from the offenders perspective. Other physical design factors such as surveillance, visibility, the number of alternative routes through a neighbourhood, shrubbery and structures also need to be analysed, as all these factors combine to bring potential offenders and targets together in time and space.

The reductions in crime and disorder at the micro spatial level were also supported at wider area levels of analysis, though the process of causal inference between intervention and outcome was more problematic to establish, and indeed, varied within and across areas, as well as between offence types. Nonetheless, projects undertaken at different levels of analysis have demonstrated the efficacy for lighting as a crime prevention measure by attempting to identify the link between lighting, physical design and neighbourhood dynamics in time and space. The general trends to emerge are that lighting improvements have been shown to reduce crime and disorder, reduce fear of crime, improve the quality of life and community safety, offset feelings of previous neglect, promote community confidence and stimulate political action and increased contacts with local agencies. It also had a tangible effect on social behaviour by increasing night time street use.

Lighting is not a panacea for crime and in all likelihood it will work most effectively in conjunction with other measures (Griswold 1992) since there are real limits as to what can be achieved by any single, stand alone preventive measure. Nonetheless, research designed to evaluate the impact of a single physical intervention has the advantage of being able to gauge the benefits of a particular programme in time and space. For, when several crime prevention measures are implemented concurrently a fundamental aim of scientific evaluative investigation is confounded since it is not possible to separate out and therefore evaluate different programme effects. Consequently, policy makers remain unsure, which of the various measures played the leading role in crime reduction (Felson et al. 1990).

The research programme illustrated that lighting improvements have some notable advantages over other crime prevention strategies. First, it is a scientifically measurable intervention, in that lighting levels before and after improvements can be accurately assessed. Second, it provides a visible and obvious improvement to the night time environment which on the whole, is recognised as such across all sections of the population. It has been shown to benefit every section of the community including some of the most vulnerable groups whose fears are highest; women, the elderly and the young. Moreover, unlike some other interventions, it has not been shown to bring about any social harm and it is worth pointing out that recent technological developments in high performance lighting are designed to be environmentally friendly and efficient with regard to light pollution.

Third, by altering the environmental cues after dark it appears to have effected resident, pedestrian and offenders image of the area. It provided a sign that the area had improved through investment in one

aspect of the built environment. As such it seemed to ameliorate residents feelings of neglect and neighbourhood decline and create a general 'feel good' safety factor. Equally, it may, in Rappaport's words (1982), have sent out a 'nonverbal' message to offenders, that the neighbourhood was changing and the heightened visibility and surveillance increased the risk of committing crime.

Fourth, lighting is a low cost option. Once installed it requires minimum resources to sustain unlike other interventions such as Neighbourhood watch, police patrols and tenant associations which require continued resourcing in terms of time, effort and money to sustain immediate benefits. Consequently, it is well placed to have longer term effects, especially if sustained by other environmental and social improvements (Painter 1991b). Lastly, it can function as both a situational and social crime prevention measure, since as a physical, mechanical intervention it has been shown to bring about a tangible change in social, criminal and disorderly behaviour.

Notes

1. One of notable advantages of street lighting as a physical, environmental improvement is that it is a scientifically measurable intervention. The exploratory projects and subsequent replications were designed to meet British Standard, BS5489, Part 3, which identifies three lighting levels to correspond with low, medium and high crime risk areas. The highest category 3/1 was achieved in all three exploratory projects, an average illuminance of 10 lux and a minimum of 5 lux, with a 'white' light source.

However, the question, *how good is good?* is not only a question of absolute measurement but one of comparative measurement; the change from pre- to post-test conditions must be both measurable and noticeable. On a conjectural note, lack of attention to measurement aspects before and after upgrading, might well have contributed to the 'nil effect' findings of some earlier studies conducted in the USA and in one small case study, recently completed in Scotland (Ditton et al. 1992).

2. Perceptions of crime problems are an important aspect of crime prevention in that attitudes can have a tangible impact on behaviour. If people believe crime is on the increase in an area they will use it less often. When they do use it they will do so in a particular way. Fixed stare, quickened pace, head down and a determination not to get involved should an incident occur (Wilson and Kelling 1982). Thus, not only the number of capable guardians, but their willingness to become involved, is reduced. Opportunities for crime can be increased as people withdraw from the streets to the privacy of the home. As will be argued subsequently, explanation of the social dynamics through which lighting can impact upon crime extend beyond a simple opportunity reduction model of crime prevention.

3. Panel interviews (where the same people are surveyed at different points in time) are a means of controlling for individual variation which can effect results. By controlling for subject variables, over time, panel interviews provide an extremely powerful and sensitive measure of change among individuals.

4. The diffusion of benefits of relighting to daylight was also observed by Poyner and Webb (1992) in their study of improved surveillance and lighting in indoor markets.

5. The space around one's home is space that must be crossed to connect with the outside world. It forms a clearly defensible boundary between the public and private sphere. The meanings most people attach to their home and the immediate space around it, affects the significance and interpretation of events which occur within it.

In the specific social and environmental circumstances of this study, vandalism and despoilment of personal property were not experienced as trivial property crimes but as serious personal, domestic offences. They combined to heighten fear and to violate and threaten the privacy, security and social control of personal space, for a group of people already rendered acutely vulnerable because of their age, physical frailty, economic powerlessness and social isolation. Relighting had such an effect because it changed the social usage, residents behaviour and image of the environment.

The project provided a clear example of the benign effects of lighting on crime and disorderly conduct. Even if, hypothetically, lighting displaced disorderly and obscene conduct elsewhere (since it cannot be conclusively proved that it did not), then the question is whether it made things better or worse, and for whom. If vomit and urine were displaced to the pub toilets, this is a positive net gain for the community. If they were displaced elsewhere, to someone else's garden or porch, then the effect is less positive but arguably has resulted in a more even and equitable distribution of the offences across the locality (Painter 1991). As Barr and Pease contend, a crime displaced can be interpreted as a crime prevented. Moreover, as this study demonstrated, rather than being regarded as an obstacle to crime prevention, displacement can be, "considered as a tool with which to work towards distributive justice. Even with the presumption of total displacement a case can be argued, that the redistribution of crime achieved is socially desirable". (Barr and Pease 1990).

6. The increase in contacts with the police has important implications for those using officially recorded crime statistics to evaluate the impact of lighting on crime. Because relighting seems to have resulted in an increase in community cohesion and neighbourhood satisfaction, this has increased the propensity of the public to report offences and has resulted in an increase in reported crime (Schneider 1986). Consequently, unless the project design and methods to evaluate effect are sufficiently sensitive to the social mechanisms which lighting may stimulate, the beneficial effects of increased satisfaction would appear as a negative outcome (an increase in recorded crime). Apparent disregard, or lack of awareness of this possibility is a major shortcoming of a recent Home Office project which attempted to evaluate the impact of lighting on crime using reported crime figures to estimate effect across an area of London (Atkins et al. 1991).

7. As a result of the physical and social diversity and as a natural step in many of the statistical tests carried out, the study area was subdivided into six sub-areas, assigned on the basis of ACORN classification.

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by Trevor Bennett

Community policing and crime prevention

Introduction

Over the last few years policing in Britain and the United States (and many other countries in the world) has moved away from what has been described as a traditional model or professional model of policing towards a more community-oriented model (Goldstein, 1990). This shift in orientation has brought with it a number of changes in police practice including a fundamental reappraisal of the nature of police involvement in crime prevention and the kinds of crime prevention activities conducted by the police.

The main aim of this paper is to consider the effect of these changes in policing on the nature of police crime prevention activities and to assess their potential effectiveness in reducing crime.

It is argued that community policing has three major impacts on the nature of police crime prevention activities: (1) it involves the police in identifying and tackling crime problems at the local level; (2) it encourages the police to use specially designed crime prevention strategies tailored to the specific types of problem identified; and (3) it encourages the police to involve the local community in the crime problem identification and prevention process.

What is Community Policing?

There is no universally accepted definition of community policing among academics or among the police. However, there is some convergence of opinion in the academic literature that community policing comprises three main elements: (1) a philosophy of policing, (2) compatible organisational strategies, and (3) compatible operational strategies and tactics (Trojanowicz and Bucqueroux, 1990; Friedmann, 1992).

It is argued in the literature that community policing is fundamentally a policing philosophy which specifies a new kind of relationship between the police and the public. Statements made in the literature about the nature of the relationship fall into two main groups: (1) statements which refer to a relationship between the police and the public which involve the police taking account of the wishes and concerns of the community (Goldstein, 1990); and (2) statements which refer to a relationship whereby the police and the community work together to achieve common goals including preventing crime (Morris and Heal, 1981; Skolnick and Bayley, 1986).

Table 1
General Orientation of the Police Towards Crime Prevention Under Community Policing and Traditional Models of Policing

Traditional Model	Community Policing Model
The police role mainly concerns law enforcement	The police role concerns a wide range of functions including prevention, enforcement, order maintenance, public tranquility and the quality of life
Police work is mainly reactive	Police work is balanced between proactive and reactive tasks
Policing is conducted mainly over large areas	Policing is conducted mainly at the local level through decentralised command units

Table 2
General Approaches of the Police Towards Crime Prevention Under Community Policing and Traditional Models of Policing

Traditional Model	Community Policing Model
The choice of crime problem to tackle is made by the police	The choice of crime to tackle is made by the police or by the public, e.g., residents or businesses
Crime prevention is focused on serious crimes	Crime prevention is focused on a range of crime and non-crime problems including serious crimes, minor crimes, disorder, nuisance, fear of crime and general local problems
Imformation about crime problems is generated by routine police knowledge and experience	Information about crime problems derives from many sources including crime pattern analysis, epidemiological data, public attitude surveys, and victimisation surveys
Crime prevention methods are selected from a limited "toolbox" of "tried-and-tested" programmes	Crime prevention methods are designed in response to the particular local needs and particular crime problem
Crime prevention is mainly done by the police working alone	Crime prevention is done by the police working alone or in collaboration with the local community or other agencies
Crime prevention resources are spread (and "diluted") across areas and problems	Crime prevention resources are focused (and "concentrated") on specific "high risk" areas or "high priority" problems

As community policing is conceived primarily as a philosophy of policing which focuses on consultation and collaboration with the community there are no organisational structures which are intrinsically community policing structures. However, some organisational structures are more frequently cited in the literature than others as being compatible with a community policing philosophy. One of the most frequently cited is decentralisation. It is argued that small command units which have small areas of operation have the capacity to deliver community policing more effectively than large units with large areas of operation.

In the same way that there are no organisational strategies which are instrinsically community policing strategies there are no operational strategies which are intrinsically community policing strategies. However, there are a number of programmes frequently cited as being compatible with a community policing philosophy including community crime prevention and problem-oriented policing (Trojanowicz and Bucqueroux, 1990; Friedmann, 1992).

Implications for Crime Prevention

The change in philosophy and practice in Britain and in other countries from a traditional model of policing to a community policing model of policing has resulted in a reassessment of the police role. Some of the relevant parts of this reorientation are summarised in Table 1.

Adopting a community policing philosophy requires a number of changes to be made in the relationship of the police to crime prevention. It requires that greater attention is paid by the police to the prevention of crime. It requires that the police create time to conduct crime prevention activities by shifting the balance from reactive tasks (such as responding to calls for service) towards proactive and planned activities (such as crime prevention). It also requires that the police shift the focus of policing from force or divisional level policing (traditionally covering fairly large areas and populations) to the local level of specific and known geographic environments.

At a more detailed level adopting a community policing model involves other changes in the way in which the police perceive and do crime prevention. Some of these changes are shown in Table 2.

The choice of crime problem to tackle need not be made solely by the police in response to their own perceptions and experience about what constitutes 'real' crime. Instead, the choice can be made by the police in response to crime and incident analysis or by the local community and local businesses in response to their own particular observations and concerns.

The method of tackling local problems need not be limited to the traditional crime prevention methods (such as security advice or property marking). Instead, the methods used can include a broad range of specially designed and tailored approaches which suit the nature of the problem and the local circumstances.

The methods adopted need also not be limited to what the police can do alone but may include collaborative and joint efforts involving local residents, businesses, and other social groups.

The overall effect of the changes identified in the preceding two tables is to concentrate crime prevention activities by increasing the number of persons or groups involved in the crime prevention process and decreasing the number of targets at which these efforts are directed at any one time.

Community Policing and Crime Prevention

Community policing is in its early stages in Britain and many of its operational elements have not yet been implemented. Nevertheless, a recent national review of community-oriented policing initiatives in England and Wales conducted by Bennett and Lupton (1990) showed that some of its organisational and operational aspects have been at least partly implemented.

Some of the main components of community policing relevant to crime prevention are listed in Table 3.

The table identifies a selection of programmes typically associated with community policing and includes programmes which involve the police working mainly with others (such as police efforts to mobilise the community to develop neighbourhood watch schemes) and which involve the police working mainly alone (such as 'hot spots' patrols).

In the following sections the discussion will be focused primarily on those programmes which involve the police working mainly alone. The main

Table 3
Community Policing Organisational and Operational Strategies and Tactics

	Police working mainly alone	Police working mainly with others, e.g., residents, businesses, agencies and other groups
Area-Based Strategies	Sector Policing	Multi-agency crime prevention
Community-Based Strategies	Estates Policing Community beat Policing	Neighbourhood Watch Shop Watch Business Watch Crime prevention panels
Targeted Strategies based on specific high rate locations/offences/ offenders/victims	"Hot Spots" Patrols Offence-oriented Patrols Offender-oriented Patrols Victim-oriented Patrols	Property marking Security surveys
	Problem-oriented Policing	Problem-oriented Policing

reason for this is that the primary aim of the paper is to draw attention to police crime prevention activities which have tended to be excluded or underplayed in debates about crime prevention. Whereas a great deal of attention has been paid to police involvement with neighbourhood watch schemes and property marking very little attention has been paid to the crime prevention effectiveness of area-based policing or targeted patrol strategies.

Area-Based Strategies

The programmes. The term 'area-based policing' is used here to describe the use of decentralised policing units and includes team policing, neighbourhood policing, zonal policing, and sector policing. (The most common term in Britain at the moment is 'sector policing'.)

The use of decentralisation as an organisational and operational strategy arose mainly from United States through the ideas associated with neighbourhood and team policing. The North American system was based on the principle that patrol officers should be formed into fairly small autonomous teams based in individual neighbourhoods who would provide a full police service (Sherman et al., 1973).

Decentralisation has always been a feature of police organisation in Britain in terms of its system of fairly autonomous sub-divisions operating from police stations in large urban areas and in terms of its system of rural policing which until recently involved officers working from detached police houses to provide a local police service to villages. However, more recently decentralisation in the form of sector policing has been incorporated into a number of forces in Britain with the explicit aim of making contact with the community and improving the quality of police service in local areas. Sector policing typically involves the partition of police divisions into two or more policing sectors each headed by a sector inspector with responsibility for identifying and tackling local sector problems.

The Evaluations. Research on area-based policing in the United States has focused mainly on the implementation effectiveness of neighbourhood or team policing.

Experiments with neighbourhood and team policing in New York City, Dayton and Holyoke each resulted in some form of implementation failure. In New York City the team policing experiment was reported as being so weak that there was little discernible difference between the new programme and what police officers were doing before. In Dayton and Holyoke internal departmental disputes and low officer morale gradually undermined the programme changes (Sherman et al., 1973).

Research on sector policing in Britain has produced similar findings to those in the United States.

One of the most comprehensive investigations of area-based policing in England was conducted by Irving et al. (1989) for the Police Foundation in relation to pilot schemes in Notting Hill in London.

The research found evidence of implementation failure at various levels. Geographic responsibility was resisted by the relief officers on the grounds that

it undermined reactive cover and manning levels, while home beat officers resisted it on the grounds that allocating proactive tasks to relief officers undermined and confused their position. The implementation of graded response was widely criticised by the officers and was eventually abandoned.

The outcome evaluation showed no change in public attitudes towards the police or the area in which they lived. There was also no reduction in reported victimisations. In fact, the report showed a slight increase in the number of victimisations from the pretest to the posttest periods and a more substantial increase in the number of multiple victimisations.

Another major study of area-based policing in Britain was conducted in Greater Manchester. Unfortunately, the report did not include an outcome evaluation of the effect of the programme as a whole on crime. However, it found that some of the key elements of the programme were not implemented because of resistance by lower ranking officers (Chatterton, 1991).

One of the largest evaluations of sector policing which has included a full outcome evaluation is a study which is currently being conducted in the Thames Valley Police Force Area. Two versions of the programme have been implemented in separate parts of the police force area. The initial stages of the programme and a summary of the pretest data collection are described in an interim report (Bennett and Kemp, 1993). However, it is unknown at this stage whether the programmes as a whole (sector policing) or specific strategies within the programme (problem-oriented policing) will have an effect in reducing crime.

Implications. The main conclusions from this research is that decentralised policing has not been fully implemented or fully evaluated in a way in which a conclusion could be drawn about its effectiveness in preventing crime. It could be argued that focusing police resources on relatively small police areas rather than relatively large police divisions would increase the chance of the police preventing crime. However, it could also be argued that decentralisation alone in the absence of some additional crime prevention programme is unlikely to be sufficient in itself to reduce crime. It is perhaps as a result of this concern that some experiments with sector policing in Britain have included problem-oriented policing as an operational arm.

Community-Based Strategies

There has been considerable innovation in Britain in recent years in policing at the community level.

The Programmes. One of the more rapidly growing policing programmes in Britain is estates policing. Under the traditional model of policing police resources and police crime prevention activities are spread across whole divisions or whole subdivisions. Sector policing focuses policing on smaller areas although these areas may still be quite large (perhaps a quarter of a large town). Estates policing involves allocating a permanent or semi-permanent police team (perhaps up to 20 officers but more typically less than 10) to a single residential area.

The national survey of community-oriented policing strategies and tactics found that approximately a quarter of all forces operated at least one estates team (Bennett and Lupton, 1990).

Evaluations. A descriptive account of case studies of estates policing programmes in England compiled by The National Association for the Care and Resettlement of Offenders (NACRO) provides some evidence of crime prevention effects resulting from these programmes.

One of the most striking examples cited was the Broadwater Farm Estate in Tottenham, London which, during the early 1980s, was a high-crime area (in the early 1980s approximately one fifth of all houses were burgled each year) and in October 1985 was the site of a riot which resulted in a local police officer being brutally killed (NACRO, 1988). Since then the estate has been policed by a permanent team of eight police constables and a sergeant (NACRO, 1988; Bennett and Lupton, 1990). The NACRO report recorded that since the inception of the team crime on the estate reduced dramatically and cited one officer as saying that the estate is now 'probably the safest place in Tottenham' (NACRO, 1988). During our own interviews with the sergeant in charge of the team in 1988 he confirmed the NACRO statement by suggesting that crime was now so low on the estate that there was almost no need to continue the estates team (Bennett and Lupton, 1990).

A similar success was shown recently in relation to another housing estate in the north of England which was the site of riots during 1991 following the death of two young car thieves who were killed when they crashed a stolen car during a high speed chase with the police. Early in 1992, the police allocated an

estates police team to the area comprising a sergeant, two detectives, and 12 constables. Recently published crime figures for the estate shown that crime overall reduced by 42 per cent during the first year of the programme compared with the previous year. In addition, burglaries fell be 48 per cent, thefts from cars by 59 per cent and assault by 79 per cent. Overall, crime fell in the police force area as a whole by just 2.5 per cent (Pavey, 1993).

Another recorded success of estates policing was an experiment conducted in the Holme Wood Estate in Bradford, West Yorkshire involving the allocation of eight officers to the estate. The results of crime figures published by the West Yorkshire Police Force showed that residential burglary fell by over one third from the same period in the previous year and other crimes showed similar percentage reductions (Rayment, 1993).

However, not all estates policing programmes have been effective in reducing crime.

An experiment conducted in Chelmsley Wood in Birmingham which involved split force policing and the creation of a structured patrol team of 28 dedicated officers to police the area proactively found little evidence of success. The programme resulted in little change in public perceptions of policing or fear of crime in the area. There was also no significant change in victimisation rates (in fact victimisation rose by five per cent overall and the number of burglaries almost doubled) or in the detection of crime (Weatheritt, 1986).

An evaluation of 'contact patrols' in London and in Birmingham which involved allocating a permanent team of four officers and one sergeant to a single housing estate also showed little effect of the programme on crime despite strong evidence of implementation effectiveness. However, the programme showed evidence of other kinds of success including statements made by the public and the police that they liked the scheme and wished it to continue. Further, during the course of the programme public satisfaction with the police almost doubled in one area from 37 per cent of residents satisfied with police performance in the year before the scheme to 65 per cent satisfied at the end of the first year.

It is also appropriate to include in this section on community-based policing strategies the use of foot patrols and community constables.

In Britain, foot patrols and community constables can mean different things. Foot patrols can be deployed to any area from within the general shift officer teams who deal reactively with calls for service. These officers might perform this duty for a relatively short period of time and then be transferred back to general response work. Foot patrols officers can also be deployed to an area (such as a housing estate) on a more permanent bases and protected from the demands of incident work. Instead, they are expected to get to know their local area and the residents within it and do whatever they can to prevent crime and disorder. Community constables differ from estates teams to the extent that they typically work alone.

There are very few evaluations of the work of community constables on which to assess their effectiveness. A recent national review of the community constable scheme found that the use of such officers was widespread among forces. However, there were various problems relating to their implementation. Community constables were frequently abstracted to perform other duties conducted off their beats (about one-fifth of the time of community constables was spent off their beats). On average they spent about half their day inside the police station dealing with paperwork and other administrative issues. When they were patrolling their beat only a relatively small percentage of their time was spent talking to members of the public or engaging in community projects (Bennett and Lupton, 1992a; 1992b).

There is almost no research in Britain on the effectiveness of foot patrols on crime prevention. The only research available is an evaluation conducted in 1965 of a controlled experiment which involved testing the effect of changes in the number of foot patrol officers patrolling a standard beat. The results of the evaluation showed that changing the number of foot patrols from one officer to three officers per beat and from zero officers to one officer was associated with a reduction in crime. However, changing the number from one to two officers per beat had no effect on crime. The evaluation also reported that reducing the number of officers from one officer per beat to zero officers per beat was associated with an increase in crime, while other decreases (from four to three, three to two, and two to one) were associated with no change in crime (Bright, 1969).

Implications. The results of research conducted in Britain on the effect of police activities on crime at the community level are once again mixed. There is

some evidence that concentrating police efforts on particular housing estates can sometimes prevent crime. However, there is also evidence that on some occasions it does not prevent crime. It is possible that these differences in outcome are a result of poor research design or poor programme design or a result of conditional elements in the crime prevention process.

Target-Oriented Strategies

The term 'target-oriented strategies' summarises all of those crime prevention activities conducted by the police which are focused on specific persons, offences, or places. These include police 'crackdowns' and 'crime attack' strategies which involve the sudden increase in some kind of law enforcement activity by the police (Sherman, 1986). They also include 'focused' and 'directed' patrols (Chatterton, 1989; Burrows and Lewis, 1988) and 'specific' patrols (Sherman, 1992).

The programmes. A recent national review of community-oriented policing strategies identified almost 500 targeted policing strategies operating among police forces in England and Wales during the period of the survey in 1989 to 1990 (Bennett and Lupton, 1990). Approximately half of these could be described as 'location-oriented' or 'hot spots' strategies. These were used mainly at five types of locations: town centre areas, residential areas, specific public places, out-of-town area, and other high-crime areas.

Town centre strategies included patrols allocated to town centre areas generally (such as high-profile patrols and late night saturation patrols) and patrols allocated specifically to shopping centres (such as police shops, police teams, and high-profile patrols). Residential area patrols comprised police shops, police surgeries, police teams (non-permanent versions of estates policing), high profile patrols, and general purpose patrols. Public place strategies aimed at specific high-risk locations such as single buildings or single locations (such as hospital complexes and public parks). Locational strategies aimed at out-of-town areas typically focused on specific villages and often focused on the village green area as a place where youths hang about. Other high risk area strategies comprised a category to collect the remainder and included particular crime clusters wherever they may be (e.g. a spate of robberies outside an underground railway station entrance).

Evaluations. There is some evidence to show that targeted policing strategies are effective in reducing crime.

A recent review of the literature on police 'crackdowns' showed that fifteen of the eighteen programmes investigated generated initial deterrent effects (Sherman, 1990). Most of these programmes showed that crime returned to a more typical level once the crackdown had ceased. However, five of the programmes investigated in the review showed signs of a 'residual' deterrent effect of continued lower crime rates after the programme had ended. In the case of two of the programmes the residual deterrent effect lasted longer than the programme itself (Sherman, 1990).

There are other examples of targeted strategies which have been shown to have some impact on crime or fear of crime. A study of policing an alcohol-free zone in the city centre of Coventry in England showed a reduction in the number of incivilities reported in the area (Ramsey, 1990). Another study of policing an alcohol-free zone in Sweden also showed a reduction in drunkenness and disorderly behaviour following the implementation of the programme (Bjor et al., 1992).

There is a growing body of literature on targeted policing strategies which aims to reduce the supply and use of drugs at specific geographic locations. Three types of locational strategy have been described in the literature.

Drug raids have been shown to result in the seizure of drugs and the arrest of users and suppliers. This typically results in a termination of the activity in the short term although it is argued that the activity recurs at another time or another place (Dorn et al., 1992).

Drug sweeps involve the police arresting drug users and dealers and clearing away other people by various means at a particular time and in particular areas of the city. It is argued that 'sweeping the streets' is designed to disrupt rather than eliminate street-level drug dealing. The results of an evaluation of Operation Pressure Point on the Lower East Side of New York City showed that following the operation buyers spent less time on the streets and sellers varied the place and time of their sales (Zimmer, 1987).

Drug location targeting is another strategy which involves a more intensive surveillance and information gathering operation in relations to a

particular location. A recent account of Operation Trident which targeted a prominent drug dealing area of Notting Hill in London reported that drug dealers were driven from the area as a result of the operation (Dorn et al., 1992).

Evidence of apparent effectiveness of 'hot spots' patrols can also be found in police reports of the outcome of particular programmes. A recent report of an attempt by Cambridge Police to target the local city-centre shopping area to tackle the problem of drunks and drug users and 'down-and-outs' who used the site as a place to congregate during the day to the annoyance of the local residents and shop users showed a preventative effect. A uniformed team of officers was allocated to patrol the city centre shopping area. The police reported that following the implementation of the programme the number of burglaries in the area was almost eliminated and the incidence of aggressive begging was reduced (Cambridge Weekly News, 1992).

Implications. The results of the available research on police strategies provide some evidence that targeting police activities onto particular clusters of crimes at particular high-rate locations can prevent crime. However, a great deal of the evidence that is available derives from unsubstantiated or anecdotal reports and more rigorous studies are too few in number to arrive at any overall conclusions. Nevertheless, the small number of evaluations showing some evidence of success (albeit short term) is encouraging and might suggest further programme and research directions.

Conclusions

Recent debates about crime prevention have tended to focus on situational and social preventive measures and have tended to ignore (or at least underplay) the work of the police in reducing crime. It is possible that this relative lack of interest in police crime prevention activities is a product of a continuing belief in the existence of the traditional model of policing which is thought to give emphasis to law enforcement rather than prevention.

There is some evidence that police forces in Britain (and the United States) are currently experimenting with a wide range of strategies to prevent crime and non-crime problems at a local level. These strategies involve a shift in crime prevention focus among the police from whole forces or whole divisions towards specific areas, communities, and targets.

Despite these important developments in the crime prevention work of the police few of these programmes have been evaluated and their existence is barely acknowledged in discussions about crime prevention.

This situation might be regarded as surprising for a number of reasons.

First, crime prevention has always been a central function of the police and was described as the primary function of the Metropolitan Police in London at the time of their inception.

Second, targeted policing strategies have a logical appeal because they represent a considerable concentration of crime prevention efforts. It would be expected that concentrated crime prevention would be more effective than diluted crime prevention for obvious reasons.

Third, environmental criminology has shown for some years that crimes cluster in space and time and more recently this has knowledge has been extended by the use of technically sophisticated crime mapping techniques.

Community policing can broaden the role of the police in crime prevention both in terms of what they do when working mainly alone and what they do when working mainly in collaboration with others. This view is consistent with the theory of community policing which is based on the principle the police should consult with the community (and other agencies) in identifying problems to tackle (which would include taking account of community concerns through crime and incident analysis) and collaborate with the community (and other agencies) in their attempts to solve these problems. While the police have broadened their crime prevention activities in each of these directions the research community and crime prevention theorists have tended to pay most attention to the collaborative aspects of community policing and crime prevention. It would appear that this is not only a missed opportunity to broaden the range of knowledge about crime prevention activity but also an omission from current debates of an area of crime prevention work which has shown at least some evidence of effectiveness.

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by George F. Rengert and Jack Greene

Knowledge and perception of the inner city: The case of community service representatives

At the beginning of the 1990's, the business and civic organizations became concerned with the image and use of inner city Philadelphia. They wanted a cleaner, friendlier, and safer place that would attract customers, tourists, and businesses to the center of Philadelphia. The question turned on how to improve the quality of life in this area for day and night time users.

It was decided that one should not turn to the traditional source of community service; the already overburdened Philadelphia Police to reconstitute this area of the city. First, equity considerations argue against the powerful business and civic organizations consuming more than their fair share of scarce police resources needed in other parts of the city as well. Secondly, the police may not be the best vehicle for improving the overall quality of life in the inner city. Community policing concepts are just beginning to diffuse through the Philadelphia Police Department and not all officers embrace these concepts whole heartedly.

It was decided to supplement the already existing police detailed to the inner city with "community service representatives" who would have quasi police powers and who would be trained from the beginning to embrace a "problem solving" approach to better the quality of life in inner city Philadelphia. The business and civic community of inner city Philadelphia decided to fund this project with private monies contributed by their constituents. The training of these community service recruits is the focus of this analysis.

At the outset, it became apparent that the preconceived notions these community service recruits might have could effect their job performance since effective community service entails an accurate, intimate knowledge of the community the officer is assigned to serve. The heart of modern community service is not only the effort, but the desire of a community service officer to become familiar with the special problems faced by the residents of their assigned community. This accumulation of knowledge is an ongoing process which requires persistent interaction of the officer with the community.

Also important is the base line the prospective community service officer is starting from. As has been well documented in the psychology of dissonance and consonance, preformed opinions of new recruits are often difficult to erase. Once a person has made up his or her mind about the characteristics of an area, it is more difficult to

correct faulty impressions than to teach correct opinions in the first place. Furthermore, the less well known an area is, the more likely it is that negative connotations are ascribed to it. For example, subjects nearly always rate their own cities as safer than other cities, and their own residential neighborhood as safer than less well known surrounding neighborhoods. Therefore, the level of knowledge is believed to be an important determinate of the positive or negative perception of an area. The people assigned to train these community service recruits became concerned with their preexisting knowledge and perception of inner city Philadelphia.

Data

In the following analysis, recruits being trained to serve the inner city of Philadelphia are examined to determine whether their level of knowledge of this community is indeed related to their perception of the relative safety of this area. Data were collected during a training session conducted by one of the authors. It consists of two parts: 1) information on the knowledge the recruits possess of the location of important landmarks of inner city Philadelphia; and 2) information on the perception the recruits have of the relative safety of the communities composing inner city Philadelphia.

In order to record each community service recruit's knowledge of inner city Philadelphia, each was handed a base map of this area with the major streets recorded on it. They also received a list of 33 major landmarks located within this area. Then they were asked to place a dot on the base map where they believed each landmark is located and to number this dot with the corresponding number of each landmark. This resulted in a map of 33 dots corresponding to where the recruits believed each landmark to be located.

The perception of inner city Philadelphia was recorded for each community service recruit on a second base map. In this case, sixteen uniformly distributed points were listed on each map. The recruits were asked to identify that point which is located in the most dangerous neighborhood of inner city Philadelphia and give it a score of zero. They were asked to locate the safest neighborhood in inner city Philadelphia and record a ten for the point contained within this community. Given these anchors, the recruits were then asked to scale all remaining points between zero and ten with regard to whether they were like the most dangerous or the safest neighborhoods in inner city Philadelphia.

The Analysis

The above data allow the measurement of each community service recruit's knowledge and safety perception of inner city Philadelphia. Knowledge of the area is assumed to be directly related to the ability of each recruit to accurately locate major landmarks on the base map. The level of knowledge is measured by determining how many inches on the map their plotted location is in a straight line from the actual location of each landmark. This measurement of error is summed over the 33 landmarks and then divided by 33 to determine the average error per landmark for each recruit. This average error is our measure of the relative knowledge of each community service recruit of inner city Philadelphia.

The perception of relative safety is measured in a slightly different manner. Since each community service recruit is compared with all others, the first task is to determine the norm with which to make this comparison. In this case, the perceived level of safety is summed over all community service recruits for each point and divided by 24 (the number of recruits) to obtain the average value for each location in inner city Philadelphia. Then, the score each recruit placed on a point centered in an inner city neighborhood has this average subtracted to obtain a measure of deviation from the mean for each neighborhood for each recruit. Finally, this deviation is summed over all points and divided by sixteen to obtain the average deviation from the mean for each recruit. This average deviation is our measure of the relative perception of safety of inner city Philadelphia. The higher the score, the safer the recruit perceives the overall inner city to be relative to his/her fellow recruits.

Finally, both the relative deviation of perceived safety from the mean and knowledge of the inner city are standardized over all subjects. This standardization controls for some extreme values and allows for the statistical test of association of whether a significant relationship exists between knowledge of and perception of safety in inner city Philadelphia by community service recruits being trained to serve this community.

The Results

Table 1 lists the landmarks of inner city Philadelphia ranked in the order of how well known their locations are to the community service recruits. Notice that City Hall is the best known landmark in inner city Philadelphia. Notice also that the two least known locations of landmarks are religious centers. One might speculate that these community service recruits know government centers better than religious centers. However, it is surprising that the Police Administration Building ranked 21 out of 33 sites. In general, centrally located sites were more accurately located than those toward the edge of the map. Maps 1 to 4 are examples of the scatter of points plotted by all recruits as the location of a landmark about the actual locations of these landmarks.

Table 1
Major Landmarks and Error in Their Locations

Landmarks	Error in Knowledge of the Location
City Hall	.26
Gallery Shopping Plaza	.50
Independence Hall	.54
Academy of Music	.73
Chinese Arch	.81
Hershey Hotel	.83
Franklin Institute	.87
Masonic Temple	.88
Main Branch of Free Library	.88
Penns Landing	.89
Rittenhouse Square	.95
Hahneman Hospital	.98
Logan's Circle	.98
Jefferson Medical College	.99
Reading Terminal Market	1.00
Betsy Ross House	1.05
Art Museum	1.13
Cathedral of St. Peter and Paul	1.14
Natural Science Museum	1.32
Philadelphia Community College	1.37
Police Administration Building	1.46
Society Hill Towers	1.53
Academy of Fine Arts	1.53
City Tavern	1.79
Ben Franklin Court	1.92
Roman Catholic High School	1.96
Graduate Hospital	2.03
TLA Cinema	2.19
Jefferson Hospital	2.20
Ben Franklin Bridge	2.30
Washington Square	2.48
Friends Meeting House	3.43
Christ Church	4.74

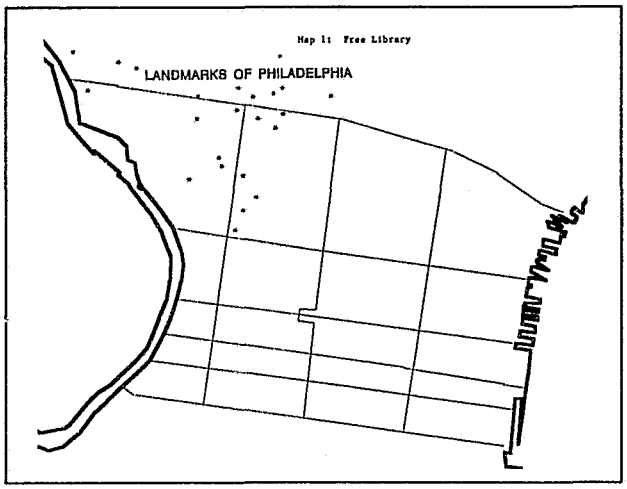
Maps 5 and 6 portray the average perceived daylight walking safety of inner city Philadelphia by these community service recruits. Contour lines have been drawn to highlight the relative safety of each area. Table 2 lists the deviation of each recruit's safety perception from the average of the entire group summed over all sections of inner city Philadelphia. Table 2 also lists the average knowledge of the location of the landmarks for each recruit as measured by a straight line from the plotted locations to the actual locations. The ranks of each recruit on each measurement is also given on Table 2.

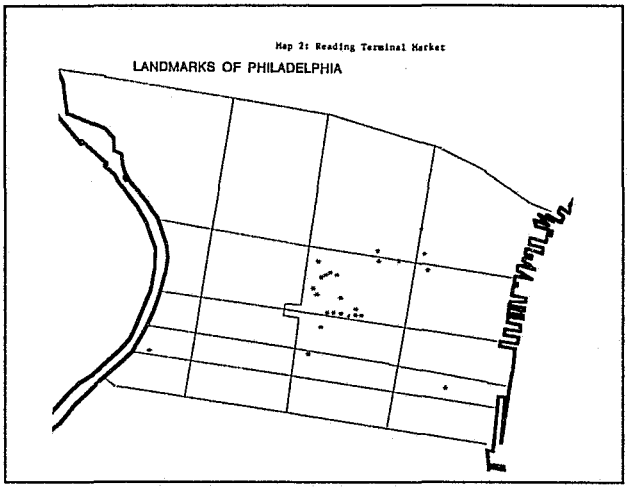
As can be seen at the outset, our initial proposition that the better known the inner city of Philadelphia is to a community service recruit, the safer he/she will perceive the area to be does not hold up. A simple regression model of the standardized variables of the form:

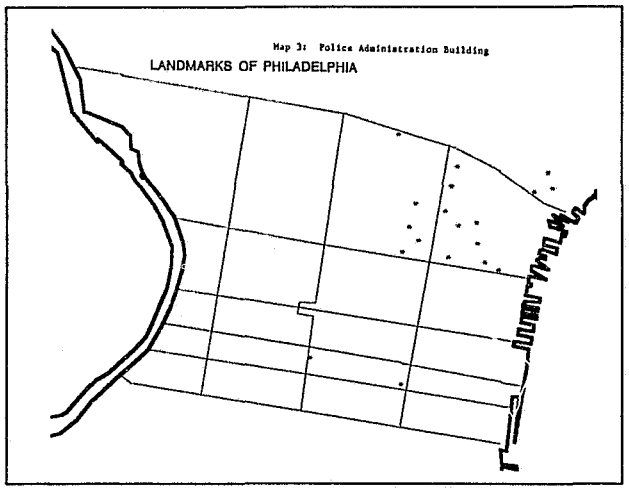
Perceived Safety = Constant + b*knowledge

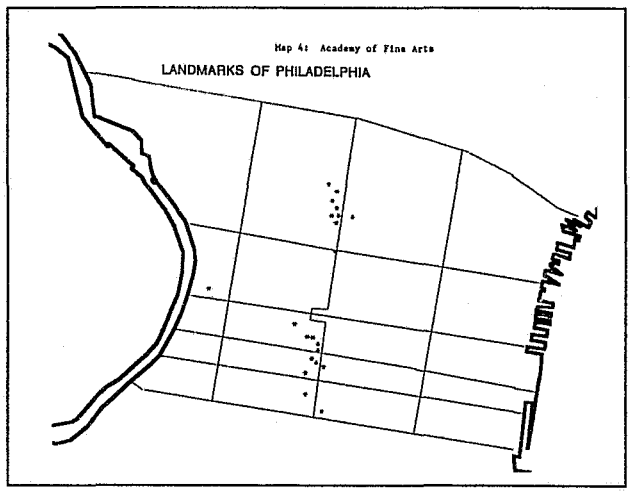
produces coefficient of knowledge of .016 and a squared r value of 0.00. This is as close to no statistical relationship as one can get! In other words, for this group of recruits, relative knowledge of the inner city does not translate into perceived safety. Since this finding runs counter to previous research, we must ask why this is the case for this group of recruits. Could it be that the inner city is indeed dangerous so that the better one knows it, the more accurate they perceive the danger? This could be tested by scaling the actual crime rates for the sixteen inner city areas between zero and ten and test whether those recruits who have the most accurate knowledge of the location of major landmarks also have the most accurate knowledge of the relative safety of different parts of the inner city.

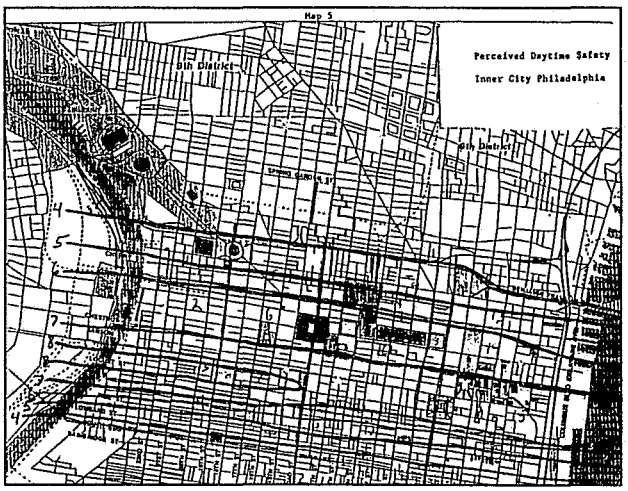
In this analysis, we scaled only the violent crimes of robbery, assault, homicide, and rape--crimes that instill the most fear in users of the inner city. This was accomplished be dividing the inner city into sixteen areas of nearly the same size and counting the number of these crimes (unweighted for severity) that occurred in each area in 1992. These values were divided by the largest value evident so that the area with the highest number of violent crimes has a value of one and all other areas are measured by the proportion they are of this value. These numbers are now subtracted from one so that the highest crime area has the lowest value (zero) as is the case when the recruits scaled the areas. These numbers are now multiplied by ten so that the possible range is zero to ten. This resulted in a range of values from zero to

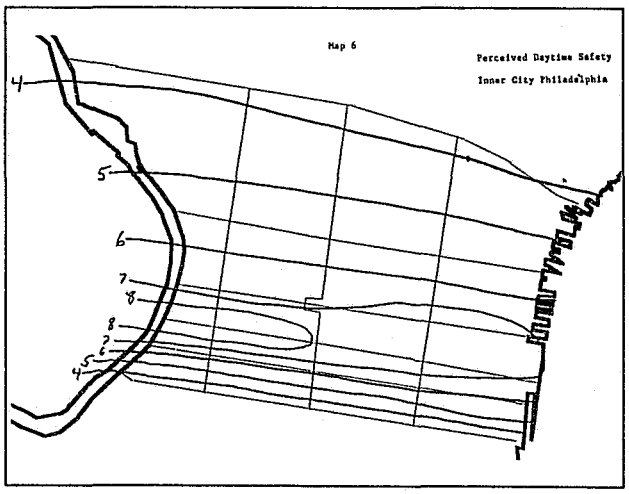

Map 1: Free Library
LANDMARKS OF PHILADELPHIA


Map 2: Reading Terminal Market
LANDMARKS OF PHILADELPHIA


Map 3: Police Administration Building
LANDMARKS OF PHILADELPHIA


Map 4: Academy of Fine Arts
LANDMARKS OF PHILADELPHIA


Map 5
Perceived Daytime Safety
Inner City Philadelphia
4th District
4th District


Map 6
Perceived Daytime Safety
Inner City Philadelphia

8.4 with five values above the midpoint of five and seven values below. In other words, it is nearly a normal distribution with few areas clustering about any value. Inner city Philadelphia is not a uniformly dangerous or safe area. There is considerable variation between regions.

A regression analysis with the dependent variable being the deviation when the actual level of safety is subtracted from the perceived level of safety for each recruit and the absolute values summed over the areas to provide a measure of how far from reality each recruit views the various areas in inner city Philadelphia in either a positive or negative direction. The independent variable is the deviation resulting when the actual locations are subtracted from the perceived locations for the thirty three landmarks in inner city Philadelphia. The result is a very weak positive coefficient of .003 and a squared r value of only .113. When the two variables were ranked across all recruits to control for some extreme values, the Spearman rank order correlation coefficient is .336. In both cases there is a very weak positive but insignificant relationship between knowledge of the inner city and perceived safety of the area.

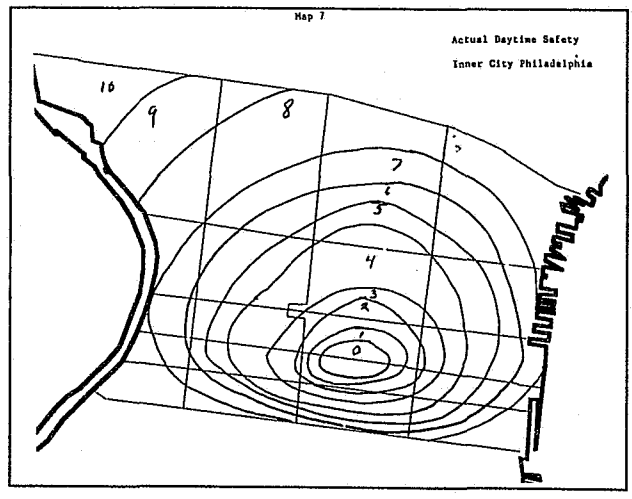
Table 2
Knowledge and Perceived Danger

Recruit	Perceived Safety	Rank	Knowledge of Landmarks	Rank
1	-.68	10	.4297	2
2	-24.68	24	1.0606	18
3	-12.68	21	.6506	3
4	4.32	9	.8952	12
5	20.32	3	1.7586	21
6	-6.68	15	1.9063	22
7	-8.68	16	2.1953	23
8	-11.68	20	.7976	9
9	-9.68	17	.3789	1
10	-13.68	22	.7887	8
11	-.68	11	.9815	15
12	26.32	1	1.1827	19
13	-3.68	12	1.0086	16
14	-14.68	23	.9436	13
15	14.32	4	.7833	7
16	-4.68	13	.6364	5
17	5.32	7	.6515	6
18	7.32	6	.7984	10
19	-10.68	19	3.1724	24
20	5.32	8	1.0577	17
21	23.32	2	.9516	14
22	-6.68	14	.8750	11
23	-9.68	18	.6212	4
24	13.32	5	1.4306	20

Since the relationship between knowledge of the inner city and perceived safety of the area is so weak, we must ask if we can identify by personal characteristics who is most likely to accurately identify the location of landmarks; and who is most likely to rate inner city Philadelphia as safe or unsafe. In other words, is there a type of recruit who does not know the inner city but rates it as a safe area or, vice versa.

Again, we will make use of previous research to guide our analysis. Past research has shown that women tend to have poorer spatial skills than men (Macaby, 1966). Therefore, we expect the nine female community service recruits to have performed less well in locating major landmarks than their fourteen male counterparts. When we summed the distance that each male recruit had plotted the location of major landmarks from their actual locations and divide by the number of male recruits, we obtain an average value of 1.48 inches on the scaled map used. When we compute the mean for the nine women recruits, it is a slightly larger 1.63 inches on average. So the women are slightly less knowledgeable and/or accurate in locating major landmarks in inner city Philadelphia than their male counter parts. This is as expected.

Next we consider feelings of safety during the daytime in inner city Philadelphia. Past research would lead us to believe that males will perceive the area to be safer than the females for two reasons. First, males are expected to explore space and to feel more secure in strange areas while females are socialized to play it safe and to remain in more secure known areas (Bardwick, 1972). Secondly, since the males have more accurate knowledge of the inner city than the female police recruits, they are expected to feel safer in these more known areas than their female counter parts.



However, when we sum their mean deviation from the average perceived safety level for inner city Philadelphia, we find a big surprise! The average deviation from the mean for the fourteen male recruits is -39.20. The average deviation for the nine female recruits is +19.88. In other words, the women recruits perceived inner city Philadelphia to be much safer than their fellow male recruits. This is a surprising finding and the one which caused our initial propositions to be rejected.

Several possible explanations for this finding can be proposed. First, since the inner city is the primary shopping hub for residents in the surrounding parts of Philadelphia, and since shopping is a traditional female function in American society, maybe females feel more comfortable in the inner city than males. Also, inner city Philadelphia provides employment for many females in the service and retailing establishments. Again, females may feel safer in these familiar environments. Secondly, on the other hand, it could be that the inner city is not safe and this is more accurately identified by the males who know the inner city better.

This second proposition is difficult to test. We can get some evidence by observing how accurately the men and the women recruits estimated the actual relative crime rates of each of the twelve locations in inner city Philadelphia. The actual violent offenses can be scaled between zero for the most dangerous location and ten for the safest location for each of the sixteen locations in inner city Philadelphia. Then, these values can be subtracted from each recruits perceived level of safety for each location. These values are then summed over the twelve locations and divided by twelve to obtain an average value for each recruit. This will be a measure of how accurately each recruit estimated the actual safety level of each inner city location. If the male community service recruits are more accurate in this exercise than the female recruits, then we might argue that they have a better knowledge of the relative safety level of the inner city as a whole. Also, if the violent offenses do not vary much from place to place and are relatively high, then there is evidence that the women are perceiving the area as safer than it actually is; possibly because of a relative lack on knowledge of the entire area. If there is considerable variation in the part one offenses between sections of the inner city Philadelphia, then the question turns on who can most accurately identify this variation--the men or the women community service recruits.

The results do not demonstrate much difference between the men and women recruits. When the actual safety level is subtracted from the perceived safety level, the mean absolute deviation is 46.76 for the women recruits and 45.55 for the men recruits. The men are a bit more accurate in perceiving the safety level than the women as we expected. But the difference is small. In other words, neither the men or the women are very accurate in identifying the relative level of safety in inner city Philadelphia. The question now turns on which areas are causing the errors in the recruits' perceptions of relative safety.

We have constructed two maps in which the contours of the perceived and the contours of the actual safety are portrayed (Maps 6 and 7) to partially answer this question. Notice that there are extreme differences between these maps. The community service recruits perceived the center of the city to be the safest (especially the area around Rittenhouse Square) with a ridge of decline in either direction away from the center of Philadelphia. In actuality, violent crime in Philadelphia is spatially arranged as a "hot spot" centered just to the southeast of the center of the city. In other words, the community service recruits incorrectly perceived crime to increase toward the edge of the inner city where low income residential areas begin while in reality, violent crime decreases in these directions. In fact, the safest area in inner city Philadelphia is the Logan Circle area to the far northwest of the inner city; an area the community service recruits rated as one of the least safe in the inner city.

The reason there is so much variation between perceived and actual safety in the case of these recruits may revolve around a conceptual problem. What the recruits may have been scaling is "potential safety" rather than "actual safety." In other words, an area may be relatively safe in actuality because people avoid the area. Both routine activity theory (Cohen and Felson, 1979) and Jane Jacobs (1965) critical intensity theory of land use explain that a potential victim must be present for a crime to take place. We are left with the question of whether an area is unsafe if people avoid it so few if any crimes take place there. In actuality, it is not unsafe if people avoid the area so that no crimes take place. But it is potentially unsafe if one were to wander into the area. Therefore, the actual safety level is lower in parts of the inner city which are heavily utilized. Actual safety is higher in areas less used. What we are missing is a measure of the "population at risk". Again, is it safe if no one goes into an area?

A better approach may have been to ask each recruit where the most violent crime occurs rather than where the safest areas in the inner city are located. As long as we have no statistics on how many people use each area of the inner city so that we can measure the population at risk, we can not compute an accurate measure of the actual safety level of each area. We are left with a measure of how much violent crime takes place and the recruits' perceptions of where it is the most and least safe to walk in the inner city. With regard to potential safety, they may be more accurate than the violent crime statistics. But in reality, if they are to serve the communities of the inner city, they must have accurate knowledge of where the most violent crime takes place.

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by Richard C. Lumb, Ronald D. Hunter and Donna J. McLain

Fear reduction in the Charlotte Housing Authority

Introduction

Since the 1950's crime rates in Charlotte, North Carolina public housing has been four or five times higher than in corresponding middle-income neighborhoods of urban communities. The Charlotte Housing Authority addressed this problem with a multi-phased attack which included additional police patrols, victim assistance and crime prevention programs, implementation of the Safe Neighborhood Awareness Program (SNAP), and plans aimed at the burgeoning drug problem.

To strengthen resident perceptions that they lived in a safe environment the Housing Authority initiated programs that involved them in the planning and decision-making process. Staff and residents worked together to eliminate social disorder and crime problems. A large grant from HUD (1980-1982) provided funds for a comprehensive crime prevention program in one of the Housing units. Tied to this were a host of other programs aimed at juveniles, victims, drug and alcohol abuse, and a youth employment project. Residents were trained to conduct the major program activities themselves. Policies aimed at removing people from public housing who were convicted of illegal activities or in violation of housing rules began to change the environment of neighborhoods. Police officers assigned to housing were allowed to act as agents on the property, substantially increasing the range of available options, other than arrest, for solving problems.

In 1990, the SNAP program was recognized by the Eisenhower Foundation as one of the five best community crime prevention programs in the United States.[1] In 1991 those neighborhoods designated these additional prevention programs experienced a 12.3 percent reduction in crime. In 1992, there was a modest increase of 3.5 percent in the targeted developments and an overall increase of 16.4 percent in all other developments.

Information on resident fear and questions of safety, Housing Authority services, and quality of life concerning the individuals who live in the ten developments with specialized community policing programs was desired by the Housing Authority. A study conducted during the summer of 1992 sought to answer these questions.

Theoretical framework

The notion that fear is an individual's reflection of victimization emerged two decades ago. The possibility of being victimized results in an emotional response and fearfulness toward unknown assailants. Public demonstration of their fear of crime has been documented by several researchers (Clemente & Kleinman, 1977; Skogan & Maxfield, 1981; Weiss & Mikakovich, 1975). Research has demonstrated that those individuals who are most likely to become victims, young men, are the least afraid (DuBow, McCabe, and Kaplan, 1979). Conversely those who are least likely to become victims of violent crime or physical harm, women and the elderly, often experience the greatest fear (Braungart et al., 1980; Clemente & Kleinman, 1976; Cook, et al., 1978; Conklin, 1975; DuBow, McCabe, & Kaplan, 1979; Garofalo, 1979; Lee, 1983; Mawby, 1986; Mullen & Donnermeyer, 1985; Ollenburger, 1981; Reed, 1988; Skogan & Maxfield, 1981; War, 1984; Yin, 1980).

Smith and Hill (1991) discuss variations in how people experience the relationship between victimization and the fear of crime. They cite Skogan and Maxfield (1981) on how women and the elderly overestimate their actual vulnerability to crime. They attribute this to greater physical vulnerability and reduced social and psychological abilities to cope with crime. Fear appears to be of high concern among the elderly, females, ethnic and racial minorities, and urban dwellers. Skogan & Maxfield (1981) associate this to their elevated physical vulnerability and disproportionate social and psychological coping mechanisms for dealing with crime. Females and the elderly appear to be more aware of the risks associated with crime and their potential for victimization.

The Select Committee on Aging (Harris & Associates, 1975) determined that the elderly place the fear of crime as their most serious problem taking the lead ahead of income, health, and housing. However, those who are most concerned about crime victimization generally take preventive action to reduce their risk (Balkin, 1979). He goes on to say that researchers measuring attitudes and perceptions of the fear of crime can lead to problems in associating the data to social and psychological variables. The fear of crime produces a number of negative effects on people (Rohe & Burby, 1988) which include psychological stress, avoidance behavior, and physically moving away from perceived unsafe neighborhoods (Balkin, 1979; Skogan, 1986; U.S. HUD, 1978; Yin, 1981). Other researchers alluded to a weak relationship in support of this view (Garofalo, 1978; Skogan & Maxfield, 1981; Smith & Huff, 1982) or to the nonexistence of this relationship (Hill et al., 1985).

Research has developed a number of theoretical models of fear. The *victimization* model which includes both direct (Greenberg, 1984; Lavrakas, 1980; Skogan, 1981) and indirect associations (Lee, 1983; Skogan & Maxfield, 1981; Tyler, 1980; Yin, 1980) states that (1) fear is larger than actual victimizations due to people hearing about crime happening to others and overlaying the possibility to themselves (Lavrakas, 1980; Klecha & Bishop, 1978; Yin, 1980). The elderly, due to their vulnerability and likelihood of discussing crime among themselves - they tend to have fewer friends for social support, and often less involved in their neighborhoods - often experience a magnified fear of crime (Curtis & Kohn, 1983). Skogan et al. (1981:209) concluded that "knowing crime victims is related to higher levels of fear, particularly when those events occur close to home." Garofalo (1981) said fear of crime among the elderly, relative to actual risk, often misleads their perception of risk of victimization.

Second, interaction among people on the local level intensifies the expectation of victimization fear levels. Lastly, sociodemographic comparisons of fear indicate victimization risk. This means that certain individuals are more physically vulnerable than others to becoming a crime victim which in turn intensifies their fear levels and vulnerability. Liska, Lawrence, & Sanchirico (1982) stated that members of minority groups and those in low socioeconomic status are more ecologically vulnerable than others in different circumstances.

The effect of victimization experience on individual response to the fear of crime is relatively unknown. Skogan (1986) alleges that property and personal victimization have an effect on the extent to which people take defensive and/or protective steps against crime. As stated in Smith & Hill (1991) Skogan believes infrequency of personal victimization may diminish its effect relative to concern about property crime.

The *incivilities* model (Hunter, 1978) reflects a persons awareness of environmental conditions both social and physical that provide clues to conditions leading to the belief there is more crime and therefore more chance of becoming a victim. Included in these incivilities are abandoned buildings, teens hanging around, litter and abandoned automobiles, noise, and loitering. In a

report by the U.S. Congress Senate Permanent Subcommittee on Investigations (1989) the incidence of drug sales and drug-related crime in urban public housing has many residents afraid to go outside their homes. Walsh (1988) discusses organized gang activity and adversarial encounters between the police and residents which led to increased fear among residents. The opening of an office by the police and the implementation of a team policing program helped reduce open drug dealing and other disobedience. Unless addressed these incivilities become a warning beacon to residents that leads to fear and increased anticipated risk of victimization.

The *community concern* model (Conklin, 1975) lies in the belief that the neighborhood is destructing and declining with a reduced level of social ties often leads to greater fear. Perceived community disintegration leads to a greater intensity of fear of victimization. People stay home to avoid problems thus reducing local social contacts necessary for a healthy community (Conklin, 1971). Maxfield (1984) alleges that community areas experiencing high crime rates, all people in those areas including youth and elderly, males and females, respond with equal awareness to the potential danger of becoming a victim of crime. In low-crime areas the elderly respond with greater levels of fear.

Fourth, the *subcultural diversity* model (Merry, 1981), alleges that fear is a product of living in close proximity with to other people whose culture and traditions are different from one's own. Misunderstanding and/or misinterpretation of other peoples habits and behaviors lead to fear and intimidation.

The *vulnerability* model the relationship of a persons physical limitations to avoid attack and exposure to the threat of victimization due to the individual's economic situation. Skogan (1981:89) describes physical vulnerability as "openness to attack, powerlessness to resist attack and exposure to traumatic physical consequences if attacked." Social vulnerability is defined by Skogan, 1981:89) as arising from being frequently exposed to the threat of victimization and suffering severe social and economic consequences from victimization.

Fifth and last, the *social control* model underscores a diminishing social alliances and loss of control and the beginning of fear. When people feel a bond between them there is generally less fear as residents believe others will support them in times of trouble. Greenberg and Rohe (1986) said that social cohesion leads to informal social control in an area. Informal social control is the observance of appropriate behavior in public, adherence to the expectations of the neighborhood regarding proper conduct and demeanor. Wilson and Kelling (1982:24) described informal social control in neighborhoods as "the observance of standards of right and seemly conduct in the public places in which one lives and moves, those standards to be consistent with - and supportive of the values and life styles of the particular neighborhood." Factors in determining resident perceptions of social control include the physical characteristics of the neighborhood. Contained in this list are vandals, drug sales, drunks, litter, building in disrepair, juveniles hanging around, and other indications of disarray. Levels of resident fear appear to rise in relation to the degree of lack of social control (Hunter, 1978). It appears that those who have a sense of strong social cohesion and control in their community and feel well integrated are less fearful of crime. Social cohesion generally fosters improved communication among residents leading to more awareness of crime in the neighborhood, resulting in higher levels of fear.

All of the above models are perceived manifestations linking a person's perceptions to the fear of victimization. Other researchers have examined the objective aspects of disorder and crime resulting in a large diversity of variables that contribute to the research on fear. These include age (physical vulnerability), race, socioeconomic status or class, lower class members of the community, racial minorities, an individual's perception of safety in his/her neighborhood, neighborhood conditions, integration among different people in a neighborhood, and other more tangible variables (Sundeen and Mathieu, 1976).

As an example, Linquist and Duke (1982) examined the greater fear by older persons but who experience fewer incidents of victimization. Questions like do people who live among many diverse ethnic and racial groups (subcultural groups) experience more fear than those who do not? Are class differences manifested by increased fear of those who are of a lower socioeconomic status? What other conditions or situations create a fear of victimization among people? Does hearing about crime and disorder cause greater fear among those who have not personally experienced being a victim? These and other questions have led researchers on a search for answers and greater understanding about the causes and manifestations of fear of victimization.

Fear may be exaggerated in those individuals who are aware of others who have been victimized, the individual's prior victimization experiences, and the seriousness of that victimization (Garofalo, 1981; Lee, 1983; Yin, 1980). Miethe & Lee (1984) cites other research concerning possible crime-related predictors of fear that have received less empirical attention. These include the perception of the likelihood of being victimized (Lee, 1983; Warr and Stafford, 1983); a person's perception of vulnerability (Yin, 1980); and the extent of precautions that persons take to protect themselves from crime (Sundeen and Matthew, 1976).

Emerging from this other research it appears that fear affects sociological aspects of people and neighborhoods. Fear of crime is also an important perception that are directly related to policy concerns and theoretical considerations. While fear crosses all socio/demographic boundaries, myths about the elderly and other groups abound. Property loss and personal injury cause anxiety and escalate the fear of crime among residents. And finally, theories dealing with victimization, vulnerability, and social control have been widely used to develop more complete models concerning the fear of crime.

Table 1
Variables and Measures[1]

Constructs	*Indicators*
Victimization and crime level in area.	Based on whether home had been broken into or an attempt had been made; was anything stolen from outside the home.
Personal and social vulnerability.	Age; education; gender; race.
Social attachment and perceived social and physical incivilities.	People drinking in public; using drugs; selling drugs; how people in neighborhoods are toward one another; how they get involved on a social basis.
Security measures.	Satisfied with safety and security; with external lighting; and with police protection.
Project management.	Services received and provided by manager of the development; by maintenance people; by central office staff; by residence safety staff; by community assistance staff; by drug, alcohol treatment and prevention staff.

[1] Not all of these variables, while available in the study, were used in the model due to their lack of significance.

Sample characteristics

Data measurement. This study includes a variety of indicators taken from the theoretical models stated above. Included are the constructs of personal victimization, personal and social vulnerability, social attachment, perceived social and physical incivilities, security measures, and housing authority project management.

Respondents. The respondents represented all social, economic, educational, and cultural strata. The largest age group was 25-44, 44.2% (N=295); males accounted for 15.1% (N=101); and African American accounted for 79.8% (N=533) of the sample. This is inconsistent with the proportions in the County which is 71.3% white and 26.3% Afro American respectively. Concerning employment 4.2% (N=28) were employed full-time, 15.9% (N=106) part-time, 37.3% (N=249) unemployed, 28.7% (N=192) retired, 10.0% (N+67) disabled, and the remainder 3.8% (N=26) fell into other categories or were missing. The majority 37.6% (N=251) said they had completed high school, 29.9% (N=200) had attended high school, 25.3% less than high school, with the remainder falling in various other categories.

Analysis

The primary concern of this paper is to evaluate the effectiveness of selected variables in predicting fear of crime among residents of ten low income housing developments in Charlotte, North Carolina. Variables for analysis were collected from a random 20% sample of residents living in the ten housing developments. The ten developments were selected as they were the recipients of a specialized community policing program by the Charlotte Police Department.

Analysis of the fear of crime -- whether a person was or was not fearful - was done using logistic

regression. Logistic regression permits estimation of influence that a variety of independent variables have on the probability of the occurrence of a certain event-the fear of crime.

Table 2
Characteristics of Respondents
(N=668)

	Number	Percent
Age		
Less 15 years	2	0.3
16-20	12	1.8
21-24	45	6.7
25-34	185	27.7
35-44	110	16.5
45-54	41	6.1
55-64	59	8.8
65-74	81	12.1
over 75	133	19.1
Gender		
Male	101	15.1
Female	560	83.8
Missing	7	1.1
Race		
White	124	18.6
Black	533	79.8
Missing	11	1.6
Employment		
Fulltime	28	4.2
Parttime	106	15.9
Unemployed	249	37.3
Retired	192	28.7
Disability	67	10.0
Other	3	0.4
Missing	23	3.4
Martial Status		
Married	550	82.3
Widowed	30	4.5
Separated	15	2.2
Divorced	19	2.8
Never Married	31	4.6
Missing	23	3.4
Education		
Less 4 years	41	6.1
5 to 8 years	128	19.2
Some H.S.	200	29.9
Technical sch	2	0.3
Completed H.S.	251	37.6
Attended trade sch	8	1.2
Completed trade sch	2.3	
Attended college	23	3.4
Completed college	4	0.6
Missing	9	1.3

Sample selection. This research sought to determine community opinions of housing authority residents on the fear of crime by individuals within one mile of their residence. The data are based on individual interviews conducted by trained interviewers with a random sample of approximately 668 residents of ten Charlotte Housing Authority areas. Fear of crime was measured using the General Social Survey question *"Is there any place right around here -- that is, within a mile -- where you would be afraid to walk alone at night?"*

Measurement concerns. Lagrange and Ferraro (1989:688, 89) state two general problems found in most research measuring fear of crime. They allude to the problems of differentiating between perceptions of fear and risk of crime or a general concern about crime as a social problem (Lee, 1983). This, they state, compounds measurement validity and interpretation of findings. The second problem references the research question itself. Citing the routine use of the General Social Survey and the National Crime Survey by researchers to obtain fear of crime information, includes three serious flaws:

(1) the reference to crime is implied rather than explicit,

(2) single-item indicators of theoretical constructs are more error prone than multiple-item indicators, and

(3) single-item indicators of fear of crime are insensitive to variation in fear of different types of crime.

They also allude to the generalization that most people are not out walking alone at night and this might be cause for inaccurate response to the question. They felt that these problems might exaggerate the true level of fear among those who responded. Lee (1983) pointed out that the question in the National Opinion Research Center's survey was conceptually ambiguous and possibility was not an equally valid indicator of fear of crime across gender, race, and geographic area. By this he believed the question may measure different underlying beliefs or expectations between men and women, young and old, and urban/rural residents.

Other researchers have suggested that differences between an individual's fear of personal and nonpersonal victimization and a generalized fear of crime. Measuring the fear of crime using a dichotomous variable which prohibits measuring the degree of fear. It seems logical that the more serious the offense against a person the greater the degree of

residual fear. Skogan (1986) believes it would be useful to weigh the frequency of victimization to distinguish serious from non-serious crimes.

Study methods and measures affect outcomes of empirical research. As example, Reynolds and Blyth (1976) found that prior victimization is a strong predictor of fear. Bishop and Klecka (1978), on the other hand, reported that prior victimization had no effect on fear.

Dependent variable. Fear of crime is dichotomized (yes-no) to indicate whether fear of crime was indicated by those respondents in the study.

Independent variables. Six exogenous variables found to have a statistically significant ($p < .05$) effect on peoples fear of crime in this analysis have been established to correlate significantly with the fear of crime in previous research studies. These include property stolen from outside the home, attempted breaking and entry, age of respondents, gender, how people interact socially, and external lighting in the developments. Table 3 presents the results of the logistic regression analysis on the dependent variable fear of crime. A total of 551 respondents were usable in the logistic regression model. Table 4 presents the independent variables coding used in the model.

Table 3
Logistic Regression Analysis on the Fear of Crime[1]

Variable	B	S.E.	Sig	Exp(B)
Stolen Outside(1)	.8077	.4125	.0502	2.2427
Attempt Break(1)	.8028	.2502	.0013	2.2318
Age				
0-20	-1.4887	.7023	.0340	.2257
21-29	-1.5047	.2625	.0000	.2221
30-49	-0.9891	.2213	.0000	.3719
Gender(1)	1.4509	.3205	.0000	4.2669
Soc Interact(1)	.7443	.2007	.0002	2.1049
Ext Lighting(1)	- .9984	.4443	.0246	.3685
Constant	- .3185	.5455	.5593	

B = estimated coefficients
S.E. = standard error
Sig = significance level for Wald statistic
Exp(B) = factor by which the odds change when the independent variable increases by one unit
Correctly predicted 69.69%
Model $X^2 = 117.111$, d.f. = 8, $p \leq 0.05$

[1] Significant at 0.05 level

These variables were run using both the forward and backward stepwise variable selection. Following the forward and backward stepwise variable selection procedure, only questions 23, 55, 71, 75, 98 and 101 remained when no other variables met the entry or removal criteria.

Results

Logistic regression of the single dichotomous dependent variable, fear of crime, resulted in a model with six independent variables found to be significant. In the above model respondents who stated that they experienced a previous attempted walk alone at night then if their dwelling had not had an attempted break in. With reference to age, all levels of age below 50 showed to be significant. Respondents below age 20 were less likely to be afraid by a factor of .22 and those between the ages of 30-49 were less likely by a factor of .3719 than respondents 50 or older. Females in this model were 4.2 times more likely to be afraid than males. Respondents who are satisfied with external lighting are less likely to be afraid by a factor of .36 than those who were unsatisfied. Finally, respondents in neighborhoods who get involved socially on a regular basis are more fearful to walk alone at night by a factor of 2.1 than those who do not get involved. Explanation for this is most likely due to a heightened awareness to crime and other peoples fears due to increased communications among people who socialize frequently.

The original model incorporated several independent variables from the questionnaire that corresponded to indicators found in the theoretical models by other researchers. Backward and forward stepwise variable selection procedures produced similar variable findings. Those variables identified as significant by both procedures were included within the model. All of the initial model independent variables are shown in Figure 1.

Discussion

Previous research identified a number of variables that were found to impact peoples fear of crime. Variables or indicators have been housed in a variety of theoretical models which were constructed to explain fear of crime. These models include victimization (Greenberg, 1984; Lee, 1983; Skogan, 1981; Yin, 1980), incivilities (Hunter, 1978), community concern (Maxfield, 1984; Conklin, 1975), subcultural diversity (Merry, 1981), vulnerability (Skogan, 1981), and social control (Greenberg & Rohe, 1986; Wilson & Kelling, 1992). For purposes of this study personal victimization, personal and social vulnerability, social attachment, perceived social and physical incivilities, security measures, and housing authority project management were grouped into five constructs. Indicators within each of these constructs allowed the researchers the opportunity to seek understanding about individual causes of fear within the broad parameters of the theoretical models. This research examined twenty-two indicators within the five theoretical models particular to the respondents in this study. Only six of the twenty-two indicators resulted in significant outcomes.

Table 4
Independent Variables Coding Used in the Model

Characteristic	Value	Freq	Parameter Coding (1)	(2)	(3)
Age					
0-20	1	13	1.000	.000	.000
21-29	2	129	.000	1.000	.000
30-49	3	205	.000	.000	1.000
Over 50	4	204	.000	.000	.000
Attempted Break Into Your Home					
Yes	1	108	1.000		
No	2	443	.000		
External Lighting					
Satisfied	1	524	1.000		
Not satisfied	2	27	.000		
Gender					
Male	1	472	1.000		
Female	2	79	.000		
People Interact Socially					
Often	1	206	1.000		
Occasionally	2	345	.000		
Property Stolen Outside Home					
Yes	1	37	1.000		
No	2	514	.000		

The indicators of a person's home having been broken into or an attempt made and property stolen from outside the home were significant in the victimization model. This indicated support to findings that being victimized raises an individual's fear of future victimization (Skogan, 1981).

Indicators of age and gender were significant in this research model - previous research placing them in the social vulnerability theoretical model of fear of crime. Persons younger than the age of fifty were less likely to be afraid of becoming a victim of crime. This is consistent with findings that older people are often more afraid (Linquist & Duke (1982) and women are frequently more fearful than males (Garofalo, 1979; Clemente & Kleinman, 1976)

In the social attachment model those individuals who got together more on a social basis were more likely to be afraid than those who did not. This is consistent with Curtis & Kohn (1983) who stated that the elderly get together less often socially and often experience a magnified fear of crime, and Yin's (1980) conclusion that getting together often results in a discussion of crime happening to others leaving people feeling more fearful.

Implications

Implications of this study are best related to policy and procedures at the Charlotte Housing Authority. Programs that emphasize individual self-help and specialized counseling services to people whose residence have been broken into would help reduce the fear of crime. After-the-fact assistance to people who have experienced a break-in would be a valuable service. Additional patrols, person to person contact by police officers, and elevated visibility by housing authority employees would also benefit.

People over the age of 50 appear to be the most fearful. Specialized programs aimed at providing safety hints, security measures, and use of neighborhood watch programs might help reduce the anxiety of fear of being victimized. As a special population, the Housing Authority could target specialized programs and plans to lessen the

conditions that elevate a person's fear who is over the age of 50.

These same programs could include special information for females as they appear to be much more fearful than male respondents of this study.

Reference to external lighting as having a positive effect in reducing the fear of crime points out the value of this variable on peoples fear of crime. The Housing Authority should insure that all developments are adequately lighted and that these lights are maintained due to vandalism or normal wear.

People who get involved with other residents were found to be more fearful than people who are more reclusive in their behavior. The cause of this is unknown, however, some supposition is in order. Perhaps people pass along both accurate and inaccurate information regarding crime. Knowledge of crime happening in a person's immediate environment can lead to heightened fear of victimization. The Housing Authority should take steps to keep residents informed of problems in their communities and work to eliminate misinformation or rumor. Facts, while not always a panacea, are felt to be more effective than falsehoods. A working communications system will do more than reduce the fear of crime among residents. It can serve as a conduit for all types of information.

Figure 1
Independent Variables Used in the Initial Model which Corresponded to Indicators in the Theoretical Models

Q3 Satisfied with Services by HA Management
Q4 Satisfied with Services by HA Maintenance
Q6 Satisfied with Services by HA Central Office
Q7 Satisfied with Services by HA Safety Staff
Q8 Satisfied with Services by HA Comm Assistance
Q9 Satisfied with Services by HA Staff
Q10 Satisfied with Services by HA Drug/Alcohol
Q21 Satisfaction with Safety and Security
Q23 Satisfaction with External Lighting
Q24 Satisfaction with Police Protection
Q29 Problem with Drinking in Public
Q30 People Using Drugs
Q31 Problem with People Selling Drugs
Q54 How People Treat One Another
Q55 How Well People Interact Socially
Q67 Home Broken Into
Q71 Attempted Break Into Home
Q75 Anything Stolen From Outside Your Home
Q98 Age
Q100 Education
Q101 Gender
Q102 Race

As demonstrated by the few indicators of fear found to be significant, the Charlotte Housing Authority has initiated several positive programs which have been effective in reducing fear among residents. Sources of problems have been identified and solutions found to improve and/or correct many problems. The six indicators which we have identified as currently contributing to peoples fear of crime can also be combated and corrected, hopefully resulting in a lessening of the fear of crime in their neighborhoods.

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by Ross Homel and Jeff Clark

The prediction and prevention of violence in pubs and clubs[1]

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Alcohol and Pubs in Australian Culture

Since the European conquest beginning in 1788, alcohol has played a central role in Australian culture. As historian A. E. Dingle (1980) puts it:

...'the blessings of civilisation came to Australia in the form of a flag, gunfire and alcohol' [from F. M. Freeland, author of The Australian Pub].

Aborigines had no knowledge of alcoholic fermentation and so by 1788 Australia had long been the world's only 'dry' continent. All the evidence on the first 30 years of settlement indicates that white Australians were intent on making up for lost time as rapidly as possible. (p. 228).

Australia's reputation for heavy drinking has its roots partly in the militarised and mostly male society of the initial British colonisation, partly in the gold rush era of the mid-1850s, and partly in the (again mostly male) tradition of itinerant bushworkers of the late nineteenth century (Room, 1988). The tradition of male mateship that developed at this time led to the formation of at least two drinking practices which persist to this day: the practice of "shouting", which is "the obligation to share in drinking as a group activity, with each man taking his turn buying a round of drinks for all"; and the tradition of binge drinking, or "work and bust", "the drunken blowout, often in town, at the end and on the proceeds of a hard spell of work in the bush" (Room, 1988: 415).

Toward the end of the nineteenth century spirits gave way to beer as the preferred beverage, resulting in a halving of per capita absolute alcohol consumption, but in the decades after the Second World War per capita consumption increased to levels comparable with those of the gold rush era. Since the 1960s, with the final, decisive defeat of the forces of moral uplift centred around the Temperance Movement, there has been an enormous increase in the availability of alcohol and in the penetration of drinking into all parts of daily life. In recent years total consumption has again started to decline, with beer giving way in its turn to wine, but Australia is still best characterised as a "wet" drinking culture, in the sense that drinking is socially integrated into daily life and alcohol consumption is accorded an important place in popular culture (Parker, 1993). By contrast, "dry" drinking cultures (mainly the Scandinavian countries) are characterised by heavy consumption of spirits, high levels of total abstinence combined with extreme forms of binge drinking, and heavy controls on alcohol availability. Britain and

the United States are characterised by Parker (1993) as "mixed" drinking cultures, displaying some features of both wet and dry societies. Parker argues that the differences between drinking cultures are large in scope, affecting nearly everyone, and that the relationship between alcohol use and violence might be strongly moderated by cultural factors. This suggests that overseas readers should as far as possible avoid reading Australian research on alcohol use through their own cultural filters.

Historically most drinking in Australia took place out-of-doors or in hotels (perhaps closest to "taverns" in American parlance). Until the First World War, when six o'clock closing was introduced after 30 years of agitation by the Temperance Movement, most hotel bars were small and catered to the needs of working men wanting to socialise away from their families. The "six o'clock swill" changed all that:

The first arrivals crowded against the counter, the less fortunate ones called over their heads, late comers jostled and shouted and swore in an attempt to be served before closing time. It was a revolting sight and one it took a long time for me to take for granted ... The shouting for service, the crash of falling glasses, the grunting and shoving crowd, and that loud, indistinguishable clamour of conversation found nowhere but in a crowded bar beat upon my brain until all my actions became mechanical. (Phillips, quoted in Room, 1988: 425).

The brutalisation of the drinking environment engendered by temperance agitation has left permanent scars, despite the gentrification in recent years of many traditional pubs and the proliferation of licensed clubs with sophisticated entertainment and dining facilities. Extreme crowding which is nevertheless within legal limits is still common, as is binge drinking promoted by the serving practices of management (Homel, Tomsen & Thommeny, 1992). An almost complete lack of effective external regulation with respect to the harmful consequences of drinking can be viewed as a direct legacy of the Temperance Movement, with its focus on prohibition rather than on the creation of less harmful, more pleasant drinking environments (Homel & Tomsen, 1991).

What has changed in recent years is the centrality of pubs and clubs as entertainment venues for vast numbers of young people, male and female, from all areas of a city. In the past, respectable women and many middle class men would never have been seen drinking in public, but since the 1960s hotels and licensed clubs have been extremely successful in attracting women and patrons from all social classes. The great majority of patrons in hotels, clubs and discos are under 30 years of age, especially at the weekends, and are often present with groups of friends. Public drinking is legal at age 18, and even neighbourhood pubs provide good quality entertainment sufficiently often to attract large crowds on Friday nights and weekends. Many well-known rock bands get their first start in hotels, and the larger hotels provide quite sophisticated dance and discotheque facilities, as well as restaurants and (in recent years) gaming machines. In New South Wales poker machines and other gambling devices have been legal for many years in licensed clubs, which has provided them with the capital base to expand and modernise their facilities. Hotels have been at something of a disadvantage in this respect, and have had to compete through such means as offering live entertainment, discount drinks, happy hours, and cheap, reasonable quality meals.

Thus the entertainment needs of young people in Australia are served primarily through licensed premises, the three major forms of which are hotels, nightclubs, and large suburban clubs financed through poker machines and run by sporting associations (such as the Rugby League) or by organisations such as the Returned Servicemen's League. Apart from drinking, activities engaged in by young people include playing games such as pool, dancing, listening to bands, eating, and gambling on poker machines. Socialising between the sexes is, not surprisingly, a common pastime, and it is not unusual, especially later at night inside and around discotheques, to see couples engaging quite openly in various forms of physical intimacy.

Many hotels and clubs are extremely large, with several separate bars and entertainment areas within the one building. In fact, the provision of physically distinct drinking and entertainment sites is one way licensed venues have catered to the needs of diverse groups of patrons, from traditional working class men to businessmen or middle class teenagers. Other hotels have been renovated and marketed in such a way that they attract patrons from a very narrow age range. For example, one well-run hotel on Sydney's northern beaches runs a disco designed, it seems, for boys and girls aged 18 to 22. Discotheques and some other forms of entertainment generally make a charge for entry, which at $10 or $15 may be a significant component of the cost of an evening out. If drinks are then offered at discount prices for periods during the evening, or if there is promotion of high alcohol

beverages with special prizes, there is obvious pressure for binge drinking. These types of irresponsible serving practices are still common, despite the promulgation in 1990 of the National Guidelines for the Responsible Serving of Alcohol (National Alcohol Beverage Council and National Campaign Against Drug Abuse, 1990).

Nearly everyone drives to clubs and hotels, and owners have accommodated demand by building enormous car parks. This makes drinking and driving a particular problem, which is combated by police random breath testing of motorists rather than by making management responsible for their serving practices (Homel, 1988). The concentration of large numbers of young people in crowded bars and discotheques creates other problems as well. Most large venues employ security firms or in-house crowd controllers, known popularly as "bouncers", to manage rowdy behaviour, disorder, and fights. Unfortunately bouncers are frequently employed straight off the gym floor and have minimal skills in communication and non-violent conflict resolution, making them a major part of the problem of violence (Homel & Tomsen, 1991). Although some states, including New South Wales, have legislation requiring the registration and identification of bouncers, police rarely check credentials and take little interest in how premises manage their affairs unless too many complaints come their way.

Alcohol, Licensed Premises, and Violence

Alcohol has frequently been noted as a factor in assaults. Evidence comes mainly from three major kinds of enquires: studies of populations (trend studies in populations and natural experiments); studies of individuals (individual coincidence estimates and experimental studies); and studies of drinking contexts (conducted indirectly from surveys of drinkers or pub managers and directly by observation of drinking in natural settings).

In trend studies, analysis is based on a correlation (over time) between aggregate levels of per capita alcohol consumption and crime rates in a jurisdiction. All the limited work in this area seems to have been conducted by Scandinavians, and it all points to a positive association between consumption and crime (e.g. Lenke, 1989; Skog, 1986). In natural experiments, sudden changes in alcohol availability or in the enforcement of laws related to alcohol consumption are studied for their impact on crime. Collins (1989) cites a number of studies which examined the effects of temporary reductions in alcohol supplies due to strikes, government experiments (in Sweden), school bans, or other factors, most of which found a reduction in the level of violence when the supply of alcohol was interrupted.

Studies examining "individual coincidence estimates" use crime events as the units of analysis, and look at the use of alcohol by the offender, the victim, or both, preceding the crime. There are three main ways in which this has been done:

(a) Studies of individuals and groups who have been under some form of surveillance, treatment, incarceration, or punishment from state agencies. Most of these studies have found a positive association between high alcohol use or 'alcohol problems' and a personal history of involvement in arguments, fights, and criminal assaults (Collins, 1989). For example, in Western Australia, Indermaur and Upton (1988) found that alcohol abuse amongst prisoners, particularly those with a history of violence, is a major problem.

(b) Studies of violent incidents recorded by state agencies, including police records of criminal assaults. These studies look at reported incidents of violent crime, and consistently suggest that alcohol is involved in between 40% and 70% of cases, being present in the assailant and frequently the victim as well. For example, in Wolfgang's (1958) Philadelphia homicide study, alcohol was found present in either the offender, victim, or both in 64% of cases. The variability of estimates is due partly to differences in what is considered a violent crime, and partly to the frequent subjectivity involved in judging the presence of alcohol. A recent, unusually thorough Australian police study (Ireland & Thommeny, in press) concluded that 77% of "public order" offenders (assault, offensive behaviour and offensive language) had been drinking shortly before the offence, and that 60% of these occurred in or around licensed premises.

(c) Studies of injured persons treated at casualty or outpatients departments of hospitals. In a review of the literature comparing injured and non-injured patients,

Cherpitel (1993) notes that the majority of studies find significantly higher levels of alcohol consumption and patterns of alcohol dependence among those with injuries.

Despite the evidence of individual coincidence studies, it is difficult to claim a direct role for alcohol in these violent behaviour patterns or criminal incidents. The problem of 'deviance disavowal' - the denial of responsibility for one's actions by citing alcohol as a determining cause or facilitating factor - remains as a confounding variable (Collins, 1989). Studies of officially recorded crime incidents are possibly unreliable, for a variety of reasons. Not only do police records of violent crimes represent only a small proportion of all such crimes which occur in the community (National Committee on Violence, 1990), it is possible that alcohol-related incidents are less likely to be recorded by police than non alcohol-related incidents. In addition, leaving aside these sampling problems, it is quite plausible that since violent crimes arise frequently from interactive disputes, the increased number of such incidents in pubs and clubs at weekends and around closing time could simply reflect intensified social interaction as people attempt to socialise and enjoy themselves.

These kinds of difficulties have led to a considerable amount of laboratory research into the effects of alcohol on aggression. Experiments on both humans and animals provide convincing evidence that alcohol enhances aggression, with Bushman and Cooper (1990) concluding on the basis of a meta-analysis of 30 human studies that the magnitude of the effect is similar to other variables such as gender. However, the relationship is not simple (White & Humeniuk, 1993). Aggression increases with alcohol dose up to a point, but high alcohol doses appear to suppress aggression. Moreover, the relationship depends on testosterone levels and (in humans) on the presence of frustration and threat (Gustafson, 1986).

The complexity of the alcohol-violence link, and the importance in nearly all studies of socially and cognitively mediated rules (Pernanen, 1991), led us in a previous paper to emphasise that a focus on the causal status of alcohol as a single "variable" is self-defeating from a prevention perspective:

A key assumption was that there is a complex (but nevertheless real) relation between violence and public drinking (not the mere ingestion of ethanol) which is imbedded in Australian history and culture and reproduced in institutional arrangements and regulatory and police practices regarding drinking. In our research we aimed to transcend the narrow debate about the effects of ethanol the substance by focusing on the total environment of drinking and its regulation (or lack of regulation) by management, police, and other public officials. Thus we considered features of the external regulation of licensed premises as well as more directly observable characteristics such as physical layout, patron mix, and social atmosphere [Homel, Tomsen & Thommeny, 1992: 681).

There is surprisingly little research of this kind in the literature. Even "the more directly observable characteristics" of licensed premises have usually been studied from a purely ethnographic or alcohol studies perspective, with the emphasis being on the anthropology of the pub as a working class institution (Fairweather & Campbell, 1990; Mass Observation, 1943) or on the contextual aspects of alcohol consumption and abuse (Cutler & Storm, 1975; Plant, Kreitman, Miller & Duffy, 1977). However, there is a developing theoretical literature on the contexts of alcohol and violence (Parker, 1993; Pernanen, 1991), as well as a growth in the use of surveys to probe the antecedents of violence.

MCM research (1990) interviewed managers of 300 licensed premises in England, and carried out some supplementary observational work on management styles and patterns of staff-customer interaction. This research is full of practical suggestions to reduce violence, although there is a clear sampling bias toward incidents involving or known to management. Perhaps the most useful aspect of their work was the development of a theoretical model (derived from Pernanen's research) which links alcohol use with violence via its influence on intellectual functioning and perceptual abilities. However, as Stockwell (1993a) observes, none of the recommendations of this alcohol industry sponsored research (see also Marsh & Kibby, 1992) relate to ways in which drunkenness per se might be discouraged.

The work of Stockwell, Lang & Rydon (1993) illustrates both the potential of population surveys to shed light on the contexts of alcohol and violence and the importance of intoxication as a predictor of alcohol-related harm. They found that in a survey of 1160 Western Australian adults, 7.9% of 873 drinkers had experienced some form of acute alcohol-related harm in the previous three months, that the most common problem was a violent argument or fight, and that 72% of problems followed drinking on licensed premises. Bar-staff continuing to serve "obviously intoxicated" customers was the most powerful predictor of harm after controlling for demographic variables, with crowding and price discounting having indirect effects on harm via their correlations with this variable.

Despite the ability of surveys to shed some light on contexts, it is clear that direct observation, supplemented by surveys of staff or patrons, is the best way of studying violence in the natural setting of licensed premises. Apart from the 1989 Sydney study (Homel et al., 1992), and some detailed descriptions in Pernanen's (1991) community study of interactional sequences in bars that alternate between positive and aggressive acts, the only major observational study of aggression in licensed premises is by Graham and her colleagues (1980) in Vancouver. Four observers (working in male-female pairs) noted 160 incidents of aggression (47 involving physical violence) in 633 hours of observation in 185 drinking establishments. Many variables were positively correlated with aggression, including the percentage of drunk patrons, the percentage of American Indians, poor ventilation, the amount of sexual body contact, lack of cleanliness, and a hostile atmosphere. The authors stressed however that the bar-room environment is best viewed as "an ecological system", and implied that the overall influence of this ecology on aggression may be greater than the sum of the effects of individual variables.

Although Graham et al. (1980) used quantitative methods and Homel et al.(1992) used a qualitative approach, the findings of the two studies are in many respects consistent. Our research confirmed that a great deal of violence occurs in and around licensed premises, and that intoxication, especially mass intoxication encouraged by irresponsible drinks promotions, is one factor leading to violence. However, we emphasised that violent incidents in public drinking locations do not occur simply because of the presence of young or rough patrons or because of rock bands, or any other single variable. Violent occasions are characterised by subtle interactions of several variables. Chief among these are groups of male strangers, low comfort, high boredom, high drunkenness, as well as aggressive and unreasonable bouncers and floor-staff.

The major aim of the present study was to replicate the 1989 Sydney study (Homel et al., 1992), this time using mainly quantitative rather than qualitative methods, building on the insights of the pioneering Vancouver research. More precisely, the aim was to quantify through structured observation methods the relationship between, on the one hand, physical and non-physical aggression occurring in and around a sample of licensed premises in Sydney, and, on the other hand, a range of management, patron, and situational variables capable of measurement through direct observation. The study had a more limited scope than the 1989 research, inasmuch as it did not involve a direct focus on external regulation, and inasmuch as it could not probe subtle interactions between variables in the way that is possible in qualitative research. A specific research question was the role of intoxication in the production of violence: does drunkenness per se matter, or is inadequate management more important? A final aim of the study was to use the results to develop more effective strategies for the prevention of violence.

Method

The observation schedule was developed and 300 hours observations carried out by 23 final year and graduate students at Macquarie University, Sydney. These students also coded and entered the data and carried out preliminary analyses, under the supervision of the first author. The study was conducted during the mid-semester holidays in July and August 1991. It is important to note that this was mid-winter, and that had the study taken place in the summer months (when universities are in recess) different patterns of activities and levels of violence may have been observed.

Sampling Methods. As in the 1989 Sydney research (Homel et al., 1992), the focus of the present study was on licensed premises open to the public and used as entertainment venues by young people. Thus all hotels and nightclubs and most types of licensed clubs were included in the sampling frame. Excluded were restaurants and licensed premises frequented largely by middle aged and elderly people such as businessmen's clubs, bowling clubs and golf clubs. These clubs usually have strict membership rules which exclude young people (or anyone else) from coming in "off the street". Although other types of clubs, such as those run by the Returned Services League (RSL), are nominally restricted to members and "guests", in practice almost anyone can gain admittance through friends who are members, particularly to entertainment such as discotheques.

One practical difficulty with observational research with physical violence as a focus is that unless premises are carefully targeted and many hours spent in fieldwork, not enough instances of assault will be observed to permit reliable statistical analysis. The 1989 Sydney research was conducted mainly in premises with a reputation for violence and at times when incidents were likely, yet in nearly 300 hours of observation only 32 clear cases of

assault were observed (Homel et al., 1992). This represented a rate per one hundred hours of observation some 50% higher than that recorded by Graham and her colleagues (1980), who used probability sampling methods. However, these researchers observed for 600 hours and analysed both physical and non-physical aggression, thereby boosting their numbers for analysis. The concentration of violence in a minority of premises is of course an important finding, and encouraging for those interested in prevention, but it does mean that either the research design must allow for the oversampling of high risk premises or observations must be conducted for a long enough period (as in the Vancouver study) to produce enough cases for analysis.

Two methods of sampling were therefore blended in the present study: purposive sampling of premises known by reputation or from the previous research to be "high risk" for violence; and two stage cluster sampling, with some "purposive" modifications. This design approximates a stratified sampling strategy, with a category of high risk pubs and clubs and a category of "normal" or "low risk" premises. The difficulty in devising a strict stratified probability sampling scheme is of course the absence of any definitive list of high risk premises. Were such a list available (as it is in Perth, WA: see Stockwell, Somerford & Lang, 1992), it would be possible to oversample high risk premises and also weight the data to produce unbiased estimates of the levels of aggression and physical violence in the whole population of hotels, nightclubs, and clubs. The assumption has been made for present purposes that the high risk premises included are representative of all such venues in Sydney, and the variable high risk/normal has been included as a factor in the analysis. Given the purposive nature of the high risk sample, however, it is impossible to use the present study to devise unbiased estimates of the prevalence of aggression and violence in the population of licensed premises.

The purposive sample consisted of three premises which were prominent in the 1989 study and eight suggested by local reputation, confirmed in most cases by exploratory visits (Homel et al., 1992). Seven were hotels, four of which ran discos or nightclubs, and one of which could be described as "skidrow" (Graham et al., 1980). The remainder were large clubs or nightclubs which had extensive entertainment facilities, including discos.

The probability sample was selected from the Index of Licensed Premises in New South Wales (Liquor Administration Board, 1990). This book arranges premises by geographical area, so 17 areas in Sydney were selected with a probability proportional to size (i.e. according to the total number of premises of all types in the area). Two premises were selected at random from each selected area (except the Sydney Central Business District (CBD), from which four premises were selected), giving each of the 1277 premises in Sydney except those in the CBD an equal probability of inclusion in the sample. Premises not fitting the selection criterion and those found on investigation to be no longer operative were excluded and replaced at random from within the area. In three cases there were no other suitable premises within the selected area to act as replacements. In these cases another area was selected at random and one premise chosen randomly. Thus premises in large areas were slightly underrepresented in the replacements, which was considered appropriate since the ones being replaced were all from small areas. The Sydney CBD was the largest and most diverse area selected, so the decision was made to select four rather than two premises from this area to allow the diversity to be more fully expressed in the sample. This biased the sample slightly to CBD premises. The 11 high risk premises were accommodated by deleting at random 11 of the randomly selected premises, yielding a total sample of 36 premises.

The selection of premises does not exhaust the sampling decisions which must be made. Other important factors are the timing of visits and the selection of drinking sites within premises, given that (as noted earlier) many of the larger establishments have several physically separate bars or entertainment areas which permit drinking. There were 45 sites visited within the 36 premises, with the guiding rule being to concentrate on areas in which most drinkers were congregated or in which entertainment was taking place. Sampling at this point was therefore more purposive than random, in contrast to the more systematic Vancouver study.

Observers were also instructed to visit no earlier than 8 p.m., and to vary the time and the day of week from visit to visit. Again, however, a rigid schedule was not devised, on the assumption that it was appropriate to concentrate limited resources on later times and days later in the week when aggression and violence were more likely. Thus nearly 80% of the 147 visits took place on Thursday, Friday and Saturday nights, and all but four commenced no earlier than 8 p.m. More than one third of the visits (52, or 35.4%) concluded at midnight or after, but given that the official closing

time was at midnight or after in 68.9% of visits, an unexpected bias toward earlier times is evident. In retrospect, therefore, a more rigid time schedule might have been appropriate.

Observation Procedures. Observers always visited at least in pairs, with friends sometimes included to increase the size of the team. Mixed sex teams were encouraged, with all female groups banned for safety reasons. Friends who completed an observation schedule were thoroughly trained in the aims of the study and in procedures. Thirteen teams made between 8 and 16 visits each, yielding a total of 147 visits. Where possible each club or hotel was visited by two teams (on different occasions), with all but one venue being visited 4 times in all (one high risk hotel was visited 7 times). Visits were for a minimum of two hours. Observers were instructed to move around the premises so they could see what was going on, and to pay particular attention to entrance where trouble frequently occurs. However, there is no doubt that important incidents were missed during some visits, particularly when the venue was very crowded. In large or crowded entertainment areas, observers were instructed to concentrate on an observable (if not audible) section of the crowd rather than to attempt to cover the entire premises.

Observers were permitted one alcoholic drink per hour so they could blend with other patrons, and were advised to avoid situations where they themselves could become victims of an assault (in fact one student was the victim of a minor assault at one high risk inner city hotel). They were also instructed to use their judgement and report any serious assaults to police if it seemed unlikely that the victim would receive appropriate medical attention. (In all actual cases of sufficient seriousness friends of the victim took appropriate action.)

No notes were taken during the observation period, but observers conferred as soon as possible after the visit and completed individual observation schedules which were compared for consistency. Discrepant items were discussed and consensus reached, with a note being taken of items which were consistently discrepant. These problem items were discussed later in class and definitions clarified so that the problems could be avoided in later visits. However, given the large number of observers involved, it was not possible to calculate formal reliability coefficients for each item. Observers did write a single narrative account for each visit, concentrating on aspects which they felt were not adequately covered in the structured observation schedule, and prepared a floor plan for each bar or entertainment area visited. These narratives provided the opportunity to record in detail the individual circumstances of aggressive and violent acts, and permitted a check on the rated seriousness of these incidents as well as on other aspects of the visit. The narratives contain rich information which complements the statistical data reported in this paper.

The Observation Schedule. A draft of the observation schedule was prepared, based on the qualitative open coding scheme devised for the 1989 study (Homel et al., 1992) and on the study by Graham et al. (1980). This was then tested and refined in a series of pilot visits. The final version ran to 18 pages and included many hundreds of separate items. Where variables were observed in the pilot visits to vary over the period of a visit (for example, the intensity of lighting), separate ratings were made for "early", "middle", and "late" periods (based roughly on 40 minute intervals). A few additional codes were devised at the end of the study to accommodate aspects of visits which were not included in the precodes (e.g., types of entertainment such as dart games not observed during the development of the schedule).

Items were grouped under seven broad headings in addition to factual items dealing with such things as closing time and number of bars on the premises: physical environment (e.g., lighting, seating); bouncers/security/doormen (e.g., sex of bouncers, presence of security firm); social environment (e.g., crowding, sexual activities of patrons such as "chatting up", "necking" or fondling); patrons (e.g., age groups, type of dress); bar staff (e.g., ratio of bar staff to patrons, staff acceptance of deviant behaviour); alcohol/drug consumption and costs (e.g., levels of male drunkenness, cost of drinks); responsible serving practices (e.g., publicity to clientele concerning under age drinking, staff intervention with highly intoxicated patrons); and conflict/violence.

The section on conflict/violence was subdivided into verbal aggression (one way abuse), arguments, challenges/threats, friendly fights ("lion cub fights"), rough ejections, accidents leading to injury, and physical aggression/assaults (deliberate unfriendly bump, grabbing, pushing, actual physical violence - punching, kicking etc.). For most types of physical and non-physical aggression, detailed data were recorded, including: types of weapons used (if any), whether the incident was victim precipitated, the number of male and female assailants or aggressors,

number of male and female victims or recipients, whether the incident occurred early or late in the visit, the severity of the incident (high, medium or low), whether there was intervention by patrons or staff, whether staff were involved in the incident, the perpetrator (bouncer, patron or other staff), bouncer treatment of the situation (inflaming, diffusing, controlling or ignoring), the location of the incident (inside, outside, or at the entrance), and the degree of drunkenness of the participants (high, medium or low). Full details of all variables are available from the first author.

Graham and her colleagues (1980) especially noted that the decision whether a particular incident should be deemed aggression is one of the major problems of data collection. In their study, to obtain some consistency operational guidelines were adopted which stipulated that an incident would be classified as aggression if it involved "personal violation (verbal insult, unwanted physical contact), behavior that was offensive according to the norms of the place, or a dispute in which the participants had personal investment" (p. 281). The same guidelines were adopted for the present study, which means that as in the Vancouver research there was some variation from establishment to establishment in the precise operationalisation of what was physical or non-physical aggression.

Results

Aggression and Violence. In the 300 hours of observation a total of 102 incidents of aggression were observed, 29 (28.4%) involving physical aggression. The rate of aggression per 100 hours observation (34.0) was a little higher than in the Vancouver study (25.2), with a correspondingly higher rate of physical violence (9.7 per 100 hours compared with 7.4 in Vancouver). The rate of physical violence in the 1989 Sydney study (Homel et al., 1992) was 10.7 per 100 hours, but this higher rate is explained by the over-representation of high risk premises in that study. The bias to high risk locations is also part of the reason for the higher rates in the present study than in Vancouver; of the 29 physical incidents, 24 occurred in high risk pubs or clubs, corresponding to a very high rate of 23.1 per 100 hours.

The majority of physical aggressive incidents were not rated as severe. Using the three point scale, only 6 (20.7%) were of high severity, with 13 being rated medium (44.8%) and 10 as low (34.5%). Some flavour of what these ratings mean can be conveyed by describing some of the incidents, as recorded by the observers.

Incident 1. In one inner city skid row pub frequented by aborigines, assaults of high and medium severity appeared to be common. Around 3 a.m. one week night a woman suddenly pushed another woman (call her Sally) across the room with such force that two chairs were overturned and a table nearly fell over, smashing glasses and an ashtray. "Sally hit her head on the tile floor and lay there for a while. I went to get up and help her but Ian put an arm across me and told me that it was a fight between two aboriginal women and that I had to stay out of it or I would get hurt. I sat down again. Sally raised herself and put her hand to her head. When she removed her hand there was lots of blood running down her aim and hand. A black woman helped her up and took her to the toilet". This incident was rated as high severity by the female observer.

Incidents 2 and 3. Half an hour later at the same hotel the observers decided to leave. "As I got up I accidentally knocked over a glass. As I reached to stop it falling I knocked an ashtray off the table that smashed. We continued to walk out but an Aboriginal man stood in my way swearing at me for breaking 'his ashtray' and for breaking 'their things'. ... I had to brush past Jane [a pseudonym for a patron] to get out and when I was just outside the entrance I ... saw that Jane was running out after me. She threw off her jumper and screamed at me, but I couldn't understand what she was saying. She pushed me in the chest and raised her hands telling me to fight her ..." The first of these incidents was rated as verbal aggression of low severity, the second as a physical assault of medium severity. This last rating could perhaps have been deemed of low severity except that Jane ran after the observer and would have assaulted her again if not restrained by Ian (the other observer).

The hotel in which these incidents occurred was probably the worst in the study. Drunkenness levels were usually very high and staff appeared to take a totally noninterventionist approach. The skid row nature of the pub and the high proportion of aboriginal patrons made it unusual in our study, since most venues were of a more "suburban" nature. However, serious incidents were by no means restricted to inner city venues, and it should be stressed that most violence observed involved not aborigines but whites. Interestingly, a few of the worst incidents involved women as assailants,

although in the majority of cases males were to blame.

Incident 4. At one large disco in a suburban hotel, an all-male group were allowed to enter very drunk. They soon began to yell abuse at the band (for example, "haven't ya heard of AC-DC?") which was rated as low severity. However, when some women walked by they would make sexual gestures and make noises. "On one occasion one of them grabbed the backside of a woman. She turned round and gave him a filthy look and kept on walking." This sexual assault was rated (by the female observer) as low severity, which in terms of the norms of the establishment was probably a reasonable judgement.

Incidents 5 and 6. A little later, one woman pushed another away from her. "The woman that was pushed away said something like, 'You shit, who do you think you are?' She then went up to the woman that pushed her and gave her an almighty slap across the face with the back of her hand. The group of drunken males ... saw this and started to yell out, 'Go for it girls' and other things. The woman then put her whole hand over the face of the woman she had just slapped and shoved her head back. The woman then put up her arm and tried to pull the hand away from her face. The woman that had her hand on the face then gave her another push, let go of her face and walked away." This was rated as high severity, in contrast with a further incident involving the drunken mates, where a half full beer can was thrown at the leg of another man, hitting him and spilling beer. This was rated as medium severity.

In contrast to the 1989 Sydney research (Homel et al., 1992) most assaults were not perpetrated by bouncers (there were only three such instances recorded), although in nearly half the cases (14) bouncers either inflamed the situation or ignored it. Male assailants (34) and male victims (24) were most common, but in all there were 9 female assailants and 10 female victims. In nearly every case victims were alone and were quite drunk, which is completely consistent with the earlier Sydney research. Also consistent with this research, the majority of assaults (22 out of 29) were not judged to have been precipitated or provoked by the victim. In contrast to the study by MCM Research (1990) into violence in English pubs, nearly all assaults in the present study involved only fists or other body parts; weapons such as broken glass or a bar stool were observed in only two cases.

The non-physical aggression observed encompassed a wide variety of incidents and types of aggression: 32 cases of verbal aggression (nearly all involving male aggressors and victims), 11 challenges or threats (also involving mostly male aggressors and recipients), and 30 arguments (about a quarter involving only women). In addition, there were 9 rough ejections which were not classified as assaults but on more detailed analysis might well require recategorisation, three accidents leading to injury, and 64 "friendly fights". Only verbal aggression, challenges or threats, and arguments were counted as non-physical aggression.

Both physical and non-physical aggression were highly concentrated in terms of time and place. Three quarters (75.9%) of the physical assaults occurred in only 8 sites (17.8%), with two thirds of the 45 sites being totally free from observed physical violence. As would be expected, non-physical aggression was more widespread, with only 53.3% of sites not having some incident recorded, but even so 83.6% of incidents occurred at a quarter of the sites. As noted above, sites in high risk premises accounted for most of the incidents of all types of aggression. The rate of physical incidents per visit was .46 for high risk sites and only .05 for non-high risk sites (a ratio of 9: 1); the corresponding figures for non-physical aggression were .80 and .33 (a ratio of only 2.4: 1). Interestingly, if one site in a pub or club tended to experience aggression and violence, so did other sites on the premises, suggesting that the management problems leading to violence am not necessarily specific to particular types of entertainment (such as discos).

The descriptions of incidents quoted above suggest that physical and nonphysical aggression are intertwined. Statistical analysis confirms this impression. Using visits (not incidents) as the unit of analysis, the correlation between observing one or more non-physical incidents and one or more physical incidents was .40 using phi and .82 using Yule's Q. Of the 38 visits during which non-physical aggression was observed, 14 (36.8%) also involved physical violence, but of the 109 visits in which non-physical aggression was not observed, only 6 (5.5%) involved physical violence. Putting this in other words, the odds of physical violence on any visit were 10 times higher when non-physical aggression was observed than when it was not.

This correlation is important for the analysis of predictors of violence, since it suggests that factors that correlate with non-physical aggression but not with physical assaults may nevertheless be of indirect importance to the prevention of violence.

The Prediction of Aggression and Violence. The remainder of the analysis is based on visits (n = 147). The distinction between non-physical and physical violence was retained (defining non-physical violence as arguments, threats, and verbal aggression), but in addition two variables were constructed which provided overall measures of aggression.

AGGRESS? is a dichotomous variable recording whether or not any incident occurred (it did during 44 visits). ATTACK? is a dichotomous variable recording whether or not physical violence occurred (20 visits). A variable called SEVERITY was constructed based on the average rated severity of each of the non-physical and physical incidents observed during each visit, with the proviso that physical violence received a double weighting. Thus the higher the score on SEVERITY, the more serious the overall level of aggression and violence (the range was 0.0 to 6.0, with 103 visits recording a zero score since there were no observed incidents). This variable is probably subject to a degree of unreliability, since the rating of severity depended to some extent on the nature of each establishment, making comparison across establishments more difficult than for the simple recording of incidents. Any bias is toward rating the severity of incidents in high risk premises as less severe than in lower risk premises. SEVERITY is independent of the number of incidents during a given visit, since it involves averaging over all incidents, so an additional variable INCIDENTS was constructed, which was just the total number of incidents of all types observed for a given visit (range 0 to 6, with 103 zero values).

Table 1 shows the major correlates of aggression and violence. This list of predictors was arrived at through several stages of culling. First, variables with little or no information content were discarded (e.g. no patrons were observed engaging in sexual intercourse, in contrast to the 1989 study (Homel et al., 1992); and on only two visits out of 147 were police observed on the premises). Secondly, variables which did not vary much by time (early, middle or late in the visit) were simplified by using only the mid-visit rating. Variables which did not differ by the sex of participants (e.g. sexual competition) were collapsed across sex. Thirdly, tabulations and correlations were run across the four dependent variables, and variables with low predictive power dropped. Some of the variables dropped correlated consistently with the dependent variables, but at below the 5% level of significance (. 16). For example, the individual level of cheerfulness of female patrons late in the visit (scored on a four point scale) correlated at around .10, and is not included in Table 1. With one exception, the variables surviving the culling process could be scored as dichotomies or as ordinal scales, allowing Pearson correlation coefficients to be used. (One exceptional variable, staff intervention with highly intoxicated patrons, was a three category nominal variable and is partially represented in Table I by a dichotomous variable indicating whether or not any intervention occurred, regardless of whether any intoxicated patrons were present.)

Many of the correlations in Table 1 are significant at levels well beyond .01 (e.g. .005 [r(crit.)=.23] or .001 [r(crit.)=.28]). This suggests that despite the large number of tests carried out, many correlations may reflect real associations (if not direct causal relationships). The strongest correlates of physical violence (SEVERITY and ATTACK?) are high risk premises, the presence of a disco, hostility, swearing, roughness and bumping, bar crowding, inadequate numbers of bar staff relative to the crowd, Pacific islander bouncers, staff intervention with intoxicated patrons, refusal of service, and low levels of server responsibility.

Of course the sheer size of an establishment would be expected to predict violence, simply because more people engage in more interaction, any instance of which is potentially aggressive. It is therefore interesting to note that the available measures of size (number of bars, number of patrons in view, seating capacity) were only moderate predictors of aggression. Overall crowding correlated more strongly, but bar crowding (which has to do with movement and concentration within the premises rather than overall density) was more important. (A more objective measure of size based on on-premise alcohol sales was sought from the NSW Chief Secretary' Department, but permission was refused on the grounds that such data, even in scaled form, are privileged commercial information.)

The correlations with hostility and roughness are so high (.50 or higher) that it is reasonable to conclude that the ratings are reflecting observed incidents of aggression and violence, so these variables were not included in the multivariate analyses. Drinking rates and levels of drunkenness did not correlate quite so highly, although male drunkenness was strongly associated with SEVERITY, and the male drinking variables were more powerful predictors than those measuring female drinking. The "intoxication" variables which correlated most highly were those to do with staff responses to drunkenness, suggesting

Table 1
Major Correlates of Aggression and Violence

	SEVERITY	INCIDENTS	AGGRESS?	ATTACK?
Type and Size of Venue				
High risk premises	.34	.34	.27	.34
Skid row hotel	.21	.21	.17	.18
Late closing (after midnight)	.19	.20	.12	.24
No. of bars (1-6)	.19	.21	.16	.15
Discotheque	.29	.25	.21	.27
No. of patrons in view (5-1300)	.13	.19	.19	.09
Seating capacity (1=<50; 2=50-99; 3=100-149; 4=150-199; 5=>200)	.13	.24	.22	.11
Physical Environment				
Inadequate seating	.22	.19	.21	.23
Bar stools available	-.20	-.19	-.24	-.18
Ventilation (1=fresh; 2=comfortable; 3= warm; 4=stuffy)	.25	.29	.25	.20
Smoke level (1=low; 2=medium; 3=high)	.30	.31	.36	.28
Cleanliness (1=filthy; 2=dirty; 3=clean; 4=spotless)	-.25	-.22	-.19	-.16
Darkness (1=well lit; 2=medium bright; 3= dim; 4=dark)	.28	.23	.23	.22
Inconvenient bar access	.20	.23	.24	.24
Staff				
Bouncers present	.25	.27	.27	.23
Islander bouncer	.38	.29	.25	.31
Ratio of bar staff to patrons (1=1:10; 2=1:20; 3=1:40; 4=1:50; 5=<1:50)	.30	.27	.37	.25
Bar staff acceptance of deviant behaviour (1=not permissive; 2=slightly permissive; 3=not applicable; 4=permissive; 5=very permissive)	.20	.16	.06	.19
Patrons				
% Aboriginal (0-95%)	.22	.30	.14	.23
% "marginal" (0-100%)	.21	.25	.17	.14
% underage females (1=20%)	.20	.24	.25	.19
% male patrons in manual working gear (0-100%)	.20	.14	.12	.17

Table 1
Major Correlates of Aggression and Violence

	SEVERITY	INCIDENTS	AGGRESS?	ATTACK?
Social Environment				
Level of crowding (1=none; 2=low; 3=medium; 4=high)	.23	.25	.25	.25
Bar crowding (1=none; 2=low; 3=medium; 4=high)	.30	.26	.31	.29
Patron boredom (1=none; 2=low; 3=medium; 4=high)	.19	.18	.12	.18
No sexual activity (males)	-.25	-.19	-.20	-.27
Discreet necking (males)	.16	.16	.19	.17
Sexual competition (male and female) (1=none; 2=low; 3=medium; 4=high)	.22	.29	.27	.19
Swearing (male) (1=none; 2=low; 3=medium; 4=high)	.37	.32	.37	.34
Swearing (female) (1=none; 2=low; 3=medium; 4=high)	.30	.38	.31	.29
Rowdiness (male) (1=none; 2=low; 3=medium; 4=high)	.34	.37	.38	.32
Roughness and bumping (male) (1=none; 2=low; 3=medium; 4=high)	.54	.51	.51	.49
Hostility (males) (1=none; 2=low; 3=medium; 4=high)	.54	.52	.47	.46
No food available	.24	.28	.18	.17
Alcohol/Drug Consumption and Serving Practices				
Male drinking rate[a] (1=<1 standard drink/hr; 2=1-2/hr; 3=3-4/hr; 4=>3/hr)	.24	.26	.32	.20
Female drinking rate[a] (1=<1 standard drink/hr; 2=1-2/hr; 3=3-4/hr; 4=>3/hr)	.21	.23	.27	.14
Levels of male drunkenness (1=none; 2=low; 3=medium; 4=high)	.29	.31	.37	.21
Levels of female drunkenness (1=none; 2=low; 3=medium; 4=high)	.21	.22	.25	.13
Round shouting (males) (1=none; 2=low; 3=medium; 4=high)	.22	.18	.28	.14
Drug dealing on premises	.22	.31	.23	.22
Staff intervention with highly intoxicated patrons	.35	.27	.32	.34
Refusal of service to highly intoxicated patrons	.35	.28	.35	.34
Overall rating in terms of responsible serving[b] (1=very responsible; 2= somewhat responsible; 3=not very responsible; 4= not responsible at all)	.34	.25	.18	.34

Table 1
Major Correlates of Aggression and Violence

NOTES:

(1) Variables for which the coding is not given are dichotomous and scored in the indicated direction, e.g., high risk premises: 1=yes; 0= no.

(2) All variables in this table are significantly correlated with the dependent variables at α=.05 (r(crit.)=.16) or α=.01 (r(crit.)=.21). Non-significant variables are not included.

[a] A "standard drink" is defined as a 'middie' (285 ml) of normal strength beer (approximately 5% alcohol by volume), a nip (1 ounce) of spirits, 2 ounces of port or sherry, a glass (4 ounces) of wine, and a schooner (1.5 middies) of low alcohol beer.

[b] "Responsible serving practices" refer to any strategies by management or staff to (a) reduce the number of intoxicated patrons; (b) avoid problems flowing from intoxication or excessive drinking, e.g., drunk-driving, assaults, accidents, vandalism, noise, or disorder.

that the way drinking and drunkenness are managed may be as important in the prevention of violence as the avoidance of high levels of drunkenness in the first place. The strong association between the employment of Pacific islander bouncers (mainly New Zealand Maoris, Fijians, Samoans, and Tongans) and violence suggests that good management should also extend to the careful selection and training of security staff, although it should be kept in mind that in only a few cases of the incidents observed were assaults actually instigated by bouncers. The issue here is not of course ethnicity as such but the expectation that islanders due to their very large size will be able to deal with "trouble" in a simple and direct physical manner - an expectation that should be modified by appropriate training of management and security staff.

As expected, the correlates of total aggressive incidents (AGGRESS? and INCIDENTS) were similar to the correlates of violence, except that aspects of the physical environment figured more prominently, especially ventilation and smoke levels, suggesting (to venture a causal interpretation) that smoke may have considerable irritation value. The presence of aboriginal patrons was also strongly associated with increased numbers of incidents, as was observed drug dealing.

There are many parallels between the patterns in Table 1 and those reported by Graham and her colleagues (1980). Although measurement and sampling methods differed, common predictors include drinking rates and drunkenness, control exercised by bar workers, percentage of aboriginal patrons (American Indians), ventilation, sexual body contact, swearing, hostility, cleanliness, marginal patrons (unkempt dress, talking to themselves etc.), and adequate and convenient seating. Variables which correlated highly with physical or nonphysical aggression in the Vancouver study but not as highly in the present study include turnover and movement of patrons, decor, noise level, aspects of entertainment (e.g. juke box), drug use (as opposed to drug dealing) and downtown location. Conversely, the present study highlighted some variables not prominent in the Vancouver study, including bouncers and bouncer characteristics, high risk premises (as opposed to downtown location or skidrow), discotheques, lighting, crowding, patron boredom, underage patrons, and aspects of staff intervention with intoxicated patrons.

Multivariate Analyses. In an attempt to isolate key predictors, a least squares multivariate regression analysis and a multivariate logistic regression analysis were carried out. The first analysis included all four dependent variables, while the second used a new three category dependent variable defined as: no incident (103 cases); non-physical aggression only (24 cases); and at least one physical assault, regardless of whether non-physical aggression also occurred (20 cases). Of the two analyses, the second is more "valid" statistically, since it makes no assumptions about the normality of the data or equal variances. However, the least squares MANOVA has the advantage that more information is contained in the four dependent variables (e.g. the severity of incidents), despite their skewed distributions.

Fortunately, the two models yielded similar results.

The models included the variables measuring size of establishment as covariates, and also whether the premises were high or low risk (reflecting the sampling strategy). Given their artifactual correlations with the dependent variables, roughness and bumping, and hostility, were not included in the models, although they were tested in a final step. The reduced MANOVA model was obtained by preliminary backwards elimination of 47 independent variables for each of the four dependent variables separately. This resulted in a likely set of 6 variables, which were fitted in a MANOVA. Each of the omitted variables was then added individually to this model, and only one was found to be significant at the .05 level over and above the initial six. The final set of seven variables are set out with multivariate p-values and standardised regression coefficients in Table 2. It is interesting to note that none of the variables measuring roughness, hostility, swearing, rowdiness, or cheerfulness, either singly or jointly, added significant variance to this reduced model, suggesting that the explanatory power of these "social climate" variables is mediated through such factors as drunkenness.

Given the small sample size and the sparseness of the aggression and physical violence categories, the multivariate logistic model was built up rather than reduced from a "full model". Using chisquare analyses, the most powerful predictor was placed in the model, the next most powerful added, and so on, until 9 variables were obtained, each of which was significant at the .05 level when fitted last. No other variables when added to this model was significant. The multivariate p-values for the model and the odds ratios for non-physical and physical aggression are set out in Table 2.

Given their empirical method of derivation, and the inclusion of some variables significant only at the .05 level, the models are likely to contain some Type I errors. Nevertheless, it is preferable to interpret small models with a large number of non-significant variables removed than to attempt to interpret very large models in which many variables, due to their intercorrelations, distort the effects of others. It is

Table 2
Reduced Models for Least Squares and Logistic Multivariate Regressions

	Least Squares MANOVA:[a] *p*-values and Standardised Regression Coefficients					Multivariate Logistic:[b] *p*-values and Odds Ratios		
	p	SEVERITY	INCIDENT	AGGRESS?	ATTACK?	*p*	Non-physical	Physical
Island bouncers	.0007	.26***	.15*	.12	.22**	.024	3.27	19.71**
Refusal of service	.015	.22**	.15	.16	.31***	.001	8.83	302.39***
Server responsibility[d]	.000	.32***	.22**	.15*	.33***	.0001	1.15	6.30***
Staff intervention[c]	.041	-.06 .18*	-.16* .17	-.09 .21*	-.03 .05	.029	.35 13.03**	.63 3.84
Male drunkenness[d]	.010	.12	.17*	.25***	.04	.0002	5.82***	2.84
Discreet necking	.014	.16*	.20**	.22**	.18**	.042	4.53	7.34*
% Aborigines	.010	.11*	.21**	.06*	.15	---		
Round shouting[d] (males)	---	---	---	---	---	.008	2.71**	2.58*
Late closing	---	---	---	---	---	.002	13.78**	1.29
Breathalyser obvious	---	---	---	---	---	.0003	58.99***	14.21*

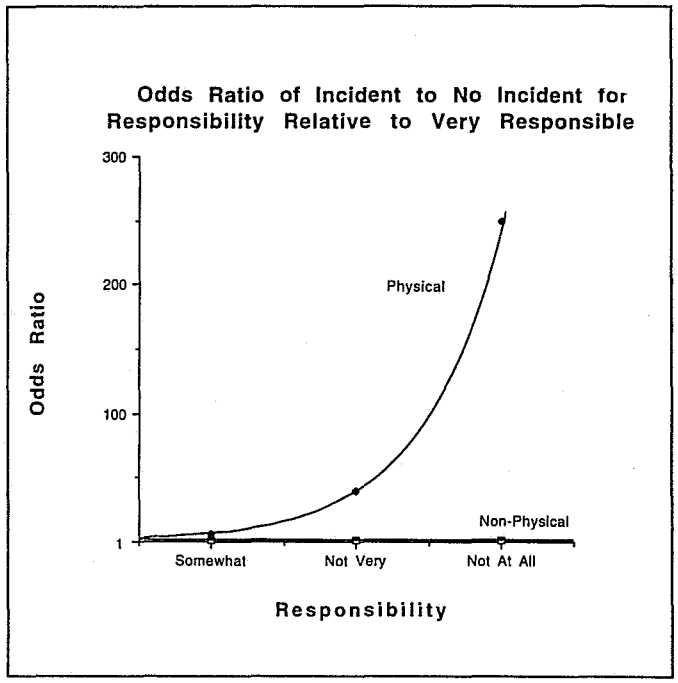
*$p<.05$; **$p<.01$; ***$p<.001$ (-values are for variables fitted last)
[a] Model d.f. = 8; error d.f. = 138; Λ = .36343
[b] Model d.f. = 20; residual d.f. = 272; residual deviance = 123.6
[c] This was the only factor in the analysis that was not a single degree of freedom. The contrasts were: (i) No staff intervention with intoxicated patrons vs. no intoxicated patrons present; (ii) Staff intervention with intoxicated patrons vs. no intoxicated patrons present.
[d] These variables are measured on 4-point scales (see Table 1), and the odds ratios must therefore be multiplied by a scale factor, depending on the category. Figures 1-3 show the relationships.

not claimed that the models in Table 2 are the only ones possible or that all the variables would survive a replication, just that they succinctly capture the measured variance. Despite the large number of variables omitted, the MANOVA model has explanatory power comparable with that found by Graham et al. (1980) for larger models. Lambda for the model is .36343, corresponding to 63.7 % of the variance explained, and the R^2 for each of the dependent variables is: SEVERITY 47.4%, INCIDENTS 40.9%, AGGRESS? 37.8%, and ATTACK? 40.0%.

The results of the two analyses are broadly consistent. Both models confirm that the presence of Pacific islander bouncers, refusal of service, and overall server responsibility are the most significant predictors of physical violence. Controlling for other factors, islander bouncers (present in 10.9% of visits) increased the odds of violence by a factor of 20, with the lower 95% confidence bound being about 2. Incidents observed when islander bouncers were present tended to be more severe, but the odds of non-physical aggression were not increased. There are at least two reasons why islander bouncers may be particularly involved in violence. First, they comprise an underclass in Australian society and are often in the country illegally (Howard, 1990), so may be more vulnerable to pressure from management to "do the dirty work". Secondly, their home cultures were traditionally rather violent, with fighting (especially revenge killings) being the most common kind of interaction between communities (Oliver, 1989). Violence was particularly important as a means of enhancing the status of young men desiring to enter full adulthood, and it is likely that the strong connection between violence and manhood remains as a cultural trait influencing behaviour (as of course it does in other cultures as well).

Staff intervention with intoxicated patrons increased the odds by about 13 of nonphysical aggression relative to the odds when no drunk patrons were present, with a lower 95% confidence bound of 1.8. Intervention, which was observed on 13.6% of visits, could take the form of offering a non-alcoholic drink, food, or alternative transport, but these were rarely observed. The most common form of intervention (11 cases out of 20) was to refuse service, which the analysis suggests was associated with markedly higher rates of physical violence (the odds ratio was over 300, with a lower bound of 10). This does not mean that refusal of service necessarily caused the violence, although this was observed on some occasions, but that visits during which refusal of service was observed were also characterised by much higher levels of physical violence. It seems that intervention with drunks is associated with arguments and verbal abuse, and that refusal of service may directly or indirectly lead to physical assaults, consistent with the findings of Felson, Baccaglini & Gmelch (1986), MCM research (1990) and Stockwell, Rydon, Lang and Beel (1993).

The overall level of server responsibility, rated by the observers as the final item on the schedule, was a strong predictor of physical violence (but not non-physical aggression). Figure 1 shows the elevated odds ratios for visits when the servers were rated "not responsible at all" (7.5% of visits) to "not very responsible" (23.8%). The lower 95% bound on the odds ratio for the "not responsible at all" category



was 25. Of course it is quite possible that the rating in some cases reflected observed violence, since one of the criteria for responsible serving is strategies to avoid problems flowing from excessive drinking, including assaults, so the association may be to some extent artifactual. This issue was examined by analysing within premises variations in ratings of responsible service in relation to the occurrence of aggression and violence. It seems from this analysis that aggression and violence may have influenced the rating, but that other factors entered in, since low ratings were given for some visits when no incidents were recorded.

The provision of breathalysers for self-testing purposes would be seen by most commentators as an aspect of responsible serving. However, the logistic analysis suggests that in establishments where such machines were present and obvious (15 visits), the odds of aggression and violence were, respectively, about 60 and 15 times higher than if such machines were not present or were present but not obvious (with lower 95% confidence bounds of 6.6 and 1.3 respectively). It is possible that these machines in obvious places encourage drinking competitions and horseplay. It is also possible that establishments frequented by heavy drinkers are more likely to install them and moreover that they help to prevent drinking and driving (Homel, 1988).

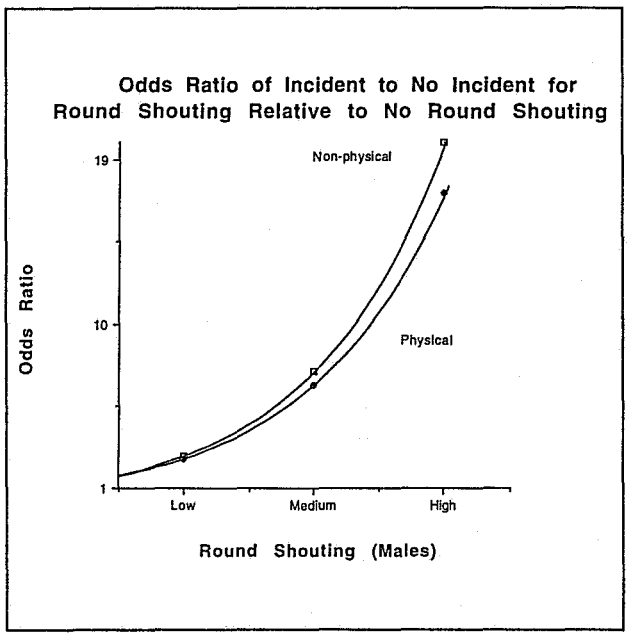
One of the most interesting outcomes of the analysis was that male drinking, as measured by shouting rates, and male drunkenness, were strongly associated with aggression but only weakly with physical violence.The relationships are shown in Figures 2 and 3. (The confidence limits for physical violence in both figures are very wide, so that the lower bounds fall below 1.0 for drunkenness and just above for shouting.) This finding is consistent with the 1989 qualitative research (Homel et al., 1992), which suggests that drunkenness was a prime risk factor for violence only when promoted en masse by discount drinking practices or when other risk factors were operating, such as boring entertainment or aggressive bouncers.

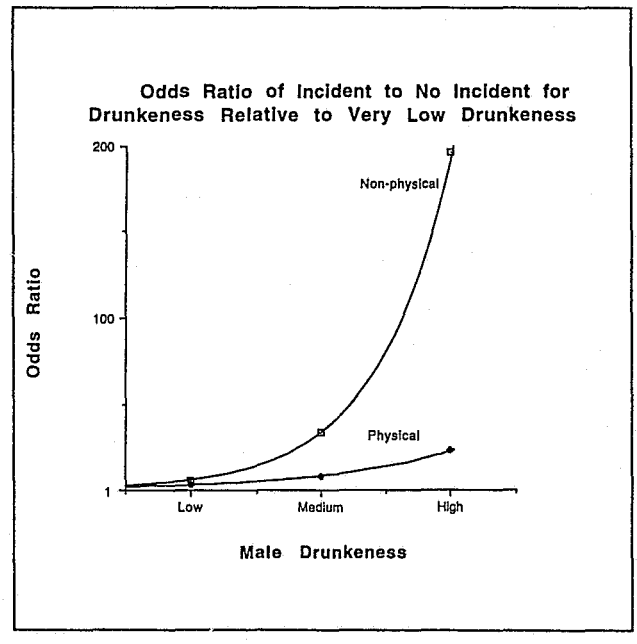
The remaining risk factors from the logistic analysis were late closings (odds ratio for aggression of 13.7 with a lower bound of 2.5), and discreet necking as an indicator of sexual activity (observed in 18.4% of visits and associated with an odds ratio of 7.3 for violence [lower bound 1.3]. More extreme sexual activities were observed, short of intercourse, but these were recorded in too few cases to reach statistical significance.

Discussion

Overview of the Study. One could spend many hours in most Sydney clubs and hotels without observing any physical violence. Verbal abuse, arguments, and other forms of non-physical aggression are, naturally enough, more common, but are still relatively rare events. In the average non high-risk premises, the chances of witnessing even a mild physical assault in a two hour visit are on the order of .05. Despite these low odds, however, a patron who visited such a hotel or club regularly-say 20 times over a year for two hours at a time-would have nearly two chances in three of observing at least one physical assault of some kind. If visits were for four hours duration instead of two, the probability of observing at least one assault would rise to nearly 90% over 20 visits. Of course in high risk premises, assaults will almost certainly be observed far more quickly and frequently.

When considering the data, the limitations of the study must be kept in mind. Although designed to provide a quantitative replication of the earlier qualitative research of Homel, Tomsen and Thommeny (1992), aspects of the research design, such as the inability to calculate formal measures of





inter-coder reliability, the over-sampling of high risk premises, and the bias toward pre-midnight observation periods, mean that caution must be exercised in generalising the results of the statistical analyses. Nevertheless, there are legitimate grounds for cautious generalisation, particularly since so many of the results are consistent with the (admittedly limited) body of observational and survey research on violence in licensed premises. Despite the differences in sampling methods, the rate of violence, at 9.7 incidents per 100 hours observation, is close to the earlier figure for Sydney of 10.7, and comparable with the Vancouver rate of 7.9 which was based on a random sample of premises (Homel et al., 1992; Graham et al., 1980).

The incorporation of a high risk/low risk factor in the analyses provided a control on the sampling bias, and the fact that this factor was not significant after adjustment for other factors suggests that the over-representation of problem premises is not something which complicates the interpretation of the relationships between the independent and dependent variables. Indeed, if the high risk premises had not been included, too few cases of aggression and violence would have been observed to permit reliable analyses. The bias toward earlier times for observation has the effect of providing a partial correction to the tendency in the sample to over-estimate the incidence of aggression and violence. Nevertheless, it is clear that given the uncertainties in sampling, it is not possible to provide more than a rough estimate of the probability of an aggressive or violent incident on a random visit to a randomly selected establishment. It is also clear that aggression and violence are much more frequent in a small minority of establishments, but that even in the worst premises there may be long periods when no incidents occur. This finding is consistent with the previous observational research and also with research into "hot spots" of crime based on police data (Sherman, Gartin & Buerger, 1989).

The strongest correlates of physical violence grouped into three classes: variables related to the type of establishment (high risk/low risk, running a discotheque, and having crowded bar areas); social climate variables (sexual activity, hostility, swearing, roughness and bumping); and variables describing staff or staff-patron interactions (inadequate numbers of bar staff relative to the crowd, Pacific islander bouncers, refusal of service to intoxicated patrons, and low levels of server responsibility). The multivariate analyses suggested that of these variables, those related to the management of intoxication are the most potent predictors. Intoxication itself, whether measured directly through ratings of male drunkenness or round shouting by men, or indirectly through late closing or the presence of a visible breathalyser, was related more to non-physical aggression than to physical violence.

In any analysis of this kind, it is always very difficult to separate the effects of patron, management, and situational variables. In the present study patron characteristics, such as the percentage of under-age females, were judged in a global fashion, and may not have captured some of the more subtle aspects of patron mix which were highlighted in the qualitative research, such as groups of males who am strangers to each other (Homel et al., 1992). Nevertheless, it is striking how few patron variables were strong predictors of aggression and violence, and that only aboriginality survived in one multivariate analysis. This may be partly because the sampling frame directed attention to premises which by and large provided entertainment for young people, so that patron mix was standardised to some extent, but it may also be that impressions that problem pubs attract much the same type of clientele as non-problem premises are substantially correct. Premises which attract a high proportion of aboriginal patrons are clearly an exception to this, and if more of such premises had been included in the present study this factor would have loomed larger (d'Abbs, Hunter, Reser & Martin, 1993).

Similarly, none of the physical environment variables and only one social climate variable (to do with sexual activity) added predictive power when the effects of management and drinking variables were controlled. This does not mean that none of these variables have a causal relationship with violence, especially since more detailed study of factors such as crowding is required to elucidate their impact. For example, Macintyre (1993) in a study of nightclubs found that premises could experience similar levels of crowding but differ in terms of how efficiently patrons were channelled between entrances, exits, bars and toilets. These "people flow" factors had a direct effect on unintentional physical contacts leading to aggression and violence. Nevertheless, the present analysis suggests that the effects of crowding may be mostly indirect or secondary, a view consistent with the survey data of Stockwell, Lang and Rydon (1993). The finding that roughness, bumping, swearing, rowdiness and hostility were not significant when adjusted for the variables in Table 2 supports the observation of Homel et al. (1992: 686)

that despite their high zero-order correlations (on an aggregate basis) with aggression and violence, and " ... despite all the myths, rough pubs with plenty of rowdy behaviour [which would include the local workingmen's pubs celebrated in Australian folklore] are not necessarily violent."

A central objective of the present study was to clarify the role of intoxication, especially when a high proportion of patrons are affected. The results are on the whole consistent with the qualitative study, which suggested that drunkenness usually only leads to violence when other risk factors are present, such as aggressive bouncers or high levels of frustration due to a lack of food and comfortable seating. The present analysis does not allow interaction effects to be tested statistically, but suggests several indirect ways in which drunkenness may lead to violence. First, it is clear that male drunkenness is a major predictor of non-physical aggression, which is in turn strongly correlated with physical violence on an aggregate (per visit) level. Secondly, the male practice of shouting drinks in rounds is implicated in both physical and non-physical aggression. The factors leading to aggression and violence in this case may have as much to do with the behaviour of men in groups as they do with intoxication, but since round shouting was correlated moderately (.27) with drunkenness for men, drunkenness may lead to violence through shouting (and vice-versa). Finally, and most clearly of all, drunkenness may lead to violence through attempts by staff to control it through refusal of service. In this respect the present analysis extends the qualitative research, which highlighted other aspects of the counterproductive role of management (especially aggressive and poorly trained bouncers).

Implications for Prevention. The rather indirect role of intoxication in violence revealed in the earlier research led Homel at al. (1992) to emphasise that although controls on consumption have an important place, especially in preventing mass intoxication caused by irresponsible discounting and drinks promotions, the top priority should be better management of the whole range of risk factors leading to violence - badly trained and aggressive bouncers, lack of comfort, crowding, inadequate food and seating, and so on. The present study does not contradict this general conclusion, but suggests that relatively more emphasis should be placed on effective strategies for dealing with intoxication. The basis of this conclusion is the fact that in both statistical models variables to do with intoxication and the management of intoxication account for most of the variance.

Should High Risk Premises be the Target?. The immediate question that arises is whether all drinking establishments should be targets for intervention, or whether only high risk premises, which appear to account for the great majority of the problems, should be the focus. There are several aspects to this question.

First, the impression that a small number of premises generate most of the violence is to some extent an artefact of the method of the study, which is based on a "snapshot" of events over a restricted period of time. While it is quite true that high risk pubs or clubs generate assaults out of all proportion to their numbers, it is also true that for every "hot spot" there are several dozen, possibly hundreds, of medium or low risk premises. As we have seen these "ordinary" establishments also generate violence over time, although at a much slower rate, and because there are so many of them relative to the high risk premises, they probably account, over a year, for a substantial number of violent incidents. The only way of determining with certainty the share of assaults attributable to high risk premises would be to conduct a complete census of such incidents and their locations over an extended period. While such a census is an impossible ideal, it is likely that a thorough survey of Accident and Emergency rooms in all the hospitals in a city would provide approximate estimates of how many of all the assaults occurring over a year emanate from high risk versus other kinds of premises.

A concentration on high risk premises also raises some ethical concerns. Training for owners, managers and staff in the responsible serving of alcohol is based on two basic premises: that management will act in their own interests, and therefore will want to stay within the law and not become embroiled in a liability suit; and that management should be concerned with the safety, health, and social well-being of their patrons (Simpson, Brunet, Solomon, Stanghetta, Single & Armstrong, 1987). One of the most striking features of most of the licensed premises visited in the present study, not just the high risk ones, is how exploitative management practices can be. One gains the distinct impression that a desire to maintain or increase profitability and to avoid trouble with licensing and other authorities are the primary motivations for most of the observed practices, and that there is very little sense of "duty of care" to patrons. This is one reason why Australian programs designed to improve the environments of licensed premises have such names as "Patron Care" (Carvolth, 1988) and "Freo [Fremantle, Western

Australia] Respects You" (Stockwell, Rydon, Lang & Beel, 1993). Even the phrase, "responsible serving of alcohol", reflects a clear ethical stance that management does have a duty of care to patrons and to those who may be affected by their actions. The attitudes and practices of all licensees, not just those responsible for high risk premises, need to be challenged and modified, so that the culture of the whole industry can, over time, be transformed. In addition, patrons themselves need to be educated through responsible hospitality programs that they are worthy of respect and should be accorded respect as a matter of course.

Recognition that licensed premises are part of larger industry with numerous interconnections, and that both licensees and patrons circulate widely throughout this industry, highlights a practical difficulty with concentrating solely on high risk premises. The difficulty is that in practice it is almost impossible to impose special conditions on some premises but not on others. If, for example, one or two high risk establishments in a locality were targeted for staff training in responsible serving practices, it is very likely that the managers or owners would very quickly make vociferous complaints to their industry association or to local politicians. Indeed, recent experience with a community based program in an international tourist location in Australia (described further below) strongly supports the argument that only when interventions are open, equally applicable to all venues, and supported by all, or nearly all, local licensees do they have any chance of success (McIlwain, 1994). This, of course, is in a context where there are neither legislative incentives (such as dram shop liability laws) nor civil liability precedents to encourage compliance with such innovations as responsible serving practices.

Given the difficulties entailed in attempting to improve practices in high risk premises through education or community development processes, it is possible that if authorities were prepared to use a "selective incapacitation" policy, violent incidents in and around high risk premises could be quickly reduced or eliminated. Homel and Tomsen (1991) recommended that continuous operation of a violent venue should be an offence leading to cancellation or suspension of a liquor license, a policy which some jurisdictions have attempted to implement (Stockwell, 1993b). Evaluation data on the effectiveness of this policy in reducing violence appear to be lacking, but common sense suggests that it should have considerable deterrent value. However, the possible problem of displacement to other venues would remain, even if one could envisage a social climate in Australia in which selective incapacitation were to be used routinely by liquor licensing authorities. The ideal, perhaps, would be to combine effective interventions in high risk and other establishments, using the threat of loss or suspension of license in the event of regular violence as a potent incentive for participation by problem licensees.

On balance, an "across-the-board" policy of intervention seems appropriate in wet cultures such as Australia where legislative and enforcement supports for public health objectives relating to alcohol are very limited. This policy is not inconsistent, however, with devoting some special attention to high risk premises, to the extent that such attention is tolerated by licensees or licensing authorities.

Preventing and Managing Intoxication. Strategies for dealing with intoxication may aim (i) to prevent all drunkenness; (ii) to prevent mass intoxication due to such practices as high cover charges combined with cheap drinks; or (iii) to better manage drunk patrons, and particularly to avoid violence when refusing service. Logic suggests that it would be more effective and less costly to prevent intoxication "up stream" than to attempt to deal non-violently with scores of intoxicated patrons.

Responsible beverage service programs, which have as objectives both the prevention of intoxication and refusal of service to already intoxicated patrons, have proliferated in North America in recent years, partly because of licensing requirements in some jurisdictions, but more importantly because of licensees' desire to reduce their exposure to multi-million dollar law suits arising from vicarious liability over the actions of patrons served to intoxication on their premises (Stockwell, Norberry & Solomon, 1993). These programs employ a variety of techniques to prevent intoxication, including observing patrons and being able to recognise intoxication; promoting non-alcoholic and low alcohol drinks; serving well-priced, attractive, and well-marketed food low in salt content; and training staff in techniques for monitoring patrons and adjusting service as necessary. Training is also provided in refusal of service to patrons who are intoxicated or who show signs of becoming intoxicated. Bar staff are trained in offering positive alternatives, such as soft drinks or food at discounted prices, and both management and staff are trained in negotiation techniques with patrons who are becoming difficult or aggressive. The importance of a well-publicised

"house policy" to provide a positive context for responsible serving practices and for negotiation with patrons is emphasised (Simpson et al., 1987).

The small number of rigorous evaluations of responsible serving programs which have been published suggest that positive effects on levels of intoxication and on alcohol-related problems can be achieved. Saltz (1987), in an evaluation of an experimental 18 hour training program in a United States Navy base, reported that the likelihood of a customer being intoxicated was cut in half, although for the establishment as a whole absolute consumption and the rate of consumption were not affected. Wagenaar and Holder (1991) used multiple time-series analysis to establish that a sudden change in exposure to legal liability of servers of alcoholic beverages in Texas resulted in significant declines in injurious traffic crashes. They speculated that this result was achieved because managers suddenly had an incentive to implement server training programs. Putnam, Rockett and Campbell (1993) report the results of a very comprehensive community intervention on Rhode Island which resulted in a 21 percent reduction in Emergency Room assault injury rates in the intervention site compared with a 4 percent increase for the comparison communities. Motor vehicle crash injuries were also reduced. The community intervention involved server training as well as publicity campaigns, local task force activities, and community forums, and was supported by training of police and increased levels of enforcement with respect to alcohol-related accidents and crimes.

It is noteworthy that in most of these programs in the United States, responsible serving programs were supported by legal sanctions or were imbedded in broader community interventions. The crucial role of enforcement is highlighted by two evaluations of the effects of police activity on licensed premises. Jeffs and Saunders (1983) report a study in an English seaside resort which examined the impact of uniformed police dropping in at random intervals two or three times a week and very conspicuously checking (in an amiable way) for under-age drinkers or intoxicated patrons. Compared with a control area, there was a decline during the intervention period of approximately 20% in all arrests, with the most marked effects being on public order offences known to have the highest association with alcohol. McKnight and Streff (1994) show that intensive undercover police operations, preceded by education of licensees about the enforcement activities, after-visit reports to licensees not cited, and media publicity, resulted (in comparison with a control county) in greatly increased refusals of service to "pseudopatrons" simulating intoxication and a marked decline in drunk drivers who had been served at the target establishments.

The huge problem in "wet" countries such as Australia is that there are no legislative or economic reasons for the alcohol industry to embrace responsible beverage service practices. As Stockwell, Norberry and Solomon (1993: 161) remark, "Civil law suits are about as likely in Australia at present as being struck three times by lightning on the same day." Every state and territory in Australia has a Liquor Act which, in one form or another, prohibits the sale of alcohol to intoxicated persons, but "...there is a tacit agreement by all involved in the management, regulation and policing of licensed premises to quietly ignore the law regarding service to intoxication -providing the intoxicated person is not causing a nuisance to other customers." (Stockwell, Norberry and Solomon, 1993: 156). This is not a new situation, of course, and reflects the historic fact that the regulatory system is undergirded by notions of the deserved misfortune of victims of pub violence as well as the belief that liquor licensing legislation is not capable of achieving social objectives such as the prevention of violence (Homel & Tomsen, 1991).

Community Interventions: The Surfers Paradise Safety Action Project

In the absence of effective official external regulation, one way of bringing pressure to bear on licensees to introduce more responsible practices is to use the local community as a lever (Victorian Community Council Against Violence, 1990). A recently completed community project in south-east Queensland, which had as its major aim the reduction of alcohol-related violence in a major international tourist area with approximately 20 nightclubs surrounding a single mall, illustrates the value of this approach (McIlwain, 1994).

The Surfers Paradise Safety Action Project was based on three major strategies: (a) The creation of a Community Forum, and the consequent development of community-based Task Groups and the implementation of a safety audit; (b) The development and implementation of risk assessments in licensed premises by the Project Officer and the Queensland Health Department, and the consequent development and implementation of a Code of Practice by nightclub managers; (c) Improvements in the external regulation of licensed premises by police

and liquor licensing inspectors, with a particular emphasis on preventive rather than reactive strategies and a focus on the prevention of assaults by bouncers and compliance with provisions of the Queensland Liquor Act prohibiting the serving of intoxicated persons.

The project largely succeeded with the first two strategies, but not surprisingly achieved less success with the third (McIlwain, 1994). Even so, evaluation data suggest that the Project succeeded in reducing physical assaults in Surfers Paradise nightclubs from 9.8 per 100 hours observation before the intervention to 4.7 per 100 hours observation after the intervention (Homel, Hauritz, Wortley, Clark & Carvolth, in preparation). Of most direct relevance to the present paper, the Venue Management Task Group was able to establish a Monitoring Committee, consisting of local community and some external representatives, but not police or the liquor licensing authorities. The committee oversaw, regulated and arbitrated a Code of Practice which was developed by the nightclub managers themselves as a response to the Project. The Venue Management Task Group also resolved major professional conflicts between police and licensees, integrated a group of licensees who were previously alienated from each other, and organised training for licensees in management practices, development of house policies, responsible serving practices, and management of security staff.

The Monitoring Committee represented the culmination of the local community's attempts at self-regulation. It came together on several occasions to address such issues as free drinks, inappropriate sexual behaviour in public by patrons following a nightclub strip show, advertising of "specials" on alcohol, and over-crowding (McIlwain, 1994). Essentially the committee, as an informal regulatory body, attempted to fill the gap created by the withdrawal of both police and the Liquor Licensing Division from the collection of evidentiary information which could result in successful legal action against deviant licensees. The committee also applied "peer pressure" to some licensees in a partially successful attempt to persuade them to comply with the Code of Practice. The committee could not compensate entirely for the deficiencies in police and liquor licensing enforcement, but it did achieve more than would have been possible otherwise.

The Code of Practice developed by the nightclubs focused on security, safety inside and outside the venue, staff responsibilities, the responsible use of alcohol, quality service and entertainment, and honest and accurate advertising. Under the security heading, the Code committed management to ensuring that all security staff were trained, registered and identifiable, and gave priority to the well being of patrons; physical violence, harassment or threat were prohibited; it was made clear that the police would be called immediately if any act of serious violence occurred; and that any patron who felt threatened or harassed should immediately inform security staff. These good intentions were supported by training for security staff conducted by a professional group (Advanced Techniques, 1994). The comprehensive training program emphasised such things as empathy in communications, being non-provocative, and evaluating before acting. It was made absolutely clear that violence should be avoided, and legal obligations under state government legislation were considered at length. A deficiency in the training was the failure to examine the critical links between masculinity, alcohol use and violence, a key issue not only for Pacific Islanders but also for other security staff who cultivate a "macho" image of themselves. However, the evaluation data did confirm that the behaviour of bouncers greatly improved (Homel et al., 1994).

The evaluation data also confirmed that the Code of Practice encouraged investment in better quality entertainment which reduced reliance on sexual titillation and alcohol promotion to attract patrons. Probably the most significant outcome of the Project was the marked reduction in levels of intoxication, due in no small measure to the abolition of free drinks and extreme price discounting, combined with substantial efforts to prevent the serving of patrons to intoxication.

Conclusion

Intoxication, and the management of intoxication, are from the present analysis key situational factors increasing the risk of violence in and around licensed premises. These factors are imbedded in a range of other situational variables and management practices, which in turn reflect the historic neglect (at least in "wet" cultures such as Australia) of drinking environments in terms of their impact on public health, as well as a cultural tendency to blame the victims of violence rather than the regulatory systems and political attitudes which perpetuate the

problem. In the long term, the key to reducing violence in licensed premises is to modify the central situational risk factors through effective enforcement of existing laws and the development of liquor legislation which makes the promotion of public health central to its objectives. In the short term, community based action that promotes the development of Codes of Practice which encourage a better social climate in all licensed premises, not just the minority of high risk establishments, is a practical and cost-effective strategy.

Top priorities should be better trained bouncers and bar staff, and the introduction of responsible serving practices which reduce the risk of patrons becoming intoxicated. These measures have considerable violence-reduction potential, provided compliance is carefully monitored by an authoritative local committee, or by the responsible external authorities.

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by Paul Ekblom

Scoping and scoring: Linking measures of action to measures of outcome in a multi-scheme, multi-site crime prevention programme

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Introduction

Most evaluations of crime preventive action focus on individual schemes taken one by one. By contrast, the evaluation of the Safer Cities Programme (SCP) has had to examine the collective impact of highly diverse activity in a number of cities. The purpose of this paper is to describe some unusual problems this has presented for evaluation methodology and to describe what are perhaps equally unusual solutions that we are currently developing. The hope is that these solutions will have a wider applicability than this one study - or will at least make researchers and evaluators think about crime prevention, its evaluation and its geography in a rather different way.

The Safer Cities Programme

To supply some context first of all, the Safer Cities Programme in England was set up in 1988 by the Home Office. It was part of Action for Cities - the UK Government's wider programme of coordinated action aimed at dealing with the multiple social, physical and economic problems of some of our larger urban areas.

The objectives of SCP are to:

- reduce crime
- lessen the fear of crime
- create safer cities within which economic enterprise and community life can flourish.

Safer Cities is locally-based. Projects have been established in 20 English cities or large urban boroughs. In each area, the project is guided by a steering committee representing local government, police, probation, voluntary bodies and commerce, which sets priorities for the project and oversees the implementation of measures directed against crime. Each project is directed by a local coordinator with an assistant and a secretary whose salaries and running expenses are met by the Home Office, which has also provided £250,000 per year per project for funding local organisations to implement preventive action. The kind of preventive action funded covers the entire range of methods - from physical improvements to high-rise apartment buildings, to educational schemes for young people; from the installation of a single street light outside a retirement home, to improvement of security on a

large residential housing estate; from a purely geographical focus on a local neighbourhood, to the targeting of vulnerable groups such as ethnic minorities, women or the elderly, to a city-centre safety strategy, to a city-wide publicity scheme. The flavour of SC action can be gleaned from the progress reports published annually (eg Home Office, 1993).

The Programme Impact Evaluation

The Research and Statistics Department of the Home Office is evaluating the impact of the Programme as a whole. Brief details of the data and the design follow. A more thorough (although less up to date) account is in Ekblom (1992).

Principal sources of data are:

- Action data from SCP's Management Information System, showing for each of nearly 3,000 schemes the target crime problems, the nature of preventive action, and the financial input. Action location data showing the site of each scheme, from interviews with the coordinators.

- Outcome data including police recorded crime statistics for selected offences by month and beat in most SC cities, and city-level statistics in up to 9 comparison cities; and survey data in most SC project areas and 8 comparison areas, covering victimisation by crime, nuisance and racial harassment, fear, community satisfaction and measures of social/economic activity. The survey is of the 'embedded panel' kind, with about 4,000 adult residents interviewed in 1990 and the same again in 1992 - about half of the respondents participating in both waves.

- Covariate data from the 1991 Census and other sources.

The basic design involves asking several key questions, principally:

- Was there a real change in crime or other impact indicators, as opposed to random fluctuation?

- What proportion of that change can be attributed to the action, as opposed to other coincidental causes and background changes?

In answering these questions we have to take account of demographic covariation and confounding influences such as other Action for Cities work proceeding at about the same time and place as that of SCP, which might distort the findings. Before-to-after changes in the action areas are to be compared with before-to-after changes in comparison areas where there has been no SC action. This filters out background changes common to all areas (and England has seen some very large countrywide increases in recorded crime over the last 3 years). Two types of comparison are to be used in this process, each drawing on police crime data and survey data. Internal comparison will be based on areas within SC project cities which are not the subject of SC action; external comparison will be based on a set of cities outside SCP, but otherwise similar.

Design problems and solutions. The conventional evaluation of crime preventive action involves assessment of a single scheme, carefully selected and located in advance and subject to reasonably tight experimental control. But even under these ideal conditions, no evaluation can provide results which are free from uncertainty or beyond dispute (Ekblom, 1990). The RSD impact evaluation faces extremely difficult conditions which centre on having to detect the effects of a set of preventive schemes which are very diverse in size and nature (some being extremely modest), which may or may not be successfully implemented, which start up at different times, which possibly overlap (if not directly, then sometimes in terms of their potential 'displacement zones'), and whose locations and start dates are not merely scattered but unknown in advance. The effects have to be detected against a background of non-SCP preventive activity in the SC areas themselves and in the country as a whole; and a range of other Action for Cities programmes which together dwarf the SCP in funding terms.

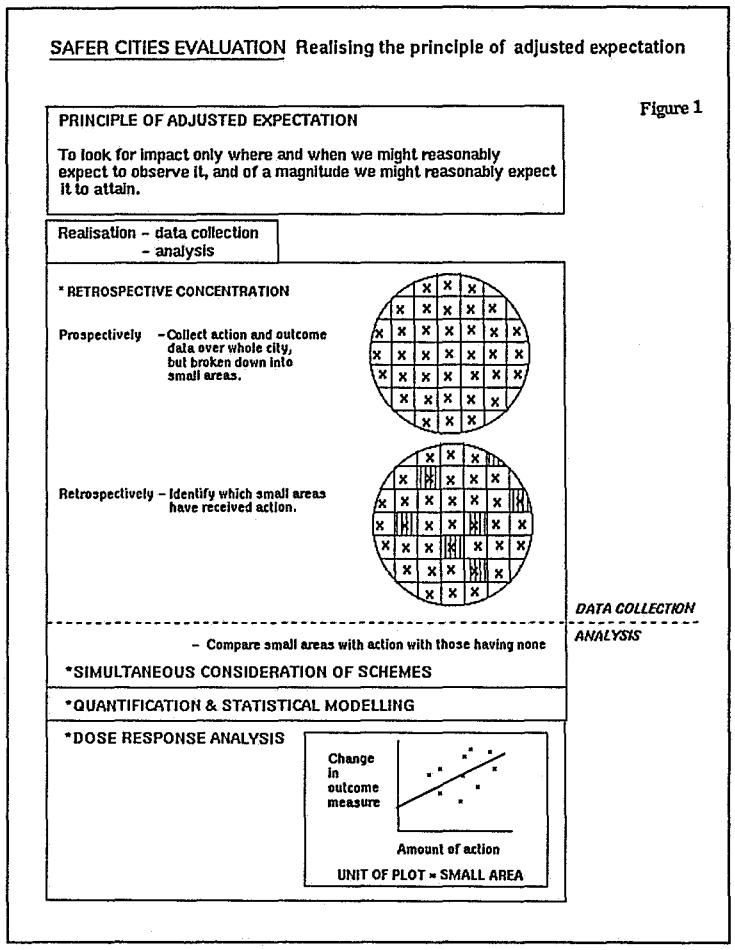
These harsh conditions reflect the real world of programme evaluation and make for a significant risk of **measurement failure** (Rosenbaum, 1986) - in other words, the possibility that the SCP will have an impact but that the evaluation exercise will be unable to detect it. The basic design has been developed to face up to this risk and to cope with it in as economical a way as possible - in particular to be extremely flexible, to adapt to the evolving nature of the SCP, to the unpredictable occurrence of confounds and to emergent problems with individual data sources. But it has been made quite clear to those with an interest in the results of the evaluation that the findings will inevitably be surrounded by a considerable margin of uncertainty.

This paper focuses on the solution we are developing to just one of the design problems referred to above - centring on the scattered and unpredictable location and timing of the preventive action, and its relatively modest scale. The consequences of this conjunction of adverse features are twofold: i) the effect of a given scheme is likely to be lost when buried among random fluctuations and background changes in crime over whole cities; schemes whose action is subject to **shareout** over a wide area or a large number of people are particularly hard to detect in comparison with schemes of an equivalent amount of input, but concentrated in a smaller zone. ii) With an imperfect overlap between where and when we measure and where and when the action is subsequently located, the effects of the action on our outcome measures will suffer from **dilution** - at a given survey sampling point, for example, we may be interviewing a set of respondents, some of whom have had the preventive action, but others of whom may not, because they lived a little further down the road from the site of the scheme.

For these reasons, we cannot have much hope of finding change if we look for it at the city level downwards (after all, £250,000 per year is not much to be spending in a large city); but there are similar limitations in conducting the evaluation by working upwards from the assessment of individual schemes. It is true that the impact of individual schemes may be detected in this process where they are large, concentrated geographically and well-implemented; however, it was methodologically and logistically difficult to envisage any way of evaluating the individual impact of many of the smaller or more diffuse schemes - and not to include these would seriously distort the picture. Besides this, there was an issue of principle - the evaluation was aimed at the Programme as a whole, not its constituent schemes.

Coping with modest action, shareout and dilution: The principle of adjusted expectation. In order to cope with problems of modest scale of preventive action, shareout of influence and dilution of measurement we evolved a fundamental principle of the evaluation: **to look for impact only where and when we might reasonably expect to observe it, and of a magnitude which we might reasonably expect it to attain**. This might be called the **principle of adjusted expectation**.

There are several elements to the approach we have chosen in order to realise this principle, acting at both the data collection stage and analysis. They are: retrospective concentration; simultaneous consideration of the impact of many schemes; a quantitative approach through statistical modelling; and a dose-response analysis. These are discussed in turn and illustrated in Figure 1.



1. Retrospective concentration.
   Retrospective concentration is an approach midway between the classic alternatives of top-down and bottom-up. It involves **prospectively** collecting action and outcome data over whole project cities/boroughs, but broken down into **small areas**; and **retrospectively**, during analysis, contrasting those small areas where action has turned out to have been successfully implemented, with areas of no action.[1]

2. Simultaneous consideration of schemes.
   Considering the schemes (and the small areas in which they are sited) simultaneously greatly improves the capacity to detect change. In fact, this is a way of circumventing what may be an important paradox of measurement: small schemes are likely to be better targeted and better implemented, and may therefore have greater

impact; but by the same token they may find it harder to make their impact felt against random fluctuation. Taken together, the idea is, the background 'random noise' masking any impact of each individual scheme cancels and only the 'signal' of preventive effect stands out.

3. Quantification and statistical modelling.
We have also sought to quantify the impact of the preventive action on the outcome measures, partly because quantitative estimates of impact (whatever their margin of error, within reason) are much more useful to administrators and managers; but partly too because with the scale and variety of preventive action implemented, a quantitative approach offers the only real hope of demonstrating the action-outcome link.

The only kind of approach to analysis capable of linking outcome to action and covariates on such a large scale and with quantitative measures of impact is statistical modelling; in particular multiple regression.

4. Dose-response analysis.
Considering the simultaneous impact of large numbers of varied schemes presents a problem, in that the schemes may differ in terms of their size, and hence the magnitude of their effects. Simply to include within a statistical model a term representing 'presence or absence of scheme' in a given small area would make finding a relationship difficult, because there would be immense variation in the action-outcome link from one scheme to the next; the probability that quite a few of the small areas measured will have more than one scheme sited there means that the relationship is further muddied.

We need, therefore, to modify the 'present-absent' comparison envisaged in retrospective concentration by adopting an approach which:

- enables us to consider the effects of many schemes in their respective small areas simultaneously

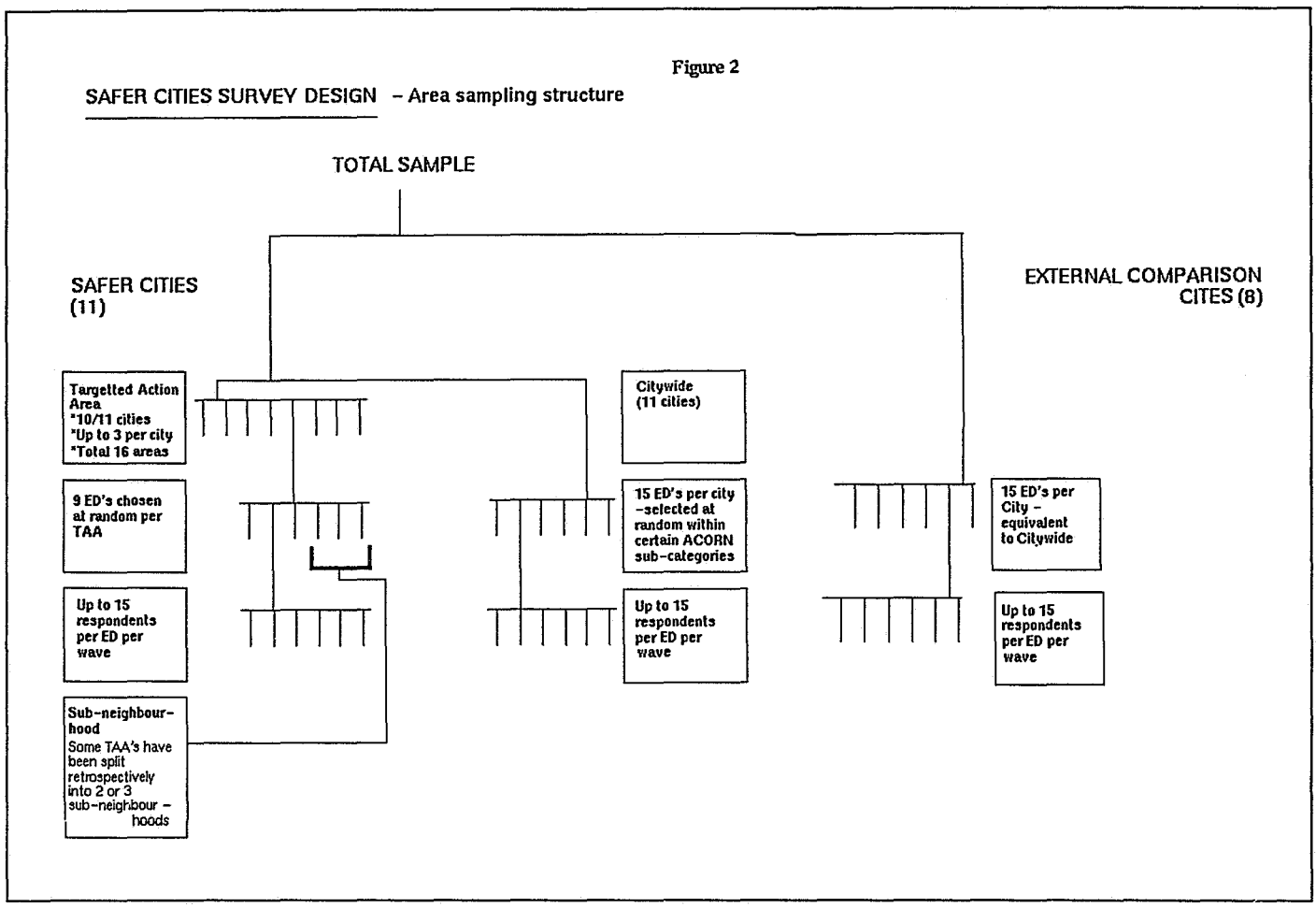
- enables us to contrast small areas with varying degrees of scheme action, taking the amount of action into account

One way of meeting these requirements is to conduct a **dose-response analysis**, often used in medical experiments. Here, though, rather than studying the effect of increasing amounts of a drug, we are interested in the effect of increasing amounts of preventive action falling within the small areas studied. What we would expect to find, then, is the more the action in a given small area, the greater the fall in crime and related outcome measures - or at least, given the large background increases in crime in the UK over the last few years, the smaller the rise. The dose-response perspective should provide a quantified measure of impact that is easy, moreover, to communicate to non-professional users of the evaluation.[2]

Realising the principle of adjusted expectation.
Putting the principle of adjusted expectation into practice in the data collection stage is discussed below; the analysis stage is also introduced - but as certain aspects of the analysis constitute the subject matter of the rest of this paper, it is mainly covered in subsequent sections. At various points the survey and the crime data are described separately, as their realisations of the principle are rather different.

1. The data collection stage.
The crime data in theory provides more or less total coverage of the SC cities, and thus can be guaranteed to 'hit' most of the preventive action. On cost grounds this was obviously not possible for the survey - we therefore faced a trade-off between interviews that were 'spread too thinly on the ground' to be useful versus those which were sufficiently concentrated, but which risked being in the wrong place. Because, self-evidently, the survey locations had to be planned in advance of the implementation of the schemes, a dual strategy was devised to try to maximise the chances of locating sufficient concentrations of interviews in areas where preventive action would subsequently occur. In each case, Census Enumeration Districts (EDs - about 150 households each) comprised the small areas for the survey.

i) Within each SC city, interviews were conducted in a sample of 15 EDs identified as 'high-crime' through ACORN - a Census-based area classification system which had been calibrated against the British Crime Survey (Mayhew et al., 1989; Appendix G) - and hence of a kind to which SC coordinators would consider assigning preventive action. Interviews were conducted on a similar basis in the External Comparison cities.



ii) In addition, to hedge our bets, in the SC cities only, 16 'targeted action areas' in total were identified where coordinators did fairly reliably know in advance that there would be plenty of preventive action. These were 'neighbourhood-sized' territories and interviews were conducted in 9 EDs within each.

The survey sampling strategy is illustrated in Figure 2.

With the crime data, coverage was much less of a problem, as said; and it had the further advantage of being disaggregated by month (as against the two 'snapshots' of the survey), which enabled a finer-grained resolution of time. On the other hand, with the smallest practicable small area consisting of the police beat[3] (averaging a few thousand households), the resolution of space was cruder, making (among other things) for greater dilution of measurement.

2. The analysis stage.
The analysis of the survey data through statistical modelling will in effect involve plotting (or regressing) the change in the outcome measures (from before to after) for the individuals in a given small area surveyed, against the amount of action the area has received - that is, the dose. For the crime data, a repeated measures analysis or even a full time-series analysis can be conducted to estimate the month-to-month change over several years, associated with the presence of preventive action at particular places and times. With both these approaches, to cope with the hierarchical nature of the data (respondents, Census Enumeration Districts, Cities for the survey; months, beats and cities for the crime statistics) the technique of 'multi-level modelling' (Goldstein, 1987) or 'hierarchical linear modelling' (Bryk and Raudenbush, 1992) is being used. In all this, it should be remembered that the 'dose' is just one extra explanatory variable in the statistical model, to be considered simultaneously with a range of contextual variables at the individual level (eg survey respondents'

demographic details), the small area level (eg the unemployment rate in the police beat) and the city level (eg city size).

Of course, our approaches to both types of outcome measure, survey and recorded crime, require us to develop a way of measuring the dose - deriving a score to represent the amount of action in each small area covered by our outcome measure, and operating over the relevant time period. But before scoring can be done, there is another major problem to solve. Linking action to outcome in the statistical modelling envisaged is not straightforward. In a traditional evaluation of a single scheme, it is almost totally implicit that the survey conducted, and the crime figures collected, will be in the right place and at the right time to detect the expected change in outcome measures; and oriented towards the particular crime problem targeted by the scheme, and any population groups targeted such as ethnic minorities. All of this is so obvious that it is in effect invisible. In the Safer Cities evaluation however, none of this can be taken for granted. As already said, the action involves nearly 3000 schemes that are scattered in space and time, targeted on a wide range of crime problems and a range of population groups. Regarding the outcome measures, in the case of the crime data, we have information from many individual police beats at monthly intervals; with the survey, we have before and after interviews in several hundred EDs grouped in 11 SC cities, posing questions that measure a range of topics including victimisation by various crimes, fear and going out behaviour, and covering a range of locations (eg household, neighbourhood, city centre) and time periods (eg last week, the last year, the last two years).

For logistical and methodological reasons we cannot operate on a 'craft-oriented' basis with measurement and analysis fitted bespoke to each individual scheme in the traditional way; rather, we are operating on an industrial scale, evaluating action that is extremely diverse and using outcome measures that are equally broadly-based. To make matters even more difficult, as said, we are only able to link action and outcome at the analysis stage, because only then do we know where it has been implemented.

The problem is thus retrospectively to link up what we know of the location in time and place of the action and on whom and on what it is targeted, to what we know about the location and time-frame of outcome measures and the kinds of targets to which they relate. All this must be done in a context in which both action and outcome measures are wide-ranging and general purpose, rather than neatly dovetailing around a single scheme.

These ecological, temporal and geographic factors intervene between our knowledge of the amount of preventive action injected into an area and our measurement of outcome, and we have to develop ways of taking them into account in order to make the link between action and outcome as clear as possible. A previous attempt to link action and outcome in a recent assessment by the Dutch of their crime prevention programme (Polder, 1992; Junger-Tas, 1993) relied on conducting a meta-analysis of what eventually became quite a small set of individual evaluations, and results were unfortunately rather limited. (However, the study did draw attention to the importance of the 'intensity' of preventive action in producing measurable impact - a concept related to 'shareout' as used here.) Within the SCP itself, efforts to conduct reviews of individual evaluations focused on particular themes (eg car park crime prevention schemes (Tilley, 1993)) have been possible, but have been considerably constrained by the usable base of individual evaluations.

Our own solution to the linkage problem and to the requirement to represent the amount of action falling within each small area measured has been to develop a dual-aspect process called **scoping and scoring.** For each statistical model constructed during the course of analysis, the starting point is choosing a particular **outcome measure** (an item, or a scale, from the survey - eg fear of burglary - or a particular category of recorded crime from the crime data - eg autocrime). **Scoping** refers to the process of determining, using logic and theory, whether any specific scheme of preventive action has the potential to influence this outcome measure, by virtue of its location in time and space, the target crime problem of the action, and any target population subgroups at which the action is directed. **Scoring** is the process of representing the **amount** of in-scope action present - at a given time and place of outcome measurement - directed towards given crime problems and perhaps given population subgroups; and taking account of dilution of measurement.

The next two sections respectively introduce the basic principles of scoping and scoring; the one after describes some of the inevitable variations and complications that are required to make simple ideas connect with reality; the conclusion discusses wider applications, and further considerations.

As with techniques such as crime pattern analysis (Ekblom 1988), the scoping and scoring processes described below represents a trade-off between, on the one hand, capturing information in a way that does justice to complex reality, while on the other, making the representation of reality as simple as possible and ensuring that it follows rigorous and reliable rules which are formally defined and can be handled in the context of a computerised database. In support of this, it is necessary to create a number of new terms to make for easy reference to key concepts.

Basic Principles of Scoping

To formalise what was stated before, there are four aspects or dimensions to characterise the way in which a given preventive scheme can be said to be in scope of a given outcome measure - ie to have the potential to influence it:

- **Space** - is a given scheme located close enough to a point of measurement, for the outcome measure to be potentially influenced?
- **Time frame** - is the timing of the action such that it could exert an influence on the outcome measure?
- **Problem** - is there a plausible cause-effect relationship between the nature of the action in a given scheme and the problem measured by the outcome measure in question (or alternatively, is there a plausible mechanism (Pawson and Tilley, 1992; Tilley, 1993; Ekblom and Pease, in preparation) whereby the action could potentially have the effect)?
- **Subgroups** - is the outcome measure directed towards population subgroups - eg women? Is a given scheme?

The Zone of Detection (ZD) of an outcome measure. A given outcome measure will have certain inbuilt scoping characteristics. In other words, it will have particular spatial implications (eg the survey questionnaire asks about 'in this area' or 'in the city centre'; the police beat again refers to a specific area); particular time frame implications (eg '...in the last year?' versus '...in the last week?'); it will relate to a particular crime or fear problem; and may have subgroup implications (eg 'women only'). These four characteristics determine what can be called the **Zone of Detection** that fans out around the outcome measure.

With the survey, some aspects of the Zone of Detection of a given outcome measure derive from the content of the questionnaire item itself; others from our optional selection of respondent subgroups using the survey demographic items; and others from the location of the interviews in particular EDs. (Another way of conceiving of the spatial Zone of Detection is to imagine each survey respondent as a detector, reporting on his/her experiences from the viewpoint of the surveyed ED where they live: relating to self, household, neighbourhood, city centre and whole city, according to the survey questions asked).

In the case of the crime data, the Zone of Detection is rather simpler: it can be defined in terms of beat (space), month (time) and crime type.

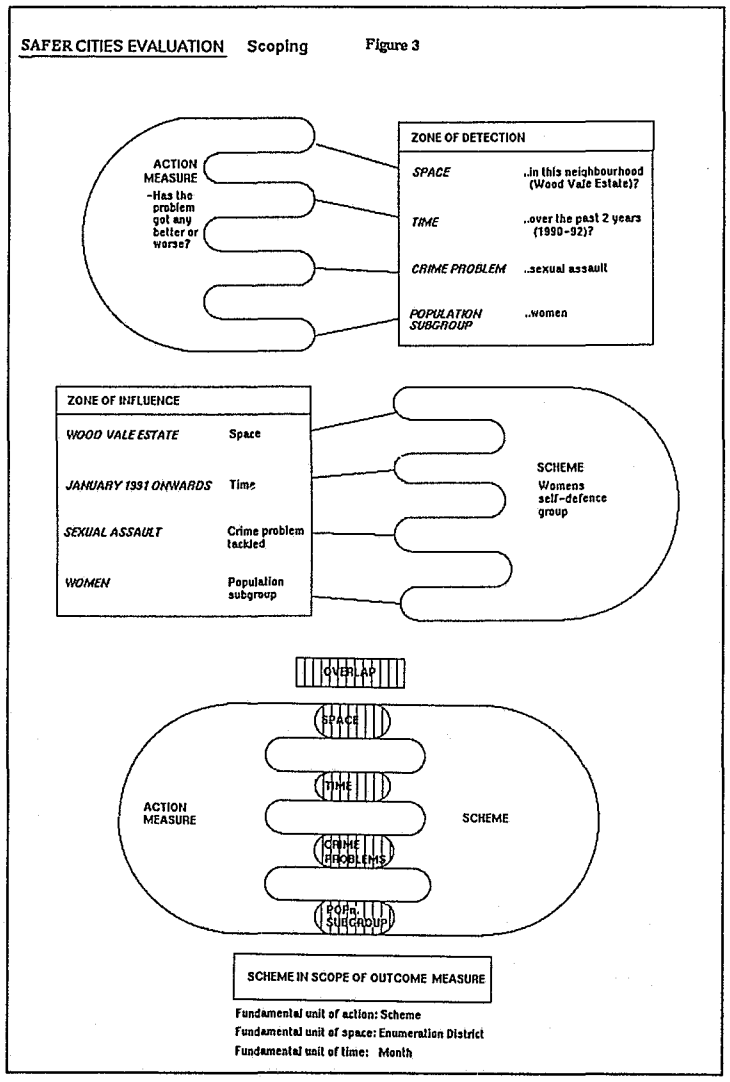
It is important to distinguish between the **generic** Zone of Detection of a particular outcome measure and the **specific** Zones of Detection that make it up. Generic refers to the type of Zone, such as 'neighbourhood', 'beat' or 'the last year'; specific refers to the individual Zones - single units of measurement of outcome. For example, in the survey each neighbourhood is defined in terms of a particular list of EDs (the neighbourhood surrounding each surveyed ED was identified as a list of adjacent EDs with the aid of SC coordinators), and there will be many such neighbourhoods covered - each one an independent unit of measurement. Likewise, with the crime data, a particular category of crime in a particular beat in a particular month is another specific Zone of Detection. Such specificity is needed when moving forward from principles into practical measurement and analysis.

The Zone of Influence (ZI) of a scheme. Around each individual preventive scheme there is a **Zone of Influence**, which again stretches out in terms of space, time, problem and subgroups. In the Safer Cities case, the spatial dimension was identified by presenting each coordinator with an ED map of their city and getting them to specify into which EDs a given scheme fell; the rest came from the

Management Information System.

The Zone of Overlap (ZO). If in a given modelling exercise (ie trying to explain the variance of a given outcome measure), a given scheme's Zone of Influence happens to overlap with a specific Zone of Detection of the outcome measure, then by definition that scheme has the potential, if it works as intended, to influence the value of the outcome measure. (The overlap has to be on all four dimensions.) The scheme in question is then said to be **in scope**, and information on it (including its action score) can be included in the modelling exercise, paired up with the scores on the outcome measure of the relevant specific Zones of Detection, and the relevant covariates. For a larger scheme or one of great duration, only part of the scheme may be in the scope of a given outcome measure's specific Zone of Detection.

Scoping is illustrated in Figure 3. To summarise, the fundamental principal of scoping to observe in our modelling is therefore that:



Only if there is overlap on all 4 dimensions between the Zone of Influence of a given scheme and one or more of the specific Zones of Detection of a given outcome measure, can we include the score from that scheme in the modelling of that outcome measure - or at least that part of the scheme which is in scope.

There is a need both conceptually and for computing purposes to specify fundamental units in space and time which can be used to define all possible Zones of Detection, Influence and Overlap to be used in the evaluation. Here, we have chosen the Census Enumeration District (ED) and the month; the fundamental unit of preventive action is taken as the scheme. The minimum overlap between a specific Zone of Detection and a Zone of Influence is therefore one ED for one month. In some respects, smaller spatial units still (such as postcodes) would have been preferable, but we were constrained to this choice by limitations of the data. On space, the survey resolves down to the ED level, as do the action location data and the Census covariates; the beats in the crime statistics, while larger territories, can always be represented as aggregations of EDs (albeit with some margin of error in those cases where EDs straddle beat boundaries). The action data records the start and stop of schemes at the month level, and the crime data likewise resolves time to this scale. The survey items cover longer spans of time (eg a year) but these spans can always be defined in terms of runs of specific months.[4]

Basic Principles of Scoring

Having now constructed a way of linking particular schemes to particular outcome measures, we can return to the issue of the action dosage. If the dose-response analysis were done using the total amount of action in a scheme - its dose - plotted against the value of the outcome measure in the relevant Zone of Detection, then at best, we would get an underestimate of the response per unit dose (ie relative fall in crime per pound of preventive action), because the Zone of Detection in question may not receive all the action, and furthermore the method of measuring outcome may only imperfectly detect its effects. At worst, and more probably, the uncontrolled and incidental variation will totally prevent any pattern emerging. Scoring adjusts the

scheme's dose to make it more closely resemble the dose which is actually received, and then measured in, the specific Zone of Detection of a given outcome measure[5]. (Scoring is thus not a luxury but a necessity.) It does this by taking account of some of the irrelevant factors that derive from the vicissitudes of measurement: the shareout of the total dose of action over its Zone of Influence and the degree to which this incompletely overlaps with the Zone of Detection, resulting in some lesser proportion of the dose being received there; and dilution of measurement within the Zone of Detection itself - in which the people or property receiving the dose may be pooled together with others who have not. The adjusted dose results from a process akin to the 'indexing out' of incidental factors of space and time, equivalent to (but more complicated than) the population - adjustment of the crime rates of different areas to make them comparable.

The principles of scoring set out below use fairly obvious logic and a minimum of theory; at this stage there is no attempt to differentiate between types of scheme (this is discussed in the next section) - merely to describe the basic ideas.

Once again, the fundamental units of analysis are the ED, the month and the scheme - although for the statistical modelling these units are eventually aggregated up in different ways for the survey (eg ED x year for victimisation questions) and the crime data (beat x month).

Amount of action of scheme: the more the total amount of action in a scheme, the higher the score.

Geographic shareout in Zone of Influence: the greater the geographical Zone of Influence of a scheme, the greater the number of **units at risk of victimisation** (such as houses), or **units at risk of offending** (such as young males) among which the scheme's total amount of action is **shared out**, hence the less the effect in any one part of that Zone of Influence.

Geographic dilution in Zone of Detection: not all the people or property located in a specific Zone of Detection receive action: the smaller the proportion of the units at risk of victimisation in the ZD that are protected, the greater the **dilution of measurement** and the less the score.

On the time dimension it is necessary to differentiate between the before-after 'snapshot' analysis of survey data, and the repeated measures / time series analysis of crime data. Basically, time shareout and time dilution are simpler concepts than their geographic equivalent because the preventive action is either present in a given month or it is not - although important variations are discussed in the next section.

Time shareout in the Zone of Influence: basic time shareout is all-or-nothing: a scheme is either active in a given month or it is not.

Time dilution in the Zone of Detection :

a) before-after analysis of survey: the shorter the time period the scheme is operational within the Zone of time Detection of the after-survey, the smaller the score, because the lower the proportion of the total 'targets-at-risk-months', in which outcome is being measured, that are 'protected'

b) repeated measures / time series analysis of crime data: a score is registered if there is action present in the particular month of the Zone of Detection; time dilution too is effectively 'all or nothing'.

Putting all these principles together, we have:

adjusted action score for a given scheme in a given specific Zone of Detection = **[total amount of action] / [geographic shareout x geographic dilution x time shareout x time dilution]**.

Putting this back into the original dose-response formulation, we should (with careful attention to arithmetic and the 'dimensionality' of the calculations) end up with the slope of the dose-response relationship representing the average **change in the value of the outcome measure, per pound dose of the action received per unit at risk when the action is fully and continuously operational**. A concrete example of this could be 'we observed an average fall in the risk per household of burglary from 10% per year to 8% per year per £100 worth of action received per household in the area, and fully active over that period'.

Additional principles of scoring. If there is more than one scheme in scope of a given Specific Zone of Detection of a given outcome measure, then summation of action scores may be necessary. **Mix** scores might be generated to help test whether there is any synergy between different preventive methods (eg a situational scheme plus an offender-oriented one) whose Zones of Influence overlap with one another and with a given Zone of Detection.

Preventive action may of course have unintended effects, both beneficial or pernicious. Action adjacent to a given Zone of Detection may either lead to **displacement** of crime into that Zone, or **diffusion of benefit** (Clarke, 1992), in which offenders give the Zone of Influence a wider berth than strictly necessary. Measuring adjacent action and modelling its effects would involve identifying the band, or successive bands, of EDs surrounding the intended Zone of Influence and identifying which of these bands are in scope of a given specific Zone of Detection. Similar principles of shareout, overlap and dilution could be used to generate 'adjacent action' scores to incorporate within the statistical model.

The technology of analysis. It should be noted at this point that conventional methods of analysis would make these operations impossibly slow and cumbersome, especially with the large number of schemes and of points of measurement (ie of specific Zones of Detection). The whole scoping and scoring exercise is only conceivable due to the arrival on the scene of the Geographic Information System - a special kind of (relational) database which can handle points, lines and territorial boundaries on computer, and link this spatial information to 'attribute' information (for example, linking a particular police beat to the attribute 'population' such that the population could be represented within the boundaries of the beat on a map; and even more usefully, calculating the population of a beat by filling in the beat territory by the EDs which cover more or less the same territory). (The GIS we are using for the SCP evaluation is Arc/Info.)

Variations and Complications on the Basic Principles

This section explores some inherent variations and complications of the various concepts introduced in simplified form above. At the same time, it begins to move away from the completely uniform application of the principles, towards taking account of differences between types of preventive action. In this respect particularly, it increasingly engages with geographic and criminological theory - although as will be seen, the process is not remotely complete, opening up many more questions than providing answers.

Total amount of action of a scheme.

1. Output or input?
   One approach to measuring the amount of action might involve some numerical count of **output**. This could reflect the numbers of units at risk of being victimised that have now received the preventive treatment (eg houses protected by target hardening). Alternatively, where appropriate, output could reflect the numbers of individuals now at less risk of offending (eg young people attending a youth scheme). Such counts would have the advantage of offering a very direct measure of output. However, houses may be protected by variable amounts, and youths beneficially influenced by equally variable amounts, that will be difficult to measure. Indeed, the output measures in the SCP Management Information System are not sufficiently reliable, comprehensive and systematic to use in the evaluation - in no small degree due to these difficulties. Given also the diversity of outputs, it is altogether simpler and safer to focus on **input**. In practice, this means **monetary** input into individual schemes, which is consistently and reliably present in the MIS because of accounting discipline. In other words, we are asking here 'what impact do we get for our money - however this relationship may be mediated by output?', rather than 'what impact do we get per protected house?'. The former is a more suitable question for the present evaluation, although (in the context of future evaluations) accurate and comprehensive output data would enable the latter question to be posed too, which would be a considerable refinement with advantages for both theory and practice.

2. Differentiation: classification of preventive action.
   Money has the particular advantage of being a universal metric. However, it is all too easy to stretch this universality too far. The enormous diversity of preventive activity means that it would be unwise to lump all types of preventive action together in scoring under a single money index (is £5000 spent on a youth club likely to have an equivalent effect to £5000 spent on target-hardening?). The un-anchored variation could shake any models to bits. We are therefore trying to mitigate some of the disadvantages of using the monetary metric by pooling **like with like** on the basis of a classification of different types of preventive method. We may then generate several separate action scores using alternative definitions of which types of schemes are eligible to contribute. We would then generate

several separate dose-response plots (ideally generated within a single overall statistical model) indicating, say, the performance of situational action and offender-oriented action separately.

The level of detail to which this differentiation of scores can proceed will have to be set by two conflicting considerations:

i) the greater the differentiation of scores by preventive method, the better 'tuned' the action-outcome linkage is likely to be, and hence the greater the likelihood of establishing a clear dose-response relationship; but

ii) limits to resolution will be imposed by the amount of reliable detail describing each scheme in the SCP's MIS, and the finite number of schemes available in the data set (there is no point in pursuing differentiation so far (eg 'target-hardening by locks' versus 'target-hardening by bolts') that numbers of schemes contributing to each separate action score variant are very small, and therefore likely to be heavily influenced by contextual factors at each location.

In the light of this, we have opted for a **flexible score-definition system** with the ability to generate a range of alternatives according to i) the rationale of the particular modelling strategy adopted and ii) a **read-out** of the numbers of schemes falling within each method-type that are available for the current modelling session. To support this flexibility, it will be necessary to classify preventive methods **hierarchically** so that we can choose to differentiate them broadly (the first branches - eg situational versus offender-oriented) or finely (the twigs - to take an extreme example, reducing target vulnerability by increasing passive resistance through extra bulk, versus increasing passive resistance through being bolted down).

The typology of preventive action that we are currently developing (Ekblom, in preparation) will fit in with these requirements. Essentially it defines crime prevention very broadly, as 'intervention in mechanisms which cause criminal events', and classifies action in terms of three key 'realms':

- the ultimate objectives of the scheme - in terms of what types of crime problem are to be prevented in what situations
- the 'final intermediate objectives' of the method/s the scheme employs - does it seek to change the situation of the event versus the disposition or presence of the offender (together called the 'proximal circumstances' of the criminal event)? Successive differentiation within each of these enables further hierarchical classification. Within the situation, the method can focus on changing the nature or presence of target or victim, the environment or interveners. On the offender side, the method can focus on changing basic disposition to offend (criminality or developmental prevention), changing current motivational state (through changing current life circumstances such as debt or poor housing) or simply through excluding or diverting the offender from the situation.
- the preventive method itself - distinguishing between the method of intervention (by which the causal chain leading originally to the criminal event is interrupted or diverted) and the method of insertion (the process of implementation through which the intervention is eventually brought to bear - such as publicity advocating the fitting of better locks).

Wherever possible the classification has been made hierarchical. It enables a whole range of possible action scores to be differentiated at various levels of detail. To a limited extent the subsequent discussion follows some of the distinctions made by the classification system, for example in treating situational schemes separately from offender-oriented schemes - but in general consideration of the process of 'tuning' the analysis to take account of the characteristics of progressively more specific sets of schemes is for the future.

Geographic shareout of action. There are two aspects of geographic shareout to consider: how the **input** of the action sited in a given location is shared out, obviously; and how the **impact** of the action on crime is distributed, which may be different. The second aspect is covered under geographical dilution, below, because for present purposes we are only interested in the impact of the action in our Zones of Detection.

Shareout of the input of preventive action is capable of a number of realisations. First of all, it should be noted that action such as mass-media crime prevention publicity schemes is not shared out at

all - each recipient individual potentially receives the whole amount. Beyond such special cases, it is possible to consider the base on which the shareout is made, and the role of distance from the centre of action - yielding the possibility of a range of alternative scores. In so doing it is necessary to distinguish between situational and offender-oriented schemes - ultimately linking with ecological perspectives on the causation and prevention of crime such as Felson's (eg 1992) conjunction between likely offender, vulnerable target and absence of capable guardian (or the extension of this used in classifying SCP action - see Ekblom, in preparation).

- For situational schemes focusing on **targets** (such as houses or other property, e.g., cars; or people, in the case of crimes against the person), the shareout base could be individual population, household population, or even car population. These all represent **units at risk of victimisation**. Where the scheme is targeted on subgroups -e.g., an ethnic minority, the young - the relevant sub-population could be used. It may not always be straightforward to measure the number of units at risk, when these cannot be derived from the Census. Other units can be found, though - for example Sherman et al. (1989) used **addresses** in their study of 'hot spots' in one large city.

- For situational schemes focusing on **guardians** (eg the provision or enhancement of surveillance), the relevant population (eg adults, retired adults) could be used.

- For offender-oriented schemes, shareout of input action would obviously depend on the number of potential offenders in the Zone of Influence, among whom the action is to be divided. This could be estimated using 'young males', for example (see Osborn et al. (1992) for a related use of Census variables in explaining area crime rates). A better base, if it were available, might be police records of numbers of offenders residing in the area. Offenders tend to commit their crimes near home (Repetto, 1976); however, neither Census nor police records would be appropriate for assessing shareout of offender-oriented action in affecting city centres.

  Some offender-oriented schemes operate through a 'catchment' process - for example where a youth-club sits at the centre of its Zone of Influence. It seems reasonable to assume that the further away from the club a given potential offender lives, the less likely he is to attend and/or the less often; hence the less the share of the action he will receive. Some sort of **distance-weighting** of offender population may then be necessary. (With situational schemes, in most cases distance-weighting does not apply, because the action is literally located in the situation. But distance could be a factor for example in some situational schemes involving surveillance.)

Geographic dilution. There are two aspects of geographic dilution: i) how that share of the preventive action which is located in the Zone of Overlap exerts its influence within the Zone of Detection as a whole; and ii) how the impact of this influence is to be measured. Again it is necessary to differentiate between situational and offender-oriented schemes, and again, base and distance play a part.

1. How the scheme exerts its influence within the Zone of Detection.

   a) Situational schemes
   With a situational scheme involving say, target-hardening of dwellings, and an outcome measure of household burglary victimisation, then the action-outcome link will be mediated by the impact of the preventive action on the vulnerability of the targets of crime at risk - and hence will depend on the amount of action that each target individually receives. Dilution will depend simply on that part of the total amount of money that is spent in the ZO, multiplied by that proportion of the total number of households in ZD that falls within the ZO. To recast as an equation, generalising households to 'units at risk of victimisation':

   [diluted action score for specific ZD] = [amount of action in ZO] x [number of units at risk in ZO] / [total no of units at risk in ZD]

   Note that the dose of action could either be shared out evenly (every person or unit of property at risk in the ZO gets the same small proportion) or probabilistically (only a few persons etc get the full individual dose of something such as target-hardening of their house, but everyone in the ZO can be said to have an equal probability of receiving that dose).

   b) Offender-oriented schemes
   With offender-oriented schemes, the link between action and outcome is mediated not by

target vulnerability, but by the **exposure** of the target to risk (in the form of presence of potential offenders). If most crime is committed by people living in the local area, then the smaller the proportion of those local offenders residing in a given ZD who have been influenced by the scheme, the smaller the expected effect in that ZD. Dilution should therefore be done on the base of the number of potential offenders in the ZO divided by the total number in the ZD.

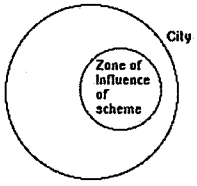
As with shareout, the base could derive from Census data (such as numbers of young males) - but again this would only be able to dilute scores properly in residential areas. With city centres we might able to identify catchment zones for offenders (or 'travel-to-crime' zones) and use their populations. Figures 4 and 5 respectively show sample calculations illustrating scoring for a situational and an offender-oriented scheme.

2. Measurement issues within the Zone of Detection. The outcome measures collected in the SCP evaluation rely ultimately on the perceptions of individuals and their subsequent action in reporting them to the survey interviewer, or to the police. Measurement issues and the 'real effects' of the preventive action on individuals come together particularly in the case of outcome measures in the survey which rely on respondents' perceptions of **collective** crime problems rather than their direct experience of crime as an **individual** victim. For example, responses to a survey item asking about fear of burglary in the neighbourhood should be affected by a (successful) burglary prevention scheme, but the size of effect on the outcome measure will depend not only on the amount of action in the ZD and the proportion of houses in the ZD that are affected by it, but also on how respondents get to hear about burglaries in the neighbourhood (newspapers, friends), and about the scheme itself, and what judgements they make about problem scale.

The implications of this for scoring need to be thought through. One idea might be, with outcome measures that relate to perception of collective crime problems, to try to characterise the degree of **visibility of target** of preventive action - a shopping centre is a very visible target for vandalism, whereas a school might be less so (as far as many of the survey respondents are concerned). Reductions in vandalism or disorder in the shopping centre may directly affect the perceptions of all residents, and there is no sense

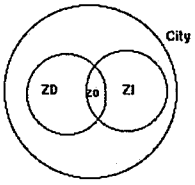
SAFER CITIES EVALUATION Scoring – Situational scheme Figure 4

1. Geographic shareout of action input



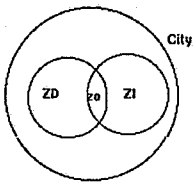
* Scheme type	: Situational – target hardening
* Unit at risk of victimisation	: Household
* Total amount of scheme	: £20,000 in whole ZI
* Shareout base	: 1000 households in whole ZI
* Shareout per unit at risk of victimisation	: £20

2. Geographic overlap between action and measurement



*No. of targets at risk in zone of overlap	: 100 households
*Share of total scheme in zone of overlap	:100 x £20 = £2000

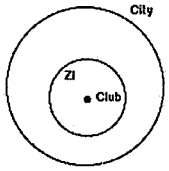
3. Geographic dilution of measurement



*No. of targets at risk in zone of detection	: 500
*No. of targets protected in zone of overlap	: 100
Target dilution factor	: 5:1
*Adjusted action score in zone of detection	: £2000/5 = £400

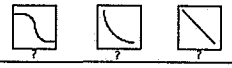
SAFER CITIES EVALUATION Scoring – Offender-oriented scheme Figure 5

1. Geographic shareout of action input

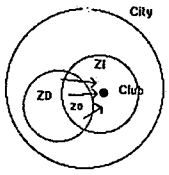


*Scheme type	: Offender-oriented youth-club aimed at reducing motivation to offend
*Unit at risk of offending	: Males aged 13-18
*Total amount of scheme	: £20,000 in whole of Zone of Influence
*Shareout base	: 1000 males aged 13-18 in whole of ZI
*Shareout per unit at risk of offending	: £20
*Distance weighting	: 1 at ED of club site 0 at notional boundary of zone of influence

Form of distance decline:

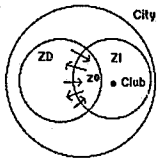


2. Geographic overlap between action and measurement



*Units at risk of offending residing in ZD	: 100 males aged 13-18
*Distance weighting of ZO	: 0.5
*Weighted shareout of action per unit in ZO	: £20 x 0.5 = £10
*Total weighted, shared-out action in ZO	: £10 x 100 = £1000

3. Geographic dilution of measurement



*Units at risk of offending in whole of ZD	: 500 males aged 13-18
*Units treated in ZD	: 100 males aged 13-18
*Offender dilution factor	: 5:1
*Adjusted action score in ZD	: £1000/5 = £200

in which a community of 1,000 residents dilutes the effect more than a community of 5,000. Another circumstance in which dilution may not operate is where the neighbourhood acts like a single perfect **network** with each 'resident-detector' connected up to the whole system, receiving vicarious experience of both individual and collective victimisation.

Time shareout. The basic approach to sharing out action over time is to define the start and the finish of the scheme and to register an equal amount of action in each month of its temporal Zone of Influence. However, time (at the risk of stating a massive truism) holds a number of complications.

It may be necessary to take account of schemes with **gradual implementation** - eg completing a programme of house security upgrades over several months. Instead of merely registering 'absence' or 'presence' of a scheme in a given month, it should be possible to generate a stepped shareout weight in each month between start of implementation and completion of implementation.
There is also evidence that some schemes' impact starts before the official start of the scheme (Ekblom and Pease, in preparation) and strong suspicion that the accuracy of start and finish dates on the MIS may not be exact, so some capacity to **loosen** too-precise time scoping and scoring may have to be incorporated (eg by applying a 3-monthly moving average to the shared-out action score over time, to smooth out a sudden step up from 'nothing' to 'all').

Some schemes take longer to **bite** than others - ie to start having an effect on crime. An example would be a scheme to improve the early education of children. We have coordinators' assessments of time to bite and could filter long-term schemes out of scope, on the principle of only looking for change when and where we would reasonably expect to find it.

Latch-on describes schemes whose influence remains potent after the scheme has been completed (eg target-hardening); **latch-off**, those whose influence stops when the money ceases (eg a summer scheme to keep young people out of trouble). The latch concept may be connected with the difference between capital-funded and revenue-funded schemes (usually involving hardware versus human resources) - but not simply, because for example, a youth club operating only for a short while might have a permanent beneficial effect on the young people attending; and the whole rationale of offender-oriented developmental (or criminality-prevention) schemes is that changes to the course of motivational, intellectual, emotional or moral development made at a tender age (using human/revenue resources) are permanent. In the scoping and scoring process, the temporal Zone of Influence of a latched-on scheme would start at its start date, but would carry on until the final date of outcome measurement.

Finally, even latch-on schemes may undergo a **gradual decline of effectiveness**: many crime prevention methods seem to have only a limited lifespan (Berry and Carter, 1992) - especially, perhaps, those which use the mechanism of deterrence. As with gradual increases, a weight could be applied to fade out the action score over several months.

Time dilution. Time dilution is relatively straightforward and there is nothing much to add to the statement of basic principle, except to note the possible significance of measurement errors in the form of i) the usual problems of recall in surveys; and ii) a kind of psychological inertia effect in which it may take some time for a change in the crime problem 'out there' to be noticed, and further time for this to be converted into a change in judgment of scale of crime problem, reported feelings of fear etc.

Geographical overlap of schemes. The geographical **overlap** of schemes (whether coincidental or part of a deliberate package) has long been identified as a problem for crime prevention evaluation (Ekblom 1990, Forrester et al., 1988) and for the Safer Cities evaluation in particular (Ekblom, 1992). **Summation** across the scores of several schemes falling within the same Zone of Detection can reduce some of the potential confusion of scheme overlap. However, this may not be sufficient in itself because there may well be overlap between schemes of different method types. To sort this issue out would not only further clarify the action-outcome relationship, but would positively enable the exploitation of the opportunity to explore **synergy**. For example, there may be synergy if there is a mix of situational and offender-oriented schemes in the same area - with effects greater than the sum of the parts. The generation of alternative action scores reflecting different preventive methods, together with a facility to combine different types of scores, should support this aspect of the analysis. (This is possible only where, as in the Safer Cities evaluation, the analysis covers large numbers of schemes simultaneously, and hopefully overlapping in different combinations.)

Some such combining of different action scores could simply be achieved in the regression modelling -

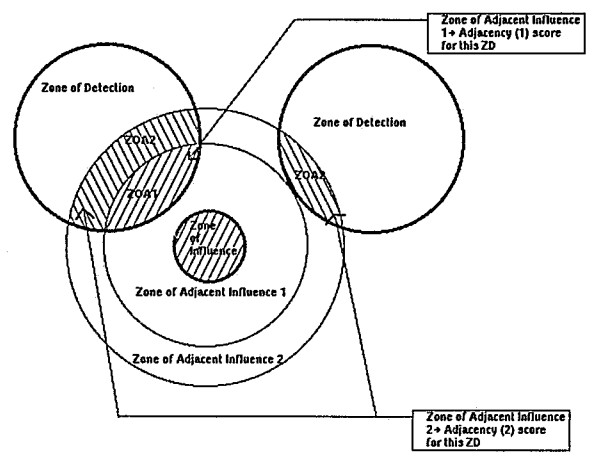
which would enable us to take account of both summation of different action-method scores, and any interaction. Otherwise we might seek to generate **action-mix scores** at the time of scoring. This would be particularly appropriate with the crime data analysis, because the geographic unit of analysis, the beat, is so large that a given mix score could reflect either 2 diverse schemes located at the same site within the beat, or the same 2 schemes located at opposite ends of the beat.

Displacement. **Displacement** of offending takes a number of forms. It can involve crimes being shifted from the site of preventive action to neighbouring areas, as potential offenders react to changes in (perceived) opportunity and risk - **geographic displacement**. Offenders can also shift in time (**temporal displacement**), or shift from one crime target to another (**crime switch**). **Diffusion of benefit** may exist, as suggested before, working in the opposite direction: for example, because offenders may not know exactly where the geographical limits of a preventive scheme are, they may err on the side of caution and give the area a wider berth than necessary, such that a wider area is protected from crime than was originally intended.

This range of possibilities within displacement, and the added uncertainty introduced by diffusion of benefit, makes for particular difficulties. Displacement/diffusion of benefit is both a substantive issue in crime prevention evaluation (making for a hard-to-measure difference between gross impact of a scheme, and impact net of displacement/diffusion of benefit), and a possible confound (for example if crimes are displaced from high-action areas to low-action areas, this would introduce a kind of double-counting, and thus an overestimate of impact). Our models somehow need to take all this into account.

1. Geographical displacement.
   On geographical displacement/diffusion, as briefly described already, we need to generate scores of **adjacent action** for a given specific Zone of Detection, much as we already have scores of intended action. This could simply be done by generating 'Zones of Adjacent Influence' around intended Zones of Influence and using the same scoping and scoring principles. It might even be possible to investigate any shift from diffusion of benefit to displacement, by generating a series of scores based on successive rings of territory around each Zone of Influence. Since displacement works through the effect of preventive action on offenders, it may make sense to start exploring its effects using the population of **offenders** as the base for shareout (in the 'Zone of Adjacent Influence') and dilution. For the immediate SCP evaluation, we will want to do the minimum necessary to take geographic displacement into account, and will have to do so by making some assumptions about how displacement operates; but looking to the longer-term use of the database, this could be a tool for exploring displacement - and testing out different models of how it might work. (For example, a 'hydraulic' theory of fixed amounts of offender motivation might suggest the displacement score varies as the ratio of the **area** of the intended action zone to that of the displacement zone, while an 'incentive' (opportunity) theory might suggest that it varies as a function of **distance**.) Adjacency scoring is illustrated in Figure 6.

SAFER CITIES EVALUATION Geographic displacement Figure 6



A special case to consider is **internal displacement**, where a scheme's ZI, and its geographic displacement zone, are both completely encapsulated within a single ZD - more likely (on size grounds) to be a police beat. Here, the change in the outcome measure would be the **impact net of displacement**. Specific computing arrangements may be necessary to try to take account of this.

2. Non-geographic aspects of displacement.
   There are also, as said, temporal and crime-switch forms of displacement to cope with. Again, we are likely to handle these issues in a very limited way (if at all) for the initial analysis, but would aim to have the database capable of ultimately handling

all permutations and combinations of spatial, temporal and crime-switch displacement.

3. Offender replacement.
   Offender-oriented schemes, which primarily focus on reducing the motivation to offend, are unlikely to suffer from displacement in the same way that situational schemes may. However, they have their own problems of substance and of evaluation. Particularly with those offender-oriented schemes that focus on individuals rather than whole communities, there is an equivalent problem which Ekblom and Pease (in preparation) have called **offender replacement**. It is possible to envisage a process under certain circumstances whereby, as individual offenders are removed from the scene or turn to legitimate behaviour, other offenders in the area are willing and/or able to step up their offending; new recruits emerge from the next cohort of young people; or outsiders move in to take over the empty niches. Whether it is at all possible to model this moderating effect on the impact of offender-oriented schemes at the present minimal state of knowledge is doubtful (unless we can identify some 'ecological truisms' which can be converted into quantitative principles, and until we can make use of small-area offender-residence information).

Conclusions

We have only just begun the development of scoping and scoring and the dose-response approach together with the rest of our proposed realisation of the principle of adjusted expectation. In the short term, we will need to use the approach only in its simplest form to deliver answers to decision-makers considering the future of the Safer Cities Programme. Looking to the longer term there are, though, many unknowns which can only be resolved through exploration of variants of the approach. In this we are fortunate to have what should prove a substantial database of details of action and measures of outcome (and covariates) in the SCP.

The unknowns in question relate to the nature of the linkages between input of action, and measurement of outcome; and error and uncertainty. Linkages on the quantitative side have rarely been considered before, let alone studied - what, for example, is the distance-decay function of the influence of a youth club on potential offenders, in terms of its form and magnitude? How long does it take for a change in the level of disorder in the city centre to be perceived and then to alter people's decisions to visit the centre? On the qualitative side, how far do we have to differentiate between the methods of prevention employed by schemes to be able to isolate regularities of relationships in time and space - how far can we get using just the basic distinction between situational versus offender-oriented? Answering questions like these can only be done with repeated explorations of the database and trying out models with different qualitative and quantitative parameters - almost akin to tuning a radio receiver until the strongest signal comes through (and finding, moreover, that there are many stations transmitting on different frequencies). There are limits to the conclusions that can be drawn from an exercise based on a single set of data - ideally, at the very least, models should be derived from half the data and cross-validated on the other.

Error and uncertainty enter the process of scoping and scoring, and modelling dose-response, at every stage. Apart from the well-known errors and biases in data collection, and the equally well-known limitations of quasi-experimental designs, the present approach has a number of facets of error all of its own, stemming from the use of geographical methods of linking data (eg deriving the population bases in the beats from the Census EDs, when boundaries do not fully match); measurement on an industrial scale, that is not specifically attuned to the peculiarities of individual schemes; the role of stochastic processes in deciding which people, or properties, get how much action within the Zone of Influence, and how survey sampling processes interact with these. This said, however, we should not forget that the main reason for embarking on this whole approach was to **reduce** error in the first place - and the expectation is that we gain much more in the way of a clear, quantitative link between input of action and outcome, than we lose in the way of the uncertainty introduced by the scoping and scoring. And besides, it is fair to say that even the best-designed evaluations of individual preventive schemes are inescapably affected by issues of scoping and scoring - shareout of action in its Zone of Influence, overlap with the Zone of Detection and dilution within it - but seem, so far, largely to have been blind to them, mainly because, as said before, they are so implicit as to be invisible. Attempts to derive a body of **quantitative** 'what works, to what degree for what cost?' knowledge within crime prevention are unlikely to deliver any findings with meaningful numbers attached to them unless scoping and scoring is taken on board - the numerical values will otherwise be determined to a far greater extent

by arbitrary factors of measurement. (If this exercise has done no more than make people aware of such issues then it has still done useful service.)

Looking beyond the unknowns, it will be important to try to highlight connections between the assumptions made in the scoring and scoping process with **theory** - criminological, geographical, ecological or whatever. In some cases the scoping and scoring process can be used not only to draw on and incorporate theory (as assumptions in the model) but deliberately to test it and to put quantitative estimates on influences - for example to look for evidence of diffusion of benefit and how this shades into displacement. Theory will, of course, be far better served if the collection of quantitative action data can be extended beyond monetary input, to include reliable and comprehensive measures of output. It will also benefit from taking account of the influence of contextual factors (eg the demographic composition of small areas) on any dose-response relationships identified. This process can begin within the present exercise: in the statistical modeling of outcome scores, the effects of the action scores on the outcome scores are modeled alongside the effects of a range of contextual variables at the level of the individual (with the survey), the small area and the city.

On the practice side, within some future programme resembling SCP, provided that one day the police are able to implement a crime database that is incident-based and georeferenced (a facility that already exists in some US forces), and provided that there is some ongoing management information system recording the amount, type and location of preventive action implemented, the scoping and scoring approach offers the possibility of on-line monitoring of the performance of preventive action, which could feed into day-to-day management decisions (both local and central) rather than (as at present) into a more or less one-off evaluation exercise. The concept of preventive action could of course be extended to include the preventive functions of conventional policing.

In evaluation itself, scoping and scoring can play several roles. In effect, it could act rather like an extension of the 'power of the test' approach to assessing whether or not a particular evaluation design, for a particular scheme or programme, is worth conducting - ie has a reasonable chance of detecting impact. This has connections with Carter and Berry's (1992) concept of 'pre-evaluation' - estimating in advance of implementation whether the scheme in question has much chance of making a real difference to crime levels. The more the scoping and scoring approach is developed to differentiate between the action-outcome linkages of successively more specific classes of preventive method, the more it almost comes to represent an expert knowledge-base which might be used to guide practitioners in their own evaluations (a desirable but a difficult goal, according to Ekblom and Pease, in preparation). Scoping and scoring might also be useful to support the 'retrospective study of fast changes in local crime figures' currently under consideration by Pease (eg Ekblom and Pease, in preparation). The rationale of this strategy is to try to discover, in the absence of a formal pre-planned evaluation, what caused any significant changes observed - accrediting them to preventive action or even conventional police action where appropriate. Without scoping and scoring and dosage estimation (as said above, action scoring could apply equally to police operations and patrolling coverage as to crime prevention schemes) there would be considerable difficulty in specifying what action, and how much, was associated with the changes.

Altogether, the scoping, scoring and dose-response approach described here has many possibilities to set alongside its many uncertainties - in methodology, theory, practice and evaluation. It may even, who knows, move the strategic planning and evaluation of crime prevention into the econometric field - but that is a long way off.

Notes

1. Obviously there are complex issues of design and inference here, relating to limitations of quasi-experimental designs such as this one - apart from ensuring that likely covariation is taken into account, we also have a particular interest in the **assignment** process - how SC coordinators have chosen to assign schemes to some parts of their city rather than to others.

2. It should be noted that the dose-response analysis is not a panacea. In particular, the 'assignment' issues referred to in footnote 1 become somewhat more complex (an observation for which I am grateful to Wes Skogan). Mark (1983) argues that dosage measurements, while improving statistical power, may simultaneously reduce internal validity and introduce bias if the causes of differential dosage are not identified and taken into consideration. For example in some cases, schemes which show signs of

success may then receive extra funding - the 'dose' then acting as a tautological proxy measure of 'perceived success'; alternatively, 'pet' schemes which do not initially seem to work may then have more funds directed towards them in an effort to get them to succeed - virtually a proxy measure of 'perceived failure'. To put these issues in context, though, the question of 'why do some schemes/areas get a greater dose of funding than others' is only really an extension to the more fundamental questions of 'why do some areas get action and others get none at all?', and 'does area assignment smuggle in some unmeasured covariance?' In other words, this is an aspect of the fundamental limitations of quasi-experimental designs.

3. In some cases, significant changes to beat boundaries meant we had to aggregate several beats together in order to preserve continuity of measurement, sacrificing even more spatial resolution in the process.

4. As a final point on the time scoping of preventive action for the survey analysis, it should be noted that only those schemes that began operation **after the before-survey** can be included within the modelling because any of the relatively small number that began so early that they may have had some effect on the before-survey too will not result in a **difference** between the before and the after outcome measures. Should there turn out to be a larger number of schemes than expected that started this early, then it may prove necessary to generate action scores for the before survey and subtract these from those of the after survey.

5. It is of course important not to confuse the scoring exercise - which aims to clarify the evaluation by adjusting-down the dose and hence the expected effect - with the evaluation itself. This would be a kind of 'begging the question' - supplying the evaluation findings by making up what it is thought should have happened! It is for the modelling exercise, of course, to supply actual, and absolute, estimates of impact, based on the observed relationship between adjusted action scores, outcome measures and covariates.

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by Marcus Felson

Poetic summary of papers

Cusson believes in social control;
His version messieurs est tres tres drole.
The citizen finds he's in a daze,
Controlled and badgered four different ways.

R.V. Clarke has remarkable verve
When going over the normal curve.
We're partly sinner and partly saint;
The rest of it can make you faint.

From Derek Cornish's tongue and lips
Emerge the burglar's roles and scripts.
He studies crime as if each blighter
Is just a slightly misplaced writer.

Homel makes his home in pubs
Where people die for little snubs.
He likes his whiskey with a beer;
His student assistants cringe with fear.

When Ekblom gives a talk on "scoping",
I find myself just barely coping.
He's multi-scheme and multi-sight;
He could be muddled, he could be bright.

The Blocks have preferences for places
Where crime unites the various races;
Where Chicagoans fight and drink and groan,
And could scare the crap out of Al Capone.

With areas, points, and lines and rasters,
LeBeau shoots slides up faster and faster.
That alone can make you nervous;
Don't ask him, please, about calls for service.

R. Titus studies linear logs.
His burglars jump around like frogs.
They may be tough but also queasy;
They break in only when it's easy.

George Rengert often finds he's lost.
He drives around at major cost.
He finds no streets nor routes nor shops;
That's why he asks the local cops.

Kim Rossmo's life is full of thrillers:
He likes to map his serial killers.
He lets them kill, then kill again
Before he sends one to the pen.

K. Painter has unleashed a shower
Of megawatts and candlepower.
She doesn't thwart these fellows rotten,
But helps them see just what they've gotten.

And then there's Bennett, comma, Trevor,
For whom police are the endeavor.
He has the patience of Mahatma Gandhi
For changing their modus operandi.

For Hunter fear is the reality
Where public housing is the malady.
The victims suffer, the criminals fester,
Then interviewers arrive to pester.

M. Felson's chutzpa is certainly ample:
He doesn't worry about the sample,
Or evidence or validations,
Or even minimal citations.

Some 14 talks, examples tangible,
And, on the whole, they're rather man'geable.
A bit of reason, a bit of rhyme,
With Kate around to keep the time.

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