

Some examples of tactical crime mapping in South Africa

Antony Cooper and Peter Schmitz

icomtek, CSIR, PO Box 395, Pretoria, 0001, South Africa
Email: acooper@csir.co.za, pschmitz@csir.co.za

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1. Background

The Council for Scientific and Industrial Research (CSIR) is one of eight statutory Science Councils in South Africa. Based in Pretoria, the CSIR is the largest scientific and technological research, development and implementation organization in Africa. For several years, the CSIR has been helping the South African Police Service (SAPS) develop its crime mapping and analysis capabilities, and has been providing specialized crime mapping and analysis for detectives working on selected priority cases.

SAPS is responsible for combating crime across the whole of the country (some municipalities are establishing their own crime prevention police forces), and for administrative purposes, is divided up into Provinces, Police Areas and Police Stations. Currently, all case dockets consist of a physical file of hard-copy documents, though SAPS does have several large data bases and analytical tools, and selected data fields are captured from all dockets in all but a few parts of South Africa. Invariably, because of a constraint on resources, many detectives have to carry several dockets simultaneously by themselves, and even large cases tend to have only small teams of detectives working on them.

This paper presents a few examples of tactical crime mapping and analysis done by the CSIR and SAPS. In these cases, the police had already arrested the suspects, and the principle objective of our work was to prepare maps for use in court, to facilitate the understanding by the whole of the court of the proceedings of complex cases. In addition, the mapping process often enhanced the quality of the preparation of the case for presentation in court, detecting errors in case dockets and enabling unsolved case dockets to be linked to a crime series – and even helping to unearth unreported cases.

2. Mapping calls made using cellular telephones

In several cases, we have mapped the usage of cellular telephones before, during and after the commissioning of crimes. For these, the police use a search warrant to obtain from the telephone service providers the billing records for the relevant telephones, the locations of the cellular telephone transmission towers and maps of their areas of coverage (cells – typically, three for each tower, each covering an arc of 120°).

Using digital street network data as the backdrop, we then digitised the locations of the towers and their cells (these were provided on paper maps). As we did not know exactly where the call was made from within each cell, we used the centre of gravity (centroid) for the cell as the location – we have found the accuracy of this to be well within the requirements of the cases. The location of each call made or received was then plotted, together with the time the call was made and a

sequence number: in the case of calls between two cellular telephones, we linked the two locations with a directed line to show from which telephone the call was made.

In the first case shown here, a gang of four men hijacked a couple on Signal Hill in Cape Town. The hijackers then drove around in their car and the victims' car holding the victims hostage, before raping the woman and murdering both. While driving around, they maintained contact by using the victim's cellular telephone to make calls to their own cellular telephone. Unfortunately, when the police arrested the criminals, there was a shoot-out and the two criminals who could be linked to the rape by their DNA were killed, and the other two subsequently denied involvement. However, using the map the prosecutor was able to break their alibi, and they were convicted. It is our understanding that the case might not have been prosecuted without the map.

Figure 1 shows the map that was used in court: it does not reproduce well here because of its size, so Figures 2 and 3 show more detail.

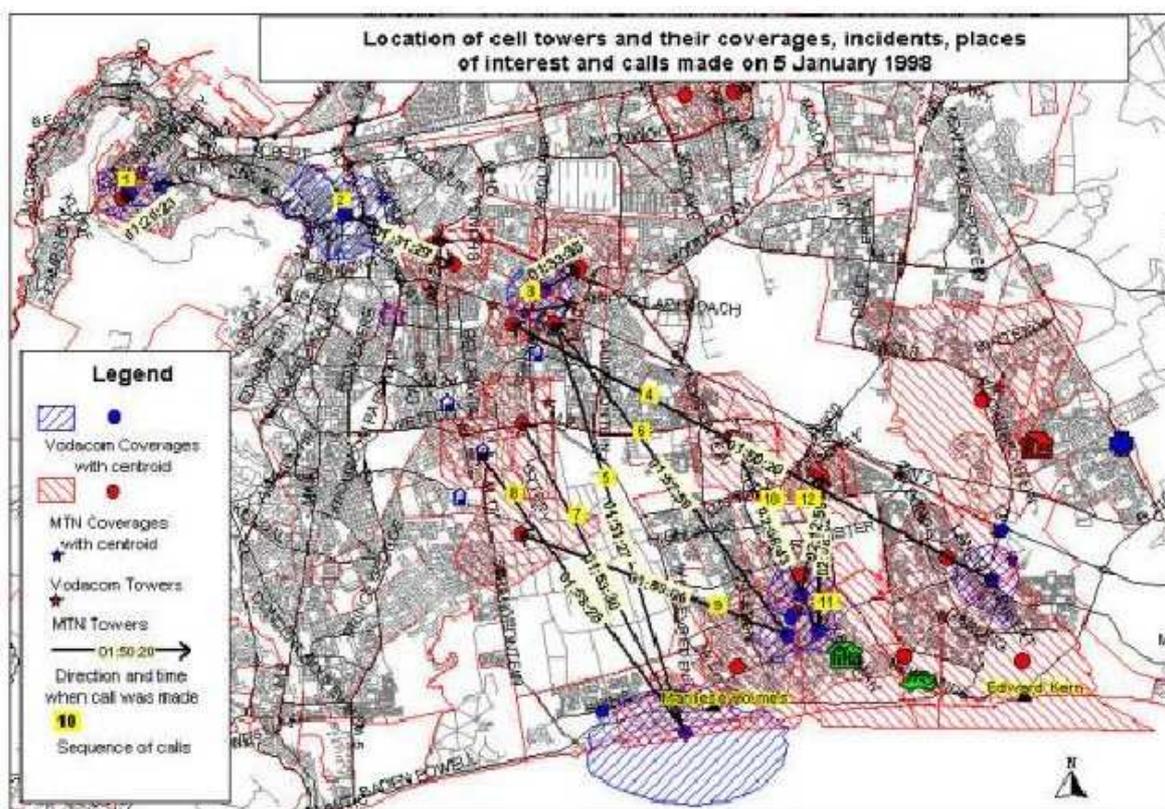


Figure 1 - The map used in court

Figure 2 shows the detail of a specific call: the calls were made from the victim's cellular telephone on the Vodacom network (shown in blue) to the criminal's cellular telephone on the MTN network (shown in red). For each telephone, the relevant tower and cell is shown. The arrow shows that the call was made from the Vodacom telephone to the MTN telephone, and is annotated with the time the call was initiated (01:31:28 in the morning) and its sequence number (this was the second call made in the sequence). In addition to showing several calls, Figure 3 also shows some of the points of relevance to the case that were also mapped, such as where the female victim was murdered and where the burnt-out hijacked car was found (the hijackers had been unable to sell it).

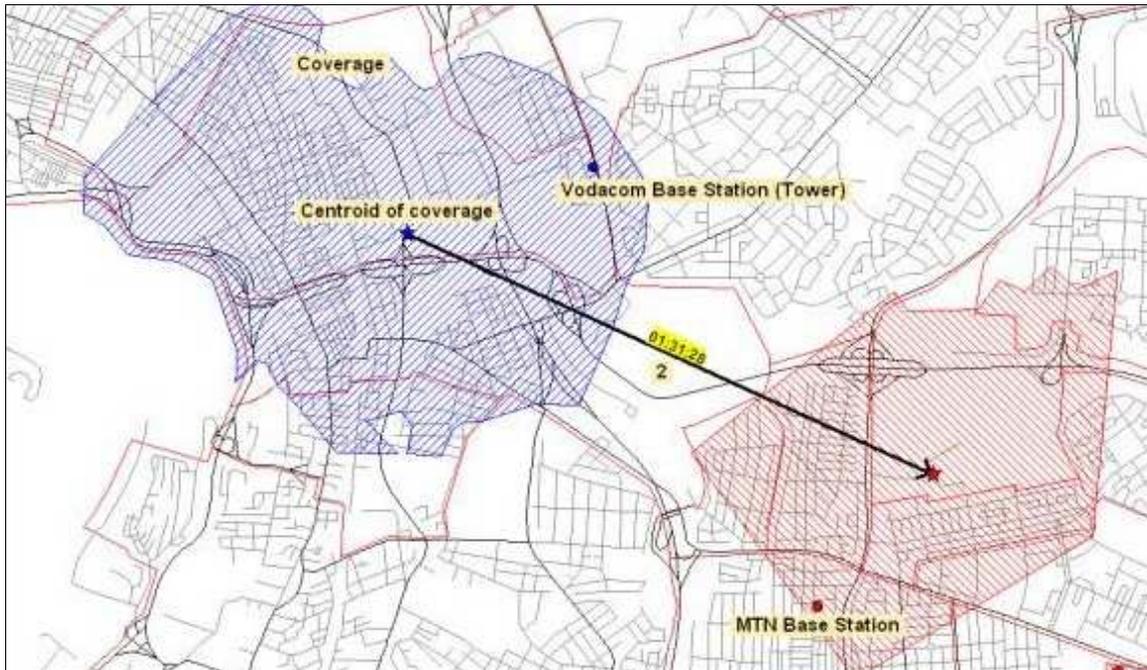


Figure 2 - Details of a call

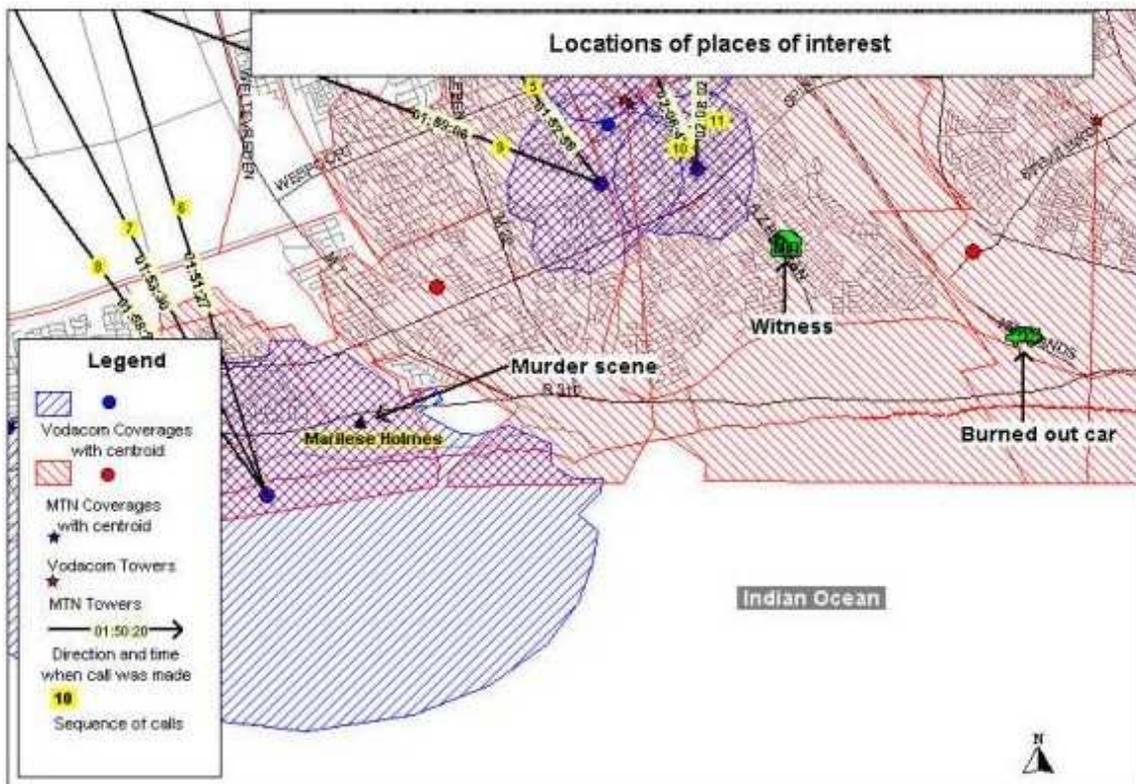


Figure 3 - Other places of interest

In the next case, a gunman shot and killed four gang members in a car at the entrance to the Victoria and Alfred Waterfront in Cape Town. The gunman used his cellular telephone to make calls before and after the attack, but as his calls were made to outside the area, we plotted only his location at the time of the call, and not that of the other party. Figure 4 shows where the calls were made

before the attack, and Figure 5 shows the calls that were made by the gunman as he fled from the scene – showing clearly his route of escape.

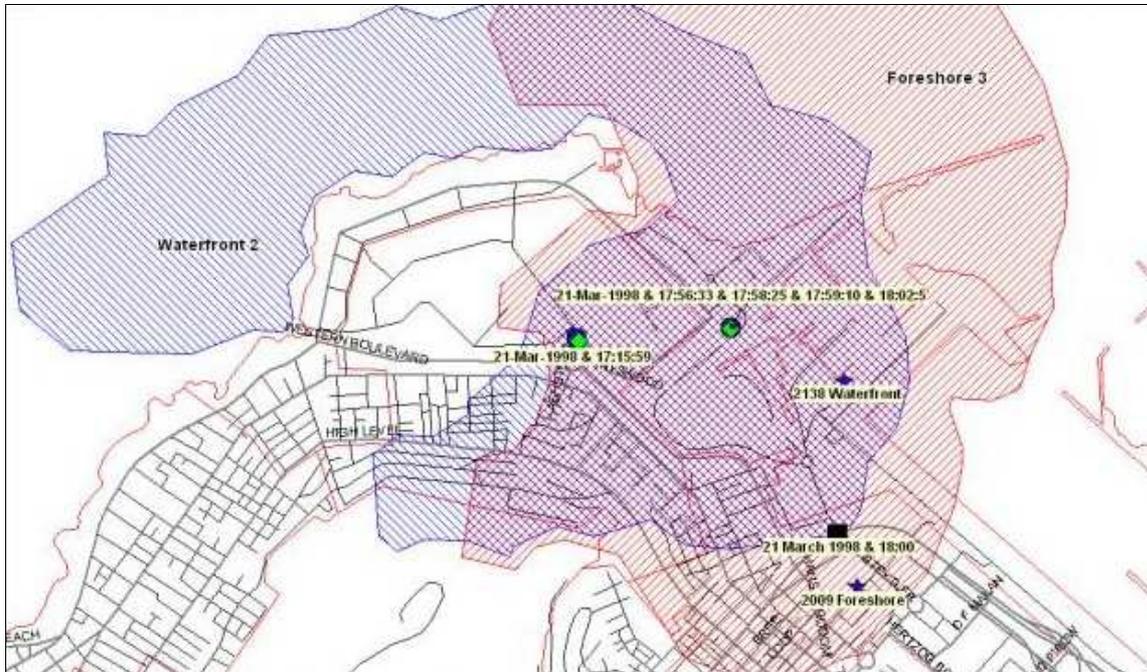


Figure 4 - Calls made from the Waterfront

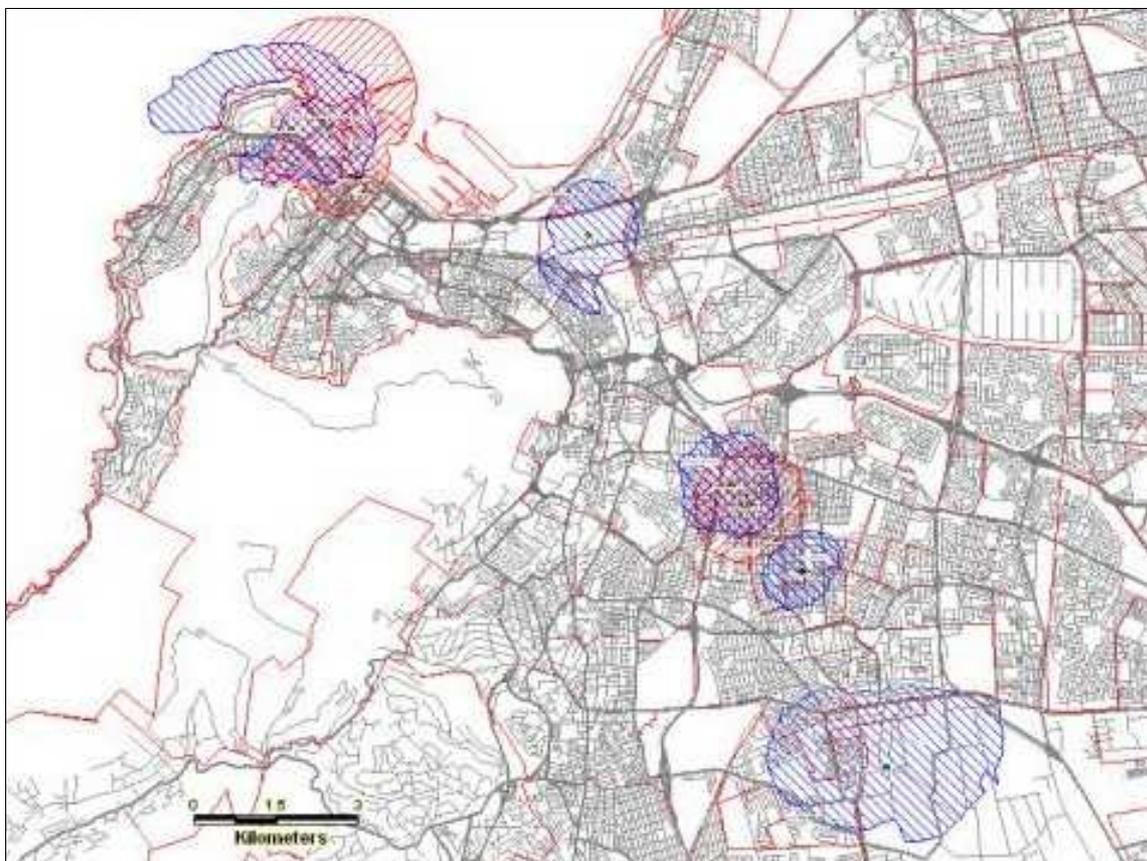


Figure 5 - Calls made in flight from the Waterfront

3. Mapping crime series

The next two examples are of mapping that we have done to help in the preparation of cases involving serial criminals. Unfortunately, serial criminals in South Africa tend to have wide-ranging activity spaces, they tend to be marauders rather than stalkers (resulting in short cooling off periods between successive crimes and a greater frequency of attacks than might be the international norm), and they tend to have multiple *modi operandi*, making it much more difficult to link a series of crimes together.

For the first example, Figure 6 shows the locations of all the incidents linked to the serial killer, illustrating his wide-ranging activity space across Johannesburg. Figure 7 shows the location of the killer's residences, at the centre of his activity space near Wemmerpan.



Figure 6 - A serial killer's activity space

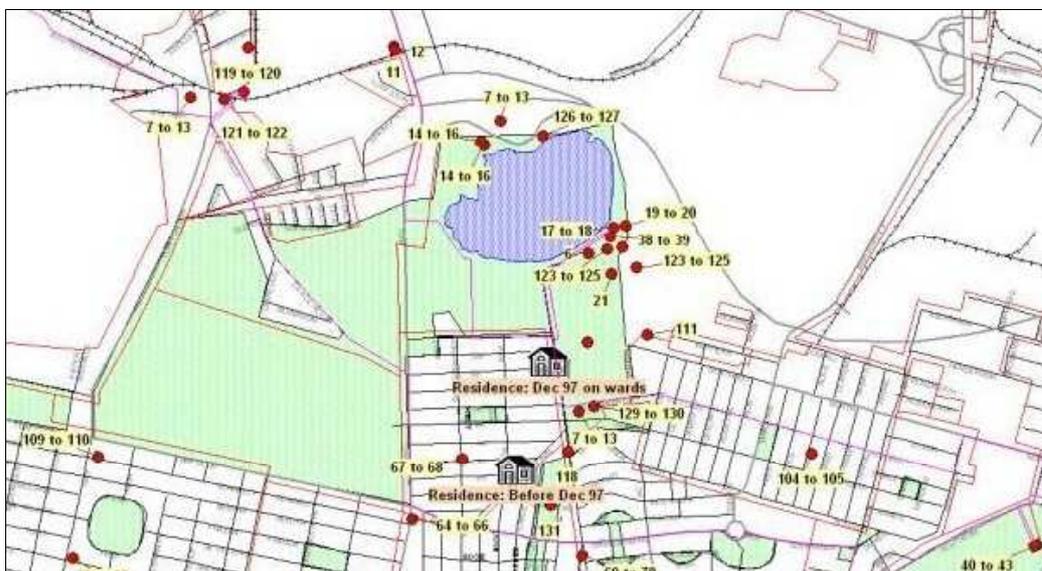


Figure 7 - The killer's homes and crime scenes near Wemmerpan

Figure 8 is a digital aerial photograph showing environmental detail around Wemmerpan, with the locations of some of the incidents indicated by white dots.



Figure 8 - Digital orthophotograph of the Wemmerpan area

Figure 9 shows part of the route taken by the accused with independent officers, when he pointed out some of the scenes of his crimes. Each scene is numbered sequentially along the route taken.



Figure 9 - Route taken and scenes indicated by the accused

The second example also concerns a serial killer who operated in the Johannesburg area, though with a much larger activity space. Figure 10 shows a digital orthophotograph of the centre of

Johannesburg, with a route taken by the accused with independent officers to point out encounter sites, together with three sites where he picked up alleged commercial sex workers.



Figure 10 - Routes taken and points of interest

This serial criminal operated in informal settlements, for which street maps are not readily available – indeed, the structure of these areas can be quite dynamic as the residents make changes. Digital orthophotography is very useful in such areas, as shown in Figure 11, which also shows the many waypoints necessary for the police to find their way around the area to reach indicated scenes, body dumps sites and other points of interest.



Figure 11 - Waypoints in informal settlements

Finally, Figure 12 illustrates the discrepancies between the encounter sites indicated by the accused and the actual body dump sites, which has enabled the police to find errors in dockets and to link additional cases to the series.

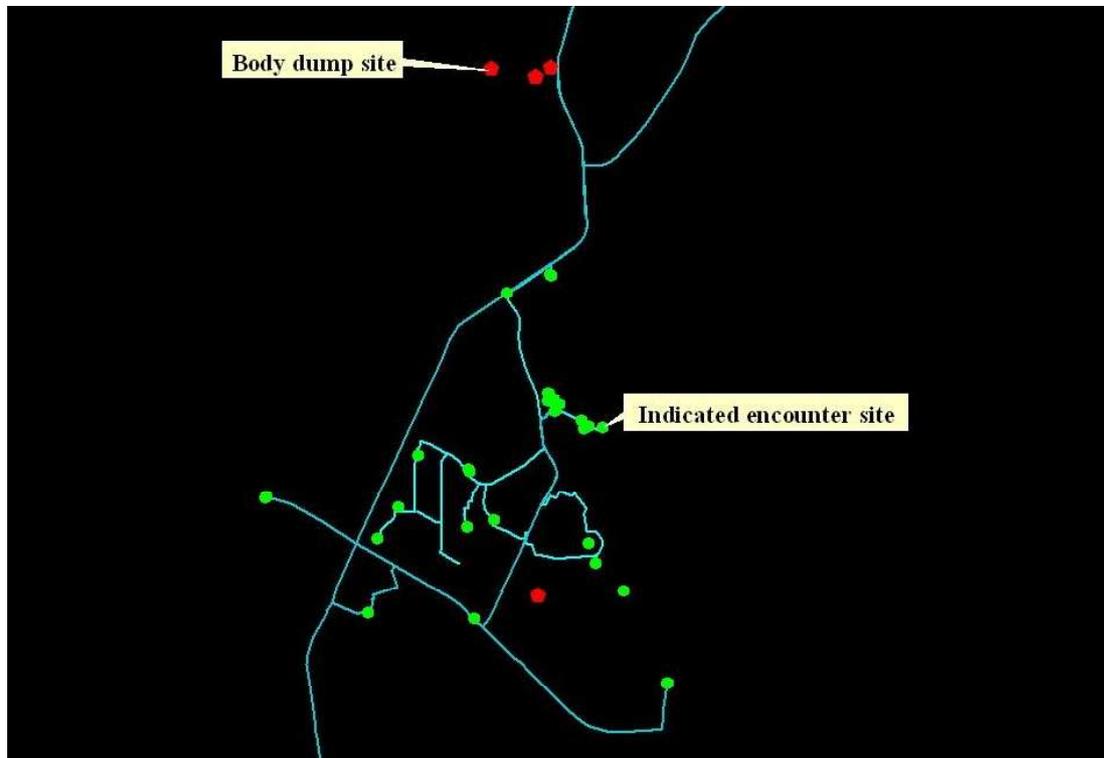


Figure 12 - Discrepancies between indicated sites and body dump sites

4. Conclusions

In this paper, we have presented a few examples of tactical crime mapping and analysis done by the CSIR and SAPS in South Africa. We believe that these maps have made a significant contribution in helping the courts understand the proceedings of complex cases and have helped to improve the quality of the cases being presented. We also believe that in some cases, they have made a significant contribution to securing the conviction of dangerous criminals.

5. Acknowledgements

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6. References

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