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CRIME CONCENTRATION THEORY

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ABSTRACT

A range of concepts and lexicon of terms denote crime's tendency to concentrate. The most established are repeat offending, repeat and near repeat victimization, geographical hotspots, and hot products. Complementary terms include hot dots, hot places, hot targets, super-targets, risky facilities, risky routes, crime sprees and spates. This study charts the relationships, offers a potentially unifying concept, and examines the causal mechanisms by which crime becomes concentrated. It is concluded that further effort to integrate concepts and explanations relating to concentrations of crime may provide insights useful to theory, policy and practice.

Suggested keywords: crime concentration; repeat victimization; hot products; hotspots; near repeats; event linkage analysis.

Introduction

Crime has a tendency to concentrate in time, space, and other dimensions along which it occurs. A range of concepts and lexicon of terms have evolved to reflect this. The best known are probably repeat offending, repeat and near repeat victimization, crime hotspots, and hot products (Hough and Tilley 1998; Tilley and Laycock 2002), with complementary terms and concepts including hot dots, hot places, hot targets, super-targets, risky facilities, risky routes, crime sprees and spates. This study explores the relationships between them, suggests that the study of crime concentration might benefit from some unification, and offers preliminary steps to that end.

The fact that a few offenders commit a disproportionate amount of crime is a mainstay of criminology and often attributed to Wolfgang, Figlio and Sellin (1972). Largely synonymous terms include recidivist offenders and prolific offenders. The overlap with repeat victimization and the geographical concentration of crime is evident since the offenders are more likely to be

those committing repeats, and such returners are more likely to be prolific (Everson, 2003, Wu et al. 2014).

Repeat victimization is crime against the same target however defined. That can be the same person or place (a household, business or facility), a vehicle, or other target. Crime follows crime such that a small proportion of targets and places experience a vastly disproportionate amount. One study found that 1% of people experience 59% of personal crime including violence, and that 2% of households experience 41% of property crime (Pease, 1998). This accounts for significant amounts of spatial concentration wherein a small percentage of *hotspot* locations account for a significant proportion of all crimes and calls for police service (Sherman, Gartin and Buerger 1989; Andresen and Malleson 2011). The most chronically victimized *supertargets*, typically two or three percent of potential targets and places, account for around half or more of crime. Hotspots may or may not be synonymous with *high crime areas*, depending on geographical scales or units of analysis, both being disproportionately composed of repeats (Farrell et al. 2005). The distribution of crimes within hotspots can vary substantially (Ratcliffe 2004), but more generally the term hotspot has emerged as a relative one: an area has a higher crime rate relative to its neighbours. This reflects the term's application at different spatial levels from global hotspots (Karstedt 2014) down to individual street segments, corners and micro-places (Braga and Clarke 2014), where micro-places are often characterised by repeat and near repeat victimization.

A common feature of retail crime and personal theft is the *hot product* (Clarke 1999). These are typically attractive goods, but that covers a broad range. It includes some motor vehicle models, some portable electronics (smartphones and laptops), and small lower value items with a high value-to-weight ratios that are easily fenced such as razor blades and cosmetics, and some goods that experience scarcity such as some metals (Whiteacre et al. 2015). Locations which repeatedly host crimes - for example if pharmacies suffer more robberies than other stores - have been termed *hot targets* (Velasco and Boba, 2000), and those hosting multiple crimes of the same and different types have been explored as *hot places* (Block and Block, 1994), *crime generators* and *crime attractors* (Kinney et al. 2008; Kurland et al. 2014) and *risky facilities* (Eck and Weisburd, 1995; Eck, Clarke and Guerette, 2007). This can include bars, retail establishments and land use of different types. Some banks are risky facilities with particular chains and branches experiencing many repeat robberies (Matthews et al. 2001), and a few schools are repeatedly victimized (Lindstrom 1997), highlighting the frequent synonymy with repeat victimization.

Crime is common for passengers on some bus routes (Tomson, Partridge and Shepherd 2009). The term 'hot routes' has been used in the urban planning literature to refer to roads with high traffic flow (Li et al. 2007) so perhaps *risky routes* distinguishes those with disproportionate crime. Most crime-related phenomena have a hot or risky subset. *Risky professions* would be a term for those that provide care or services to the public such as nurses, customer services staff and emergency services staff that experience vastly disproportionate crime. Some taxi drivers are unusually likely to be robbed (Smith, 2005), while fire-fighters, police, and paramedics often find themselves in the firing line. Within those professions crime is concentrated on a small percentage of oft victimized staff: one study of police officers found half were assaulted but 3.5 per cent experienced a quarter of the assaults - likely a conservative estimate (Morgan and Clare 2010).

Pease (1998) coined the term *virtual repeats* to refer to victimization of similar targets. While this pioneered the concept, the popular term to emerge seems to be *near repeats* (Morgan 2001), referring to similar crimes a short time and distance away. For example, neighbouring and nearby households are more likely to be victimized after a break-in (Townesley et al. 2003, Johnson et al. 2007a, b), while Ratcliffe and Rengert (2008) found repeat shootings in Philadelphia more likely within a city block and two weeks. Thus repeats and near repeats together offer insight into why crime concentrates spatially and underpin the algorithms of predictive policing (Groff and LaVigne 2001; Chainey et al. 2008; Short et al. 2009; Johnson 2010; Pease and Tseloni 2014). Levy and Tartaro (2010) refer to repeat victimization locations as inclusive of repeats and near repeats, hot dots and hot spots, writing:

“In 1996, repeat locations became known as hot dots (Pease & Laycock, 1996; Townesley, Homel, & Chaseling, 2000). “Hot dots” are locations within a hot spot that are known to have a high incidence of victimization – a repeat victimization location.”

(Levy and Tartaro, 2010; 300)

and

“Repeat victimization locations are defined as any street segment on which more than one auto theft occurred during the study period. In Atlantic City the average length of a city block is approximately 150 ft.”

(Levy and Tartaro, 2010; 304-5).

Related concepts denoting crime’s tendency to concentrate are widely used in the vernacular. A crime *spree* or *spate* usually means more than two similar crimes in a short time period, suggesting they are intense near repeats. Overall though, it is apparent that many of the concepts relating to crime’s tendency to concentrate are empirically related. A characterisation of theft might be that repeat offenders keep stealing hot products from repeat victims at risky facilities.

Most of the concepts discussed so far relate to crime recurring within a short period of time. Yet crime recurs over longer periods. Averdijk (2010) explores the area of victimization over the life-course or ‘victim careers’ (Farrell et al. 2001), identifying a clear need for further research. Similar terminology has been proposed for the criminal careers of places (Sherman 1995) while the life-cycle of frequently stolen products (Wellsmith and Burrell 2005) has been explored as stolen product careers (Mailley et al. 2008). The study of the crime careers of targets and places use the terminology of onset, frequency and duration that are used in criminal career research (Blumstein et al. 1986).

Overall, it is apparent that the study of crime concentration has evolved on a piecemeal basis. The result is a diverse set of sometimes overlapping terms, concepts and evidence, some of which has been described so far. Yet it is also clear that there are common threads running through the field. The bulk of the remainder of this study is concerned with exploring aspects of how conceptual and theoretical integration might be pursued in ways that seek to promote the goal of reducing crime opportunities.

Charting the relationships

This section describes the relationships summarised as Table 1. Following routine activity theory, the columns relate to targets, locations, and offenders. Following crime displacement (e.g. Barr and Pease 1990) and repeat victimization typologies (e.g. Farrell 2005), the rows are spatial unit, time, crime type, and modus operandi. The matrix is intended as a heuristic device to allow different types of crime concentration to be viewed alongside each other in terms of their key characteristics. It is a simplification of reality because in practice many of the cells overlap. It aspires to be a step towards clarification of the relationships and thereby perhaps to conceptual integration.

Table 1: Crime Concentration Matrix

	Target	Location	Offender
Spatial repeat	Same target in same or nearby place. <i>Hot dots</i> .	Near repeat at same/nearby place (not necessarily same offender or crime type). Includes: <i>repeat victimization locations; attractors; generators; hot smudges and hot spots; risky facilities; risky routes</i> .	Same offender reoffending at same/similar place (not necessarily same crime type). Linked to <i>repeat offending</i> .
Temporal repeat	Quick repeat against same target e.g. much domestic violence; <i>risky professions</i> . Longer-term: <i>Victim careers</i> .	Quick repeat at same or nearby place (not necessarily same offender) e.g. looting of a prone store. Longer-term: <i>Criminal careers of places</i> .	Quick repeat by same offender (not necessarily same crime type or place) - a <i>spree</i> or <i>spate</i> . Longer term: <i>Criminal careers</i> .
Crime-type repeat	Same crime-type against same targets e.g. robbery in same location.	The same crime type in the same or similar place e.g. Continued drug dealing in local area.	Same offender commits same crime-type e.g. Identity theft from different persons. Linked to <i>serial offending</i> and <i>offence specialisation</i> .
Tactical repeat	<i>virtual repeat</i> using same tactic (modus operandi) leads to <i>hot products</i> .	Same tactic facilitated by same place e.g. theft and pick-pocket at a street market.	Repeat offending using same <i>modus operandi</i> ; linked to <i>offence specialisation</i> .

In Table 1, the first column identifies crime against the same or similar (including perceived similar) targets. Such crime may be in the same or a nearby place, but not all repeat targets are spatially alike: consider a victim who is robbed, harassed, and assaulted at different places, perhaps on the basis of ethnicity, sexual orientation, ostentatious wealth or perceived vulnerability. The cell in the second row of the first column identifies the role of time, that is, temporal similarity. Many repeats and near repeats occur quickly, particularly when committed by the same offenders. Continuing down the first column, repeats are disproportionately by the same crime type (Reiss 1980). The row for tactic or modus operandi identifies the fact that crime is often repeated using the same method, particular quick repeats of the same crime type by the same offender, as when a burglar re-enters a home through the same rear window.

In reality, crime is often concentrated along more than one dimension. The limiting case here is crime against the same target in the same place shortly after the previous crime, and committed by the same offender using the same tools and tactics. Intimate partner violence is perhaps the

easiest to conceive in these terms. In many instances however, nearness is greater in some dimensions than others. Crimes concentrated upon the same victims and product types but which are not necessarily temporally concentrated have been noted already in the context of the criminal careers of targets.

Just as the definition of target was broad, the second column of Table 1 defines repeats at the same location, at a nearby location or a location with similar characteristics. The term location or place seems to be scaleable: it could cover a region, a country, city, neighbourhood, building, apartment, street corner or intersection, or other precise geographical or virtual coordinate. Consequently, the intersection with spatial repeats (the top cell in the second column) reflects the importance of possible variation in spatial unit. A street or neighbourhood which hosts a cluster of burglaries, or a shopping mall suffering multiple robberies, a street intersection or other micro-place, may be the same location for many crime reduction purposes. Within those locations however there are specific targets where crime is repeated – particular houses, retail outlets, street corners or alleyways. Unit of analysis are fairly widely discussed in this context. Levy and Tartaro highlight the ambiguities and issues:

“Other aspects of the event should be studied to better understand the repeat victimization phenomenon. One such concept is the “unit of analysis” for the initial criminal event. As the unit of analysis changes, the way in which police and researchers view the crime may also change. Using auto theft as an example, if the unit of analysis is the car, and the car is stolen and dismantled, there is no chance of that car being stolen again. However, if the unit of analysis is the location from which the car is stolen, the fate of the first car has little to do with whether another car could be stolen from that lot. In this situation, there is a chance for repeat victimization, another car could be stolen from that lot and the lot would then be victimized twice. Similarly, the location may be repeatedly victimized, but the owner may not be. If the location is a parking lot, many cars can be stolen from the lot, but they may not belong to the same owner. An owner can be yet another type of repeat victim. The owner could have a different car stolen at different points in time, from the same or different locations. Though the same car has not been victimized again, the owner has still been victimized repeatedly.” (Levy and Tartaro, 2010; 301)

It may be necessary to consider other units of analysis. A recommended practice for police seeking to prevent repeat victimization was to use the unit of analysis which worked best to facilitate prevention (Bridgeman and Hobbs 1997), although that may be easier with hindsight.

It is also necessary to consider the composition and nature of exact and near repeats, as these may inform how crime prevention resources are best allocated. Hence Table 1 includes concepts relating to attractors and generators, hot spots and risky facilities. Spatially-defined repeats may also vary in the time to repetition, in the type of crime and the modus operandi, or some combination of these relating to the criminal career of the place.

Column three of Table 1 refers to repeats by the same offenders. Progressing down the column, these may be at the same or a similar location, may recur quickly, and may be the same type of offence committed by the same tactic. The same offender committing further crimes shortly afterwards could result in a *sprees*, which may or may not involve the same crime types and

tactics. However, crimes of the same type may be indicative of offence specialisation. It should be noted that using offender characteristics to identify concentration is only possible after detection. The more usual causal direction involves taking event characteristics to suggest likely offenders.

The matrix provides an overview of a few of the key dimensions of the various forms of concentration, and helps clarify their relationships. Since concentration is a necessary condition of non-random prediction, the matrix may add value by offering insight to assist in the development of preventive responses.

Towards a unifying concept

The concept of near repeats has been discussed so far as referring primarily to *spatial* and *temporal* proximity. However, the concept of nearness can be applied more generally. Spatial proximity is the most easily conceived form of nearness, but a crime may also be a near repeat in terms of any quantifiable characteristic or combination of quantifiable characteristics. For example, hot product theft is a form of near repeat along the dimension of product similarity. A higher rate of robberies at one chain of stores rather than others in the same sector and shopping mall may be near repeats due to its layout, management practices, or other factors rather than solely the fact they carry the same products, as may drive-offs from service stations (La Vigne 1994). Near repeats may be inferred from similarities between types of entertainment facility or location and staffing levels. Thus 'near repeats' is suggested to be an inclusive term. Strictly speaking even an 'exact' repeat (Summers 2010) against the same person or place is really a near repeat - the nearest – but distinct in its timing. In reality exact repeats will likely also differ in some of their minutiae.

In addition to inclusiveness, the term 'near repeat' embodies the *mechanism* by which crime is patterned, namely nearness along at least one dimension. Nearness may vary, and there are degrees of nearness because some crimes are more similar than others, an issue returned to later. However, a broad concept of near repeats includes a range of types of crime concentration where similarity between event, participants and context is central. While it could perhaps be suggested that terms such as 'hot' or 'risky' are equally good as near repeats, unlike the term near repeats these terms do not embody the notion of why repetition occurs. Thus near repeats seems to be a preferable general term because it embodies the notion of similarity and difference between crimes across any dimension or combination of dimensions. This is relevant because it is similarity that binds the forms of crime concentration.¹

Crime Event Linkage and Gauging Similarity

In offender profiling, behavioural linkage analysis (BHA) seeks to determine whether, in the absence of physical evidence, unsolved crimes were committed by the same serial offender. For example, with a burglary where there is no DNA or other evidence, the behavioural characteristics of the crime (e.g. type of property targeted, means of access and egress, type of items stolen, the presence of gratuitous mess) are used to develop a behavioural profile. The characteristics of different crimes can then be compared to determine, within parameters, whether they may plausibly have been committed by the same offender. There are multiple

comparison techniques which use metrics of the goodness of a match between case characteristics. Some crimes are more similar than others. Two of the more prominent measures are Jaccard's similarity coefficient and the taxonomic similarity index. Thus behavioural linkage analysis has been used to determine whether, in the absence of physical evidence, unsolved crimes were committed by the same offender, based on across-crime similarity coefficients (Melnyk et al. 2010; Bouhana et al. 2014).

BHA is predicated on two assumptions (Canter 2004). The first is behavioural stability – the assumption that offenders are reasonably consistent in their offending so that a series of their crimes has common characteristics. The second is behavioural distinctiveness – the notion that each offender's crime series embodies particular characteristics that effectively serve as their behavioural signature.

The application of linkage analysis and similarity coefficients to crime *event* profiling, rather than *offender* profiling, sits well with evolving approaches to crime concentration analysis. Concentrations of crime can be linked by factors other than the offender. They have other similar characteristics and similar underlying causal mechanisms relating to the opportunity structure (the characteristics of frequently stolen products, for example). Crime event linkage analysis is thus predicated on the supposition that similarity across crimes is a key factor underpinning concentration of crime irrespective of the dimensions across which common features are held. The orientation of such analysis should be to inform prevention efforts. That could involve the detection of serial offenders but seems more likely to involve designing-out crime.

Most concepts relating to crime concentration hinge on the similarity between criminal events. This can be gauged via an index of similarity. Consider how crimes differ. One crime is only perfectly identical to itself. Thus 'identical' is the theoretic maximum level of similarity. Two entirely unrelated crimes of, say, different types in different countries and eras, are in effect completely dissimilar (other than that they both involve human behaviour and breach of a criminal code). This theoretically maximum difference defines the theoretically minimum level of similarity. All other criminal events lie on a spectrum somewhere in-between.

Quick repeat burglaries by the same offender against the same household are very similar crimes, as is repeated domestic violence involving the same partners, household and situation. They are sufficiently similar to have been termed 'exact' repeats (Summers 2010), differing only in time of occurrence. Likewise, simultaneous attacks on two computer networks by the same hacker using the same modus operandi differ primarily in the geographical location of the target. Hence they could conceivably be considered exact repeats insofar as they differ primarily in one dimension. Of course, repeats will often differ in other aspects of the minutiae – so repeat violence may result in different injuries, and different goods may be stolen in repeat burglaries - but they are assumed similar for this reductionist exercise.

One step further away is a spatially near repeat burglary of a neighbouring household in the wake of a previous burglary. It differs in two elements – time and target – from the prior burglary, although only by a small amount in each case. Other forms of crime concentration are typically very similar or 'near' in relation to other characteristics.

The crimes of a prolific thief who targets the same type, make and model of products, such as iPhones, using the same modus operandi such as sneak theft, will still typically differ in terms of

time, and perhaps micro-place and victim. Racist attacks against members of the same ethnic group by the same perpetrator have different specific targets. However many targets have similar characteristics whether portability and high resale value or perceived ethnicity. For present purposes the target is the same and they are forms of near repeat victimization. Whereas the near repeat burglary was defined by spatial proximity (which means housing layout and other factors are more likely similar), the near repeat theft or assault is defined by the nearness of interchangeability of the target. That is, as noted earlier, the concept of ‘nearness’ is not confined to the spatial and temporal variables. For present purposes, spatially near repeat burglaries might be considered equally similar as the targeting of hot products which are near repeat thefts. A hot spot has crimes that are similar in spatial terms but perhaps in little else. This means a hot spot warrants closer scrutiny to determine if it is composed of repeat victimization of the same target or victimization of different targets and crime types (Farrell and Sousa 2001). The important point, however, is the following: similarity is the key to prediction and informed crime prevention. The greater the similarity between crimes, the potentially more informed the response, and the greater the preventive scope. The predictability of a repeat crime depends on the type of crime and the context. Hence quick repeats of the same crime type against the same target, by the same offenders using the same tactic, present the greatest potential for crime prevention. Such precise repeats should be easiest to prevent because the maximum amount of information is available. Other forms are derivatives with less similarity or, conversely, a higher index of dissimilarity.

Although the discussion so far has focussed on similarity, the appropriate terminology may prove to be that of *difference*. They are two sides of the same coin but difference might be preferred when metrics are developed because it allows lower values to refer to more similar crimes – that is, it is more appropriate to refer to a *low* difference score. Similar indices exist in various fields including the Hamming distance, and the Sorensen Index and various metrics for DNA fingerprint matches. Critical elements of crime event similarity are the *target*, the *location*, the *time*, the *crime type*, the *modus operandi*, and the *offender*. Measures of the extent of difference *within* each variable may be required. However, a difference index for crime events that is as simple as possible is to be preferred insofar as this would make it more likely to inform crime prevention.

Mechanism-Based Theory

Theories of repeat victimization and hot spots emerged around the same time and from a similar epidemiological tradition. As key areas of crime concentration where some theory exists, if they prove compatible then this may provide a platform for further integration of both theory and crime prevention practice. Hence, while recognising the need for a wider repertoire of variables to be considered, the present study now reverts to these more familiar concepts because their familiarity will facilitate a closer examination of the possibility for integration.

Cohen and Felson, in the pioneering study of routine activity theory, anticipated more recent theories of crime concentration. They noted that:

“[T]he effects of the convergence in time and space of these elements [suitable targets, likely offenders, and the absence of capable guardianship] may be multiplicative rather

than additive. That is, their convergence by a fixed percentage may produce increases in crime rates far greater than that fixed percentage.”

(Cohen and Felson 1979; 604).

There are two main theories of hot spots. These are embodied in the concepts of places that are crime attractors and generators (see Kinney et al. 2008 for a recent statement). Generators are places with high flows of people which yield spatial concentrations of crime, even though one crime may be no more related to another than elsewhere. Attractors are places that gain a reputation for crime and thereby attract likely offenders. The same place can be a generator and an attractor, because a generator is likely to attract would-be offenders due to the rich supply of suitable targets. There is much in common here with Cohen and Felson’s notion of multiplicative interaction effects. Likewise, three reasons for repeat victimization have been identified:

- “1. The same offenders return, perhaps upon recognition of neglected crime opportunities, or the anticipated reinstatement of goods.
2. The first offenders tell others of the house and what it still offers. The others then burgle it.
3. Features of the house are such as to mark it out as a compellingly attractive target to all those tempted to burgle it, leading to repeat victimizations linked only by the seductiveness of the target.”

(Polvi et al. 1991; 414)

The first of these denotes event dependency and has become known as the boost hypothesis, the second might be termed the buddy theory, and the third denotes risk heterogeneity and is known as the flag hypothesis. This led to a model of the relationship between repeat victimization and high crime areas which drew on Cohen and Felson’s notion of multiplicative interactions (Farrell et al. 1996, 2005). The model showed how linear increases in the number of interactions between suitable targets, potential offenders, and conducive environments (the absence of guardianship) produce non-linear increases in crime. As crime increased, the effect on repeat victimization was found to depend upon the specifics of the respective changes. There is similarity between this model and that of the generator at crime places. The second step of the model of repeat victimization and high crime areas added the boost component - victimized targets having a heightened risk of further crime. Since such risk increases with each subsequent crime, a small proportion of targets progress to become chronically victimized supertargets. This offers an account of why repeat victimization occurs disproportionately in high crime areas, as found elsewhere (Trickett et al. 1992; Johnson, Bowers and Hirschfield 1997).

The models briefly examined here offer stepping stones from repeat victimization to hot spots. Some hot spots are defined solely in terms of repeat victimization. Others include multiple targets that may or may not be repeatedly victimized. The mechanism that underlies generators is common to these theoretical perspectives. The interaction-contagion model incorporates increases in the interactions between suitable targets and unguarded environments plus the same offenders returning, in addition to the increase in likely offenders that is the main characteristic of attractors.

This exploratory assessment suggests theories of repeat victimization and hot spots are compatible due to their common origins in routine activity theory. Hence they seem to be integrated to some extent, at least implicitly, though differences in terminology and emphasis mean this is not necessarily obvious. Interaction-generator concepts are common to both. Statistically, these result in a random chance or Poisson distribution of victimization across targets in the absence of a boost or attractor effect. This has been a mainstay of research on repeat victimization since Sparks et al. (1977) and was examined by Sherman et al. (1989) in their study of repeat calls for service that came to define spatial hot spots. Boosts, buddies and attractors offer similar but distinct explanatory mechanisms. Boost denotes increased likelihood of *the same* offenders returning, buddies denotes increased likelihood of criminal *associates* returning, while attractors denote increased likelihood of *other* offenders returning. These three separate mechanisms all fall under the broad category of event dependency.

The overlap between the theories bodes well for integration of theory and concepts relating to crime concentration. This opens the door to the possibility that crime concentration of all types occurs is produced by the same underlying mechanisms. This would mean that a theory of crime concentration would include

- risk heterogeneity effects (flags),
- interaction effects (interaction-generators), and
- three types of event dependency effects (attractors, boosters, and buddies).

If this proves to be the case then these mechanisms could provide the basis for a mechanism-based theory of crime concentration. It would appear to account for changes in the number and interactions of suitable targets, suitable environments, and likely offenders, and thereby for variation in both individual risk and that at different spatial units of analysis.

This section so far appears promising in terms of integrating concepts relating to the spatio-temporal concentration of crime. Whether it might account for other forms of crime concentration is not obvious. Where do concepts such as hot products, risky routes, risky professions, and the careers (of victims, places, stolen products, criminals) fit in? It seems likely that risky routes and risky professions fit well into the mechanisms identified above. Risk heterogeneity between routes or professions, combined with interaction effects and event dependency, appear to explain variation in crime concentration. It seems less obvious that career concepts are a good fit. The notion of crime careers, whether of victims, places, products, or offenders, implies change in concentration of crime over time. For hot products, their careers and concentration at any one point in time depends upon market demand as well as product prices. For repeat targets, particularly victims, risk partly reflects lifestyle factors that may change over time. For places it can reflect factors including management practices and changing flows of persons and transportation. For offenders it can reflect variation in the ascribed and acquired attributes of individuals including physical ability, age, knowledge and experience, and resources. Each of these examples suggests variation in risk heterogeneity over time. Hence a product which is hot at one time is not when the market is saturated and its resale value low. Likewise, the lifestyles of victims or offenders (and the two overlap disproportionately – see Lauritsen and Laub 2007) will change over time, while risk heterogeneity between places can change with management practices, building designs and urban architecture. Transportation routes and flows also change over time as well as within periods of time to produce diurnal and

seasonal variation. Thus there are many variables relating to risk heterogeneity. It is also apparent that further iterations of such conceptual integration may need to consider additional concepts: the more recent crime *radiators* and *absorbers* (Bowers 2014), for example, presents a strong case for inclusion.

The three broad mechanisms of risk heterogeneity, interaction effects, and event dependency, denote three routes, perhaps a tripartite conceptual framework, via which crime prevention might be pursued. If risk heterogeneity is addressed, this would make all products, persons, professions and routes less prone to crime. Yet this is not easy because some elements of risk heterogeneity are fixed or change only slowly. That is, tackling risk heterogeneity and interaction effects are desirable but may sometimes prove difficult. This leaves addressing event dependency effects – whether attractors, boosts, or buddies – as the more viable short-term approach for situational crime prevention and predictive policing efforts. These rely on prediction of where, when, and against which targets crime has occurred and is therefore most likely to repeat, and on doing something to stop that. In the short term at least, it is difficult to change urban form and individuals' predisposition to crime triggers, and may be easier to do something more immediate or, to use Ekblom's (1994) terminology, more proximal, relating to the immediate situation.

Conclusion

A range of concepts and terms have emerged to denote types of crime concentration. They frequently overlap, often extensively, though this is sometimes unacknowledged. The feasibility of their theoretical and conceptual integration requires further study, and the present effort is just a toe in the water. It has explored the possibility for the integration of concepts as near repeats, and integration through investigation of the underlying theoretical causal mechanisms. It seems reasonable to conclude that theoretical and empirical work along these lines is desirable and that it should aim to better inform crime prevention efforts.

Note

1. Defining how concentration is distinguished from non-concentration of crime is avoided here, but a simple definition as a rule of thumb would be two standard deviations from the mean.

REFERENCES

Andresen, M. A. and Malleson, N. (2011) 'Testing the stability of crime patterns: Implications for theory and practice' *Journal of Research in Crime and Delinquency*, 48(1); 58-82.

Averdijk, M. (2010) *Individuals victimization patterns over time*. The Netherlands, Alblasterdam: Haveka.

Bowers, K.J. (2014). 'Risky facilities: Crime radiators or crime absorbers? A comparison of internal and external levels of theft' *Journal of Quantitative Criminology*, 30(3); 389-414.

Barr, R. and Pease, K. (1990) Crime placement, displacement and deflection. In Tonry, M and Morris, N (Eds) *Crime and Justice: A Review of Research*, vol 12 (pp.277-318) Chicago: University of Chicago Press.

Block, R.L. and Block, C.R. (1994) 'Space, place and crime: Hot spot areas and hot places of liquor-related crime' in J. Eck and D. Weisburd (Eds.) *Crime and Place*, volume 4 of *Crime Prevention Studies*. New York: Criminal Justice Press.

Blumstein, A., Cohen, J., Roth, J.A. and Visher, C.A. (1986) (Eds.) *Criminal Careers and "Career Criminals"*. Washington D.C.: National Academy Press.

Bouhana, N., Johnson, S. D., & Porter, M. (2014) Consistency and specificity in burglars who commit prolific residential burglary: Testing the core assumptions underpinning behavioural crime linkage, *Legal and Criminological Psychology*, DOI:10.1111/lcrp.12050 (pp. 1-18).

Braga, A.A. and Clarke, R.V. (2014) 'Explaining high-risk concentrations of crime in the city: Social disorganization, crime opportunities, and important next steps' *Journal of Research in Crime and Delinquency*, 5(4); 480-498.

Bridgeman, C. and Hobbs, L. (1997) *Preventing Repeat Victimization: The Police Officers' Guide*. London: Home Office Police Policy Directorate. At http://www.popcenter.org/problems/domestic_violence/PDFs/Bridgeman&Hobbs_1997.pdf (accessed 12 April 2013).

Canter D.V. (2004) 'Offender profiling and investigative psychology' *Journal of Investigative Psychology and Offender Profiling*, 1(1):1-15.

Chainey, S., Tomson, L. and Uhlig, S. (2008) 'The utility of hotspot mapping for predicting spatial patterns of crime' *Security Journal*, 21(1-2); 4-28.

Cohen, L. and Felson, M. (1979) 'Social change and crime rate trends: A routine activity approach', *American Sociological Review*, 44(4); 588-605.

Clarke, R. V. (1999) *Hot products: Understanding, anticipating and reducing demand for stolen goods*. Police research series paper 112. London: Home Office.

Eck, J.E. and Weisburd, D. (1995) 'Crime places in crime theory' in J.E. Eck and D. Weisburd (Eds.) *Crime and Place*. Monsey, New York: Criminal Justice Press (pp. 1-34).

Eck, J.E., Clarke, R.V. and Guerette, R.T.. (2007) 'Risky facilities: Crime concentration in homogenous sets of establishments and facilities' in G. Farrell, K. J. Bowers, S.D. Johnson and M. Towne (eds.) *Imagination for Crime Prevention: Essays in Honour of Ken Pease*, volume 21 of *Crime Prevention Studies*. New York: Criminal Justice Press.

Ekblom, P. (1994) 'Proximal circumstances: A mechanism-based classification of crime prevention' *Crime Prevention Studies*, 2: 185-232.

Everson, S. (2003) Repeat victimisation and prolific offending: Chance or choice? *International Journal of Police Science and Management*, 5, 180-94.

- Farrell, G. (2005). 'Progress and prospects in the prevention of repeat victimisation' in N. Tilley (Ed.) *The Handbook of Crime Prevention and Community Safety*. Cullompton, Devon: Willan. (pp. 145-172).
- Farrell, G., and W. Sousa. 2001. Repeat victimization and hot spots: the overlap and its implications for crime control and problem-oriented policing' in G. Farrell and K. Pease (Eds.) *Repeat Victimization* (pp.221-240). Monsey, N.Y.: Criminal Justice Press.
- Farrell, G., A.Tseloni, B. Wiersema and K. Pease. 2001. 'Victim Careers and 'Career Victims'' in G. Farrell and K. Pease (Eds.) *Repeat Victimization*. Monsey, NY: Criminal Justice Press. (pp. 241-254).
- Farrell, G., D. Ellingworth and K. Pease. 1996. 'High crime rates, repeat victimization, and routine activities' in T. Bennett (Ed.) *Preventing Crime and Disorder*. Cambridge: Institute of Criminology, (pp.276-296).
- Farrell, G., Clark, K. Ellingworth, D. and Pease, K. (2005) Of targets and supertargets: A routine activity theory of high crime areas. *Internet Journal of Criminology*. (pp.1-25)
- Groff, L. and LaVigne, N. (2001) 'Mapping an opportunity surface of residential burglary' *Journal of Research in Crime and Delinquency*, 38 (3); 257-278.
- Hough, M. and N. Tilley. (1998) *Getting the Grease to the Squeak: Research Lessons for Crime Prevention*. Home Office Crime Detection and Prevention Series Paper 85. London: Home Office.
- Johnson, S.D. (2010) 'A brief history of the analysis of crime concentration' *European Journal of Applied Mathematics*, 21(4/5); 349-370.
- Johnson, S. D., Bernasco, W., Bowers, K., Elffers, H., Ratcliffe, J., Rengert, G. and Townsley, M. (2007a) Space-time patterns of risk: A cross national assessment of residential burglary victimization. *Journal of Quantitative Criminology*, 23(3), 201-19.
- Johnson, S.D., Bowers, K.J.. and Hirschfield, A. (1997) 'New insights into the spatial and temporal distribution of repeat victimisation' *British Journal of Criminology*, 37(2); 224-241.
- Johnson, S. D., Birks, D. J., McLaughlin, L., Bowers, K. J. and Pease, K. (2007b) *Prospective crime mapping in operational context*. London: Home Office.
- Karstedt, S. (2014) 'Global Hotspots of Violence: Intervention and Prevention in the Top 20 Most Violent Countries' paper presented to Conference on Global Violence Reduction 2014. World Health Organisation and University of Cambridge. Cambridge, September 17-19. (at http://www.griffith.edu.au/__data/assets/pdf_file/0018/701316/reduction-of-violence.pdf)
- Kinney, J.B., Brantingham, P.L., Wuschke, K., Kirk, M.G. and Brantingham, P.J. (2008) 'Crime Attractors, Generators and Detractors: Land Use and Urban Crime Opportunities' *Built Environment*, 34(1); 62-74.

- Kurland, J., Johnson, S.D. and Tilley, N. (2014). 'Offences around stadiums: A natural experiment on crime attraction and generation' *Journal of Research in Crime and Delinquency*, 51(1); 5-28.
- La Vigne, N. (1994). 'Gasoline drive-offs: Designing a Less Convenient Environment' in R.V. Clarke (Ed.) *Crime Prevention Studies*, vol. 2. Monsey, NY: Criminal Justice Press.(pp. 91-114)
- Lauritsen, J.L. and Laub, J.H. (2007) 'Understanding the link between victimization and offending: New reflections on an old idea' in M. Hough and M. Maxfield (Eds). *Surveying Crime in the 21st Century*. Monsey, NY: Criminal Justice Press.
- Levy, M.P. and Tartaro, C.. (2010) 'Repeat victimization: A study of auto theft in Atlantic City using the WALLS variables to measure environmental indicators' *Criminal Justice Policy Review*, 21(3); 296-318.
- Li, X. Han, J. Lee, J-G., Gonzalez, H. (2007) Traffic Density-based Discovery of Hot Routes in Road Networks. *Proceedings of the 10th International Symposium on Spatial and Temporal Databases*, Boston, MA, Jul 2007. At <http://www.xiaolei.org/research/pubs/ssstd07.pdf> (accessed 12 April 2013).
- Lindstrom, P. (1997) 'Patterns of school crime: A replication and empirical extension' *British Journal of Criminology*, 37(1); 121-130.
- Mailley, J., Garcia, R., Whitehead, S. and Farrell, G. (2008) 'Phone theft index' *Security Journal*, 21(3), 212-227.
- Melnyk, T., Bennella, C., Gauthiera, D.J. and Gauthier, D. (2010). Another look at across-crime similarity coefficients for use in behavioural linkage analysis: an attempt to replicate Woodhams, Grant and Price (2007), *Psychology, Crime and Law*, 17(4); 359-380.
- Matthews, R., Pease, C. and Pease, K. (2001) 'Repeated bank robbery: Theme and variations' in G. Farrell and K. Pease (Eds) *Repeat Victimization*. Monsey, NY: Criminal Justice Press. (pp. 153-164).
- Morgan, F. (2001) 'Repeat burglary in a Perth suburb: Indicator of short- term or long-term risk?' in G. Farrell and K. Pease (Eds.) *Repeat Victimization*. Monsey, New York: Criminal Justice Press. (pp. 83-118).
- Morgan, F. and Clare, J. (2010) *Survey of Assaults on Police Officers*. Unpublished report. University of Western Australia.
- Pease, K. (1998) *Repeat Victimization: Taking Stock*. London: Police Research Group, Home Office.
- Pease, K. and G. Laycock. (1996). *Revictimization: Reducing the heat on hot victims*. Research in Action. Washington D.C.: National Institute of Justice.
- Pease, K. and A. Tseloni. (2014). *Using Modeling to Predict and Prevent Victimization*. New York: Springer.

- Polvi, N., Looman, T. Humphreys, C. and Pease, K. (1991) 'The time-course of repeat burglary victimisation' *British Journal of Criminology*, 31(4); 411-414.
- Reiss, A.J. (1980) 'Victim proneness in repeat victimization by type of crime' in S.E. Feinberg and A.J. Reiss (Eds.) *Indicators of Crime and Criminal Justice: Quantitative Studies*. Washington D.C.: Bureau of Justice Statistics.
- Ratcliffe, J. H. (2004) 'The hotspot matrix: A framework for the spatio-temporal targeting of crime reduction' *Police Practice and Research*, 5(1); 5-23.
- Ratcliffe, J. H. and Rengert, G. F. (2008) Near repeat patterns in Philadelphia shootings. *Security Journal*, 21(1-2), 58–76.
- Sherman, L.W. (1995). 'Hot spots of crime and criminal careers of places' in J. E. Eck and D. Weisburd (Eds) *Crime and Place*. Monsey, New York: Criminal Justice Press. (pp. 35-52).
- Sherman, L.W., Gartin, P.R. and Buerger, M.E. (1989) 'Hot spots of predatory crime: Routine activities and the criminology of place' *Criminology*, 27(1); 27-55.
- Short, M. B., D'Orsogna, M.R., Brantingham, P.J. and Tita, G.E.. (2009). Measuring and modelling repeat and near repeat burglary effects. *Journal of Quantitative Criminology* 25(3):325–339.
- Smith, M.J. (2005) *The Problem of Robbery of Taxi Drivers*. Problem-Oriented Policing Guide 34. Office of Community-Oriented Policing Service, US Department of Justice: Washington D.C.
- Sparks, R., Genn, H. and Dodd, D. (1977) *Surveying Victims*. Wiley: London.
- Summers, L. (2010) Virtual repeats and near repeats. In *Encyclopedia of victimology and crime prevention*. Edited by B. Fisher and S. Lab, 1043–1047. Los Angeles: SAGE.
- Tilley, N. and G. Laycock. (2002). *Working Out What To Do: Evidence-Based Crime Reduction*. Crime Reduction Research Series Paper 11. London: Home Office.
- Tompson, L and Partridge, H and Shepherd, N (2009) Hot Routes: Developing a New Technique for the Spatial Analysis of Crime. *Crime Mapping: A Journal of Research and Practice*, 1 (1) 77 - 96.
- Townsley, M., Homel, R. and Chaseling, J. (2003) 'Infectious burglaries: A test of the near repeat hypothesis' *British Journal of Criminology*, 43, 615–33.
- Trickett, A., Osborn, D. Seymour, J., and Pease, K. (1992) What is different about high crime areas?' *British Journal of Criminology*, 32(1), 81-90
- Velasco, M and Boba, R. (2000) 'Tactical crime analysis and Geographic Information Systems: Concepts and Examples' *Crime Mapping News*, 2(2); 1-4.
- Wellsmith, M. and Burrell, A. (2005) 'The Influence of Purchase Price and Ownership Levels on Theft Targets: The Example of Domestic Burglary', *British Journal of Criminology*, 45(5): 741 - 764.

Crime Concentration Theory

Whiteacre, K., Teheide, D. and Biggs, B. (2015). 'Metal theft and repeat victimization' *Crime Prevention and Community Safety*, 17(3); 139-155.

Wolfgang, M.E., Figlio, R.M. and Sellin, T. (1972). *Delinquency in a Birth Cohort*. London: Chicago University Press.

Wu, L., Xu, X., Ye, X. and Zhu, X. (2014) 'Repeat and near-repeat burglaries and offender involvement in a large Chinese city' *Cartography and Geographic Information Science*. 42(2): 178–189.

Crime Concentration Theory