
HOT SPOTS AND COLD COMFORT: THE IMPORTANCE OF HAVING A WORKING THERMOMETER

by

Michael Townsley

University of Liverpool

and

Ken Pease

University College, London

***Abstract:** The effective deployment of police resources is heavily dependent on the quality of analysis available. Over the past decade, the term "hot spots" has come to be commonplace in policing, and it is rare to find a police agency that cannot or does not identify spatial clustering of criminal incidents. Equally rare is the consideration of any other type of clustering. The following study highlights the existence of other dimensions that may provide more accurate tactical directives for the deployment of resources ("hot groups") or at least qualify the spatial clustering ("hot times").*

INTRODUCTION

The spatial distribution of crime has been of interest to criminologists for the entire life of the field. While the level of interest has waxed and waned according to the prevailing theoretical perspective, in the last decade both the technological and theoretical advances have made micro-level spatial analyses possible.

One area of intense activity has been the identification of crime "hot spots," i.e., areas of spatial concentration of crime. Their appeal lies in the promise that crime is so prevalent in certain locales that concentrating police resources there will lead to greater impact on crime levels than targeting other areas. If crime is spatially skewed, so, the argument goes, should police attention.

Of somewhat less prominence in the literature has been temporal variation of hot spots (notable exceptions are Ratcliffe [2000] and Rengert [1997]). Understanding temporal variation is self-evidently crucial to policing hot spots, not least in choosing when to apply resources. This paper looks at one aspect of analysing temporal variation, namely the temporal stability of hot spots relative to the point of their designation as such. Some analysis focused on that point is followed by a wider discussion of how temporal issues should or could inform the policing of places consistently or intermittently high in rates of crime.

Allocation of Police Resources To Designated Hot Spots

The context for this article is provided by the authors' work in a Basic Command Unit (BCU) of a British police force. In common with other BCUs in the force area, the practice has been to designate sub-areas as hot spots, and to address the problems thereby highlighted. Our role was to facilitate the development of evidence-led policing as part of day-to-day operations. Members of the command team wished to know how effective actions taken after hot-spot designation were in reducing levels of crime. The most common response was High Visibility Policing (HVP) — deployment of extra patrols in the troubled area. Hence, the issue which they wished to be addressed concerned trends in crime around the point of hot-spot designation.

Data

The set of hot spots examined were identified between May and November 2000. Typically the designated hot spot was a beat, and a type of crime was identified as the problem. Where the area circumscription was more specific (e.g., the Smith Street area) the hot spot was not included in the analysis reported here because of problems in knowing where the Smith Street area ended.

Officers learned about their local hot spots primarily by means of an internal document designed to disseminate information and analyses to BCU staff. During the six month period in question, 62 issues of the internal document were produced. To restate, these set out both current hot spots and the crimes that made them hot.

Recorded crime data for the BCU were extracted and aggregated by week, beat and crime type. The time period spanned March 2000 to January 2001, overlapping the hot-spot range at both ends to allow the scrutiny of pre- and post-hot spot crime levels.

Method

Having identified beats and periods designated as hot spots, the next step was to look at trends in crime before, during and after the point of hot-spot period. While there was no consistent tendency for crimes to fall after hot-spot designation, the variation in numbers of crimes per unit time (some very small), and the number of different patterns, taken together, made it difficult to detect any overall reduction. It was decided to aggregate by crime type. This was done by indexing the first week of hot spot in an area as week zero, and summing the number of relevant crime events in that week, the week before hot-spot designation, and so on, across designated hot spots. The choice was made to separate crime types because hot-spot designation may well have effects which differ according to the crime type addressed.

A period of seven weeks before and seven weeks after the week of hot-spot designation was chosen to depict any trends. Thus, levels of crime were measured for 15 weeks for each hot spot.

RESULTS

The analysis thus yielded three graphs, for autocrime, domestic burglary and violence. In addition, all 42 hot spots were combined to measure overall trends.

Figure 1 shows the trend in crime around the designation of an area as an autocrime hot spot. That is to say, each area designated as an autocrime hotspot has the first week of the designation set to 0, and the number of autocrimes seven, six, five etc., weeks before and after the hot-spot designation plotted. Week 0 reflects different calendar weeks for each of the areas, whose data are aggregated to yield the graph. It will be noted that the decline after hot-spot designation appears to be merely the continuation of a decline that had started some weeks earlier, the bulk of which occurred before hot-spot identification.

Figure 1: Autocrime Trends around Designation of Autocrime Hot Spot (N=20)

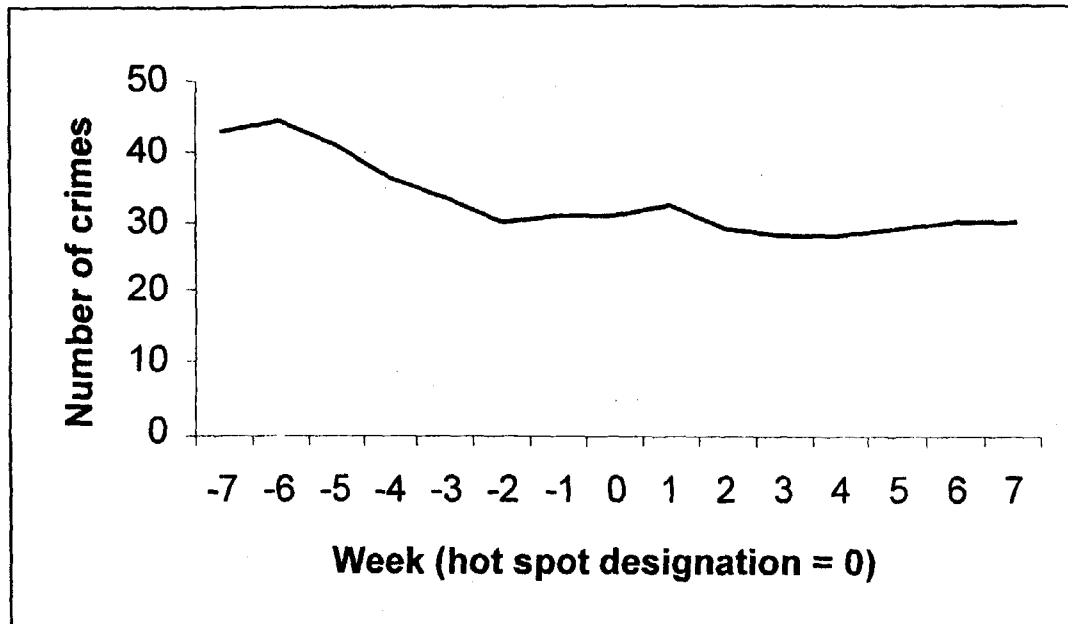


Figure 2 shows the aggregate level of domestic burglary hot spots pre- and post-hot-spot designation. In a similar way to autocrime hot spots, there was a decrease in burglary counts before hot-spot identification. The decrease continued after hot-spot designation, but at a more modest rate. Unlike pre-hot spot patterns for autocrime, domestic burglary started to decline quite close to hot-spot designation.

Figure 3 shows the aggregate level of violence hot spots pre- and post-hot-spot designation. Levels of violence are lower than the preceding crime classifications, and consequently are susceptible to fluctuation to a greater extent. This makes interpretation of pre- and post-hot spot levels less straightforward. Nonetheless, the weeks immediately prior to violence hot-spot designation enjoyed declining crime levels.

Figure 2: Domestic Burglary Trends around Designation of Hot Spot (N=13)

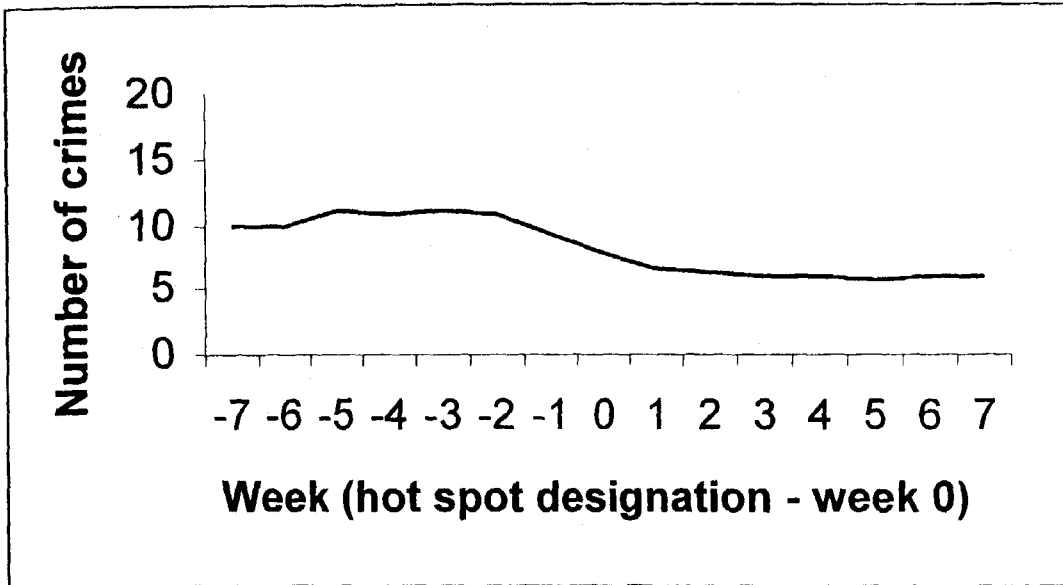


Figure 3: Violent Crime Trends around Designation of a Violence Hot Spot (N=9)

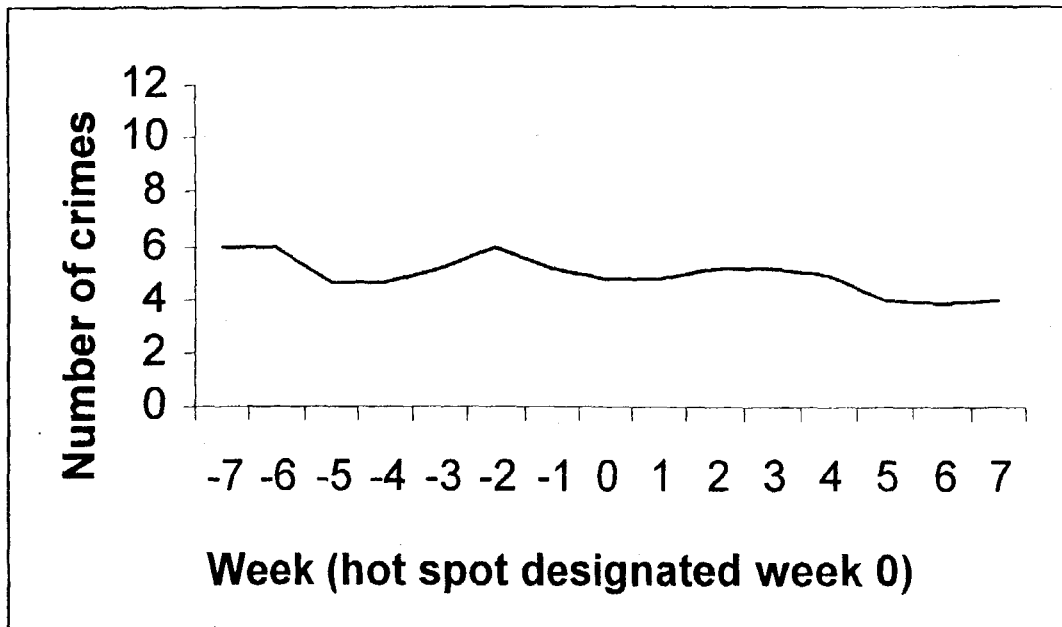
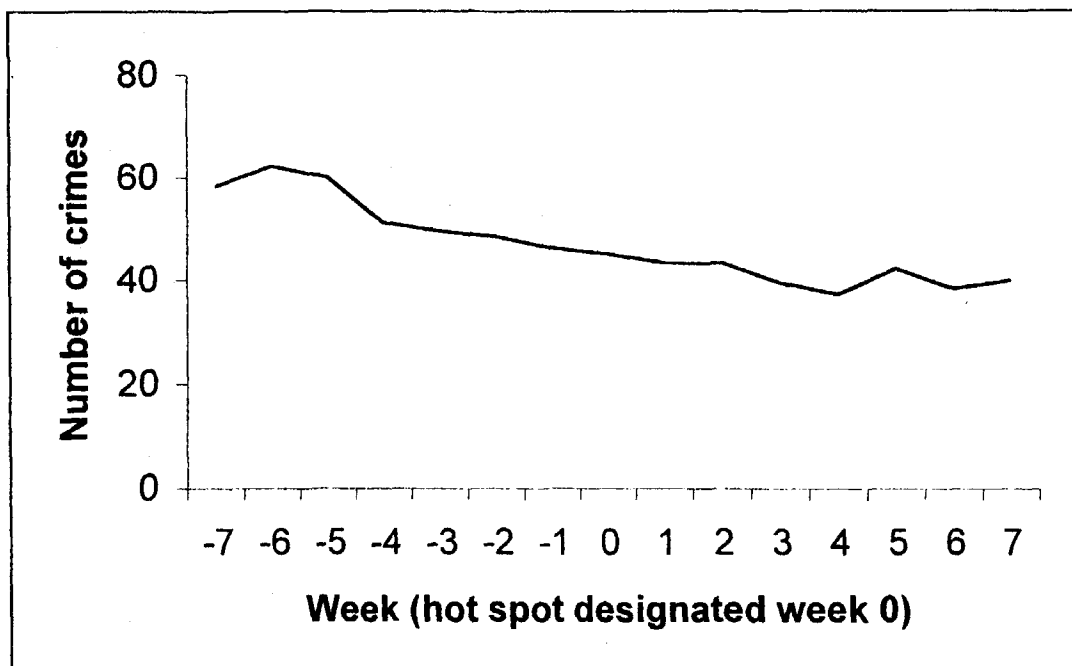


Figure 4 shows the aggregate crime level of all hot spots pre- and post-hot-spot designation. Given the consistent trends for the separate crime types, it is not surprising that similar pre-hot-spot levels were observed. The maximum weekly crime level was observed at six weeks prior to hot-spot identification.

Figure 4: Crime Trends Around Designation of Hot Spot (N=42)



What does this analysis amount to? The conclusions tentatively reached are:

- When the number of crimes involved is low, their rate is volatile. It may be less helpful for police operational purposes to designate hot spots than to describe other kinds of regularities and predictability in crime rates.
- Hot spots, when designated, are on average cooler than they had been a few weeks before. This is possibly a consequence of the phenomenon known as regression to the mean. When something is chosen because of its extremity, it will tend to become less extreme. Alternatively, officers on the streets may

have already identified a cluster of crime, and so the pre-designation decline can be ascribed to good police work.

- There is no indication that designation of a hot spot speeds the decline of crime already in place.

DISCUSSION

Good police work and regression to the mean provide alternative accounts of the pre-designation crime decline that seems common across crime types. Distinguishing between these alternatives is difficult, but could be addressed by finding how well neighbourhood officers know current hot spots in advance of their designation. If they were good at this task, good police work would be the leading explanatory account. If they were not, regression would be favoured.

The Designation of Hot Spots

The exercise reported above led to a renewed consideration of hot-spot designation. There is a fairground game in which figures pop up from holes randomly, the player having to strike the figures with a mallet before they retreat into the hole. This is a good metaphor for the designation and policing of transient hot spots. To anticipate, the work reported above led to a process where areas are selected for special consideration on the basis of their enduring high rates of crime.

There are many different techniques to calculate hot spots, each having strengths and weaknesses over rival methods. It is important to emphasise that no single method has found universal approval.

There are two main ways of designating hot spots: (a) the relative method, hot-spotting places that are high in crime compared to themselves at all times, and (b) the absolute method, hot-spotting places that are high in crime compared to all places at all times. The difference between the relative and absolute methods can be likened to the comparison of winter in Barbados and summer in Alaska. Barbados has a high average temperature. Local minima exceed the majority of local maxima of other areas (absolute method), whereas the latter has a low average temperature such that local maxima (considered Alaskan heat waves), would barely be registered by other areas (relative method).

Before the exercise reported above, hot-spot designation tended to be by the relative method outlined. Discussion in the light of the exercise had the effect of de-emphasising hot spots generally in resource allocation in favour of the SARA (Scanning, Analysis, Re-

sponse and Assessment) process central to problem-oriented policing.

Although the hot spots which comprised the data in the analysis reported above were not entirely systematic in their calculation, the method of analysis which was being developed at the time, and which reflected the current thinking, was as follows. A hot spot is a police beat where the weekly level of a crime type is one standard deviation above the mean for that area calculated over the last 52 weeks. In other words, beats with high crime counts relative to themselves were to be deemed hot spots. In this way, an area will, in any week, have a .165 probability of having a crime level that high, assuming the normal distribution is an appropriate choice in this context. The number of standard deviations can be changed to lower or heighten the threshold at which hot-spot designation takes place. The higher the number of standard deviation units above the mean which triggers hot-spot designation, the more confident we can be that a real problem has been identified, and the fewer spurious hot spots will be designated. In the following table, the number of hot spots identified at different thresholds has been calculated, using the beat as the geographical unit of a hot spot, that would be expected by chance alone.

Table 1: Number of Hot Spot Beats Produced Using Different Thresholds

Hot spot threshold	Expected number of beats identified as hot spots^(a)
Avg + 0.5 standard deviations	15.73
Avg + 0.75 standard deviations	11.56
Avg + 1 standard deviation	8.08
Avg + 2 standard deviations	1.19
Avg + 3 standard deviations	0.09

^(a) Based on an area containing 50 beats

Table 1 demonstrates that changing the threshold for identifying hot spots alters the number of hot spots inversely. We would expect to see about 8 beats every week with a crime count that exceeds average + 1 standard deviation, due purely to random variation. Increase the threshold to two standard deviations, and the number of

hot spots falls to a little over one hot spot (again, due to random variation).

If ten beats (the force norm) were identified exceeding the one standard deviation threshold, about eight would be due to random variation alone.¹ The remainder would be considered actual high-crime areas and therefore hot spots. Identifying the "random" hot spots may be achieved through looking at the recent history of the area or the magnitude of the crime problem. Areas with low crime counts find it comparatively easy to become a hot spot because proportional increases are great compared to absolute increases.

There are a number of problems with this method used to identify hot spots. The principal one is that if random variation is driving the beat's high crime rate, it will diminish of its own accord. Two implications arise from this scenario: a false success rate (crime goes down, but not due to analytical work), and wasted resources (which could have been allocated to areas in legitimate need).

Absolute hot spots — those areas with high crime levels with respect to all areas at all times — are now to be dealt with through a SARA process, the problem-solving model developed by Eck and Spelman (1987) in the well known Newport News project and used by many police agencies around the world. Briefly, it is characterised by a cycle of analysis, intervention and assessment with clear objectives to indicate when the problem is solved. Hot spots that do not respond to the usual High Visibility Policing tactic, or are clearly complex from the outset, will be assigned SARA status.

The primary advantage of the SARA process is that it is not constrained by geography. A geographically defined absolute hot spot may frame the problem to which a SARA may be applied, but place is only one of a range of variables in terms of which a problem may be framed. In short, crime concentration is not purely spatial. Other useful, but rarely mentioned dimensions that display crime concentration include the temporal ("hot times") and the demographic ("hot groups"). Repeat victims are a hot group not necessarily constrained by spatial concentration; there is evidence to suggest that repeat victimisation occurs at higher levels within geographically defined hot spots (Johnson et al., 1997 and Townsley et al., 2000). By focusing on prior victims, reductions in future victimisation may be possible at levels far greater than focussing on hot spots.

Targeting vulnerable groups (young, ethnic minorities, aged) may provide an alternative strategy to the conventional spatial approach. The following table, reproduced from Budd (1999), shows the relative risk of household type for domestic burglary victimisation.

The figures can be multiplied, so that (for example) where head of household is aged 16-24 and is Asian, the burglary risk is 2.71 x

1.77 = 4.79 times the national average. In this way, manageably small high risk groups can be identified. The rationale for doing this is identical to that for identifying hot spots in the first place. If crime risk is skewed, so should police attention be. The mistake made by some is to assume that spatial skewness will be greater than temporal or demographic skewness. Restricting attention to geographically defined hot spots is to neglect people at individually high risk of crime victimisation in areas of low risk, and to unnecessarily support people at low risk in areas of high risk.

Table 2: Risks of Domestic Burglary by Household Type

Household is...	Relative Risk
Head of household 16-24	2.71
One adult living with children	2.00
Head of household is single	1.73
Head of household is separated	1.63
Respondent is Asian	1.77
Head of household is unemployed	1.80
Head of household is economically inactive	1.70
Home is privately rented	1.73
Respondent resident for less than one year	1.75
Home has no security measures	2.71
Home in inner city	1.52
Home in an area with high levels of physical disorder	2.14

Source: Budd (1999).



Address correspondence to: Dr. Michael Townsley, Department of Civic Design, University of Liverpool, P.O. Box 147, Abercrombie Square, Liverpool, UK L69 3BX. E-mail: <mtownsle@liverpool.ac.uk>.

REFERENCES

- Budd, T. (1999). *Burglary of Domestic Dwellings: Findings from the British Crime Survey*. (Home Office Statistical Bulletin 4/99.) London, UK: Home Office Research and Statistics Directorate.
- Eck, J.E. and W. Spelman (1987). *Problem Solving: Problem Oriented Policing in Newport News*. Washington, DC: Police Executive Research Forum.
- Johnson, S.D., K. Bowers and A. Hirschfield (1997). "New Insights in the Spatial and Temporal Distribution of Repeat Victimization." *British Journal of Criminology* 37(2):224-241.
- Ratcliffe, J.H. (2000). "Aoristic Analysis: The Spatial Interpretation of Unspecific Temporal Events." *International Journal of Geographical Information Science* 14(7):669-679.
- Rengert, G. (1997). "Auto Theft in Central Philadelphia." In: R. Homel (ed.), *Policing for Prevention: Reducing Crime, Public Intoxication and Injury*. (Crime Prevention Studies, vol. 7.) Monsey, NY: Criminal Justice Press.
- Townsley, M, R. Homel and J. Chaseling (2000). "Repeat Burglary Victimization: Spatial and Temporal Patterns." *Australian and New Zealand Journal of Criminology* 33(1):37-63.

NOTES

1. Interestingly, this is the reason given for the use of a one standard deviation buffer around the mean, rather than the conventional two. In the words of one police officer, "it gave us about the right number of hot spots that we needed."