GEOGRAPHIC OFFENDER PROFILING

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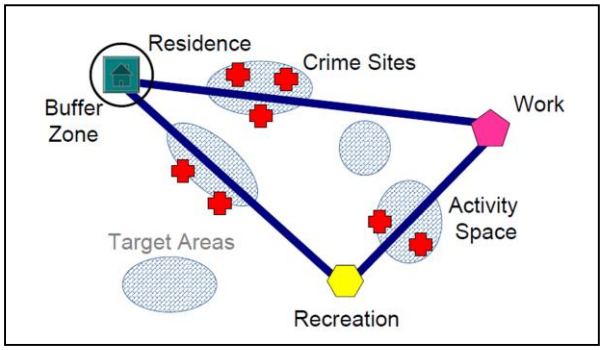

Figure 1: Brantingham's Crime Site Selection

Geographic offender profiling is used to predict offender related parameters using their information about location and timing of offences. There are several ways that Geographic profiling can be used for offender profiling in crime investigation. One of the most frequently used applications of geographic profiling is to predict criminal's most probable place of residence. This is performed with the help of where they are likely to live; what sort of knowledge they have of a particular area; understanding the link between an offend and a location such as why certain places attract more crimes than others; why, even in 'high crime' neighborhoods, some addresses are repeatedly victimized and some are left alone. Therefore, geographic profiling is well suited for serial offences committed in the areas of murder, bombing, arson, rape, child abduction, sexual homicide, credit card fraud, property theft, etc. The results filtered from Geographic profiling can then be used to let police officers protect more vulnerable areas. This method has been first developed by Kim Rossmo as his Ph.D dissertation at Simon Fraser University based on the work of Brantingham, making an assumption that crime locations are not random [1].

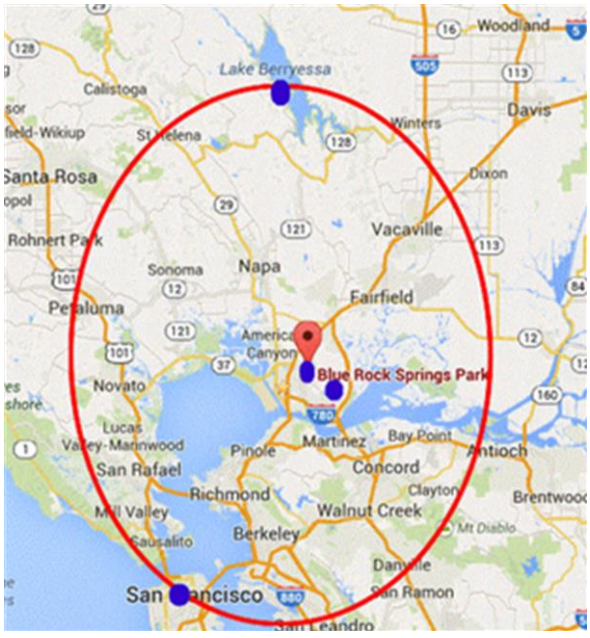

Figure 2: Canter and Larkin model of 'circle theory of environmental range'

Several principles such as "least effort", "routine activity", "distance decay" and "rational choice" have been used in taking the decisions upon geographic profiling. Many criminals have their own territory where they conduct crimes. Most of the time, these criminals tend to stick within the area of which they have most of their power of. This is called the principle of "least effort". It has been observed that the inexperienced offenders move less than the experienced offenders. But in the case of bank robbers and burglars, it is a bit different because they move farther than the other criminals to accomplish their goal. In "routine activity" principle, the victims are connected to some routine activity of suspects. For example, both suspect and the victim might have been travelling in the same bus, or maybe they have been having their meals in the

same restaurant. “Routine activity” in geographic profiling assumes that the criminals plan their crimes during their daily routine. The principle of “distance decay” is related to “least effort” in such a way that the criminals making less effort to move farther from their living area. This may cause crime investigators capturing the criminals less probable when they investigate for criminal residences further away from the scene of crime [1]. “Rational choice” refers to the fact that the humans making their decisions rationally or either in the narrow sense of rational self-interest. The principle of “Rational choice”, in the sense of geographic profiling is applicable towards criminals preferring same areal pattern committing their crimes [2]. Brantingham has proposed a crime site selection model [3] based on these principles as depicted in Fig. 1.

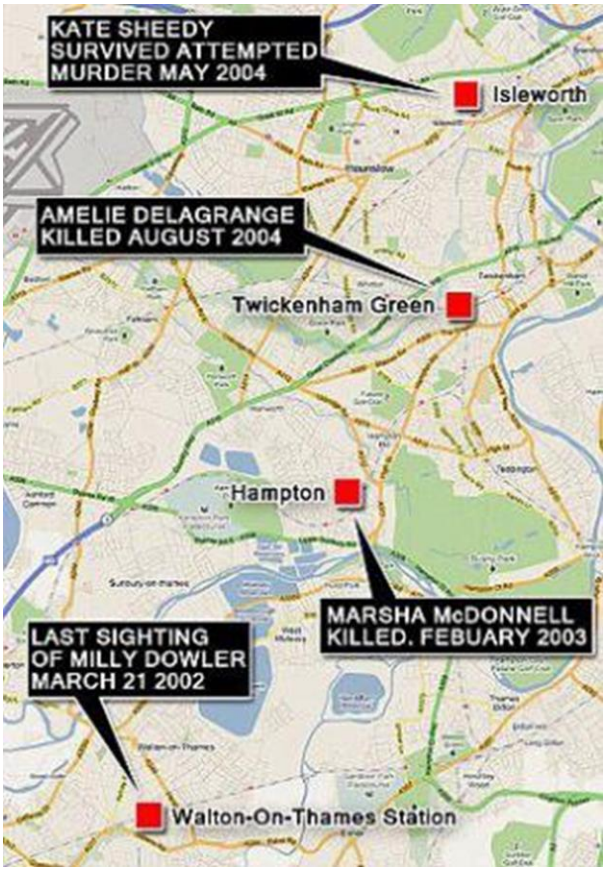

Figure 3: The crime series of Levi Bellfield

Many geographic profiling models have been proposed. Canter and Larkin (1993) have proposed a model called ‘circle theory of environmental range’ based on the principles of geographic profiling. This model suggests a circle to be drawn around the crime scenes. One of the actual situations where this method has been applied to resolve a crime scene is the incident of the Zodiac Killer [4] where the criminal has conducted a series of crimes. Fig. 2 shows how the ‘circle theory of environmental range’ has been used to narrow down the area of the killer’s residence. It can be assumed that the killer’s residence should be lying somewhere within the circle. According to the principle of “least effort” and “distance decay”, we can assume that a killer normally starts his crimes closer to his residence. Since, San Francisco crime was the killer’s last crime; it should have been the farthest from his residence. In further analysis of the investigation process, the investigators have observed that there is a 30 minute delay after the Blue Rock Springs attack. This has made the investigators to assume assuming that he would have lived nearby [4].

Another serial crime scene where it has exhibited “least effort”, “distance decay” is the crime series of Levi Bellfield[5] who was convicted of murdering three young women and trying to kill another which has been depicted in Fig. 3 [5]. Operation of Lynx [6] is another example where geographical profiling has been used in order to predict the criminal’s residence. Fig. 4 shows a probabilistic map of probabilities that the criminals home can lie in. The places with the highest probability have been colored in orange by directing the police as where

to focus their research [6]. Several computer applications have been developed to assist the analysis of geographic profiling. The Criminal Geographic Targeting Model built in to the "Rigel software" [7] includes mathematical models of known offending movement patterns and hunting behavior, journey to crime distances and includes a method to calculate the relationship between sets of crime locations and offender residence [7].Imagine a map with an overlaying grid of pixels. Let $S_{i,j}$ denotes the pixel on i^{th} row and j^{th} column located at the point with coordinates (X_i, Y_j). The following function gives the probability $(P_{i,j})$ of the position of the serial criminal residing within a specific point.

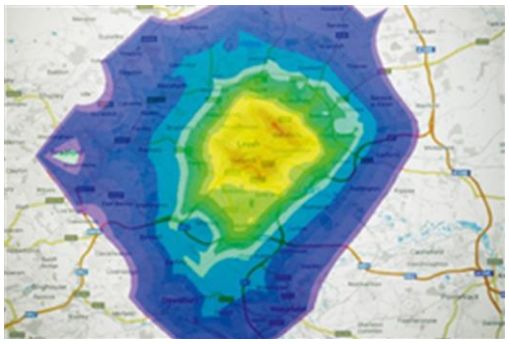

Figure 4: Operation of Lynx

$$P_{i,j} = k \sum_{n=1}^{total\ crimes} \left[\frac{\phi_{ij}}{\left(|X_i - x_n| + |Y_j - y_n|\right)^f} + \frac{(1-\phi_{ij})B^{g-f}}{\left(2B - |X_i - x_n| - |Y_j - y_n|\right)^g} \right]$$

Where $\phi_{ij} = \begin{cases} 1; & (|X_i - x_n| + |Y_j - y_n|) > B \\ 0; & \text{otherwise} \end{cases}$

Here, the summation is over past crimes located at coordinates (x_n, y_n). ϕ_{ij} is a characteristic function that returns 0 when a point (X_i, Y_j) is an element of the buffer zone B which is defined to be the neighborhood of a criminal residence that is swept out by a radius of B from its center. $|X_i - x_n| + |Y_j - y_n|$ is the Manhattan distance between a point (X_i, Y_j) and the nth crime site (x_n, y_n) [8].

Conclusion

Geographic offender profiling is mainly used as a tool in the crime investigation process to either to locate an offender's residence or to use special patterns to profile a particular offender. But the results of the findings can be subjected to contamination due to the cognitive biases of the offenders as they can have multiple spatial patterns of operandi.

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