

Breaking Alibis Through Cell Phone Mapping

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BACKGROUND

In February 1998, at approximately 7:50 P.M., a couple was hijacked outside their home when they returned after a day spent visiting family. The four attackers waited at the couple's house in their own vehicle. When the couple arrived, two of the attackers forced their way into the couple's car at gunpoint and made the couple drive away. The other two attackers left shortly thereafter in their own vehicle. The couple was taken to a desolate area, shot and killed. Their stolen vehicle was delivered to a person who had previously "ordered" such a make and model of vehicle.

Two days later, the same attackers executed a second hijacking, using their own vehicle to follow a man and his son before hijacking them. These victims were relatively fortunate: They were taken to a remote area and tied to a tree, but their lives were spared. During that same night, just after midnight, the attackers hijacked a couple visiting Signal Hill near Cape Town, South Africa. The couple was held hostage while the gang traveled around in their car and the couple's car; the couple was later murdered execution-style. Evidence showed the woman was also raped prior to being shot.

Two of the suspects (whom DNA analysis later proved had raped the woman) were killed in a shootout with police while attempting to evade arrest. The investigating officer learned that the woman's cell phone was missing and obtained the number from her family. To trace her phone, he obtained a warrant for its detail billing. The cell phone records revealed that a particular number had been called on 12 occasions at approximately the time she was last seen alive. The owner of that number was traced, and those cell phone records confirmed that the phone had received the 12 calls. The receiving phone's owner stated to police that he had lent the

phone to his brother-in-law, one of the suspects who was shot and killed in the shootout with the police. Further investigation revealed that the attackers used both cellular telephones and were in constant contact with each other from the time of the hijacking until shortly after the murders, lasting about 52 minutes and ranging over 50 kilometers.

During the first hijacking, one of the accused allegedly made a phone call from a public telephone to the cell phone of a co-accomplice who was driving the hijacked vehicle. During the third hijacking, the accused robbed the victims of their cell phone and, while driving away in the hijacked car, called their co-accomplices, who were following in another car. Police subsequently obtained a warrant to acquire the call logs of the two cellular telephones and the locations of the base stations and their respective coverage areas.

Seeking assistance in the prosecution of the hijackers, the state advocate from the Office of the Director of Public Prosecutions (Cape of Good Hope, Department of Justice) requested the investigator to produce maps depicting the defendants' cell phone usage. The maps were produced by a GIS expert at the Council for Scientific and Industrial Research (CSIR), a research organization based in Pretoria, South Africa.

ANALYSIS

Using MapInfo Professional Version 4.5, analysts mapped the locations of the cell phones when defendants called each other during the hijacking incidents. Analysts also mapped the base stations, their coverage areas, the centroids of the coverage areas and other locations of importance to the case, such as where the suspects and witnesses lived, where the bodies were found and where the hijacked vehicle was recovered. The final product was a roughly 3-foot-by-4-foot map of the area (see Figure 1).

Using data supplied by the cell phone service providers, analysts plotted the calls on the map. Arrows linked the centroids of coverage areas where the cell phones were located during the calls. The arrows also showed from which coverage area the call was made. The arrows were numbered sequentially to show the sequence of the calls and annotated with the time the call was initiated (see Figure 2). The locations of the suspects, witnesses and crime scenes were captured using heads-up digitizing, with the investigating officer indicating the locations on-screen (see Figure 3). The original map served as a prosecutorial exhibit. Copies were also provided before the original was submitted as evidence (one each for the judge, the two assessors, the prosecution, the defense and the investigating officer).

Figure 1
Location of Cell Towers and Their Coverages, Incidents, Places of Interest and Calls Made
on 5 January 1998



ABOUT THE AUTHORS

Peter Schmitz is a GIS specialist in CSIR's Division of Information and Communications Technology (also known as MIKOMTEK) in Pretoria. His main activities include crime mapping and analysis, mapping potential areas for growing essential oil plants in South Africa and providing clutter data for cellular telephone coverage planning. Schmitz holds bachelor's degrees in Geography and Mathematics from Rand Afrikaans University and a master's in Geography from the University of Durban-Westville. He is pursuing doctoral research on essential oil plants and is a member of the executive committee of the Association for Geographic Information of Southern Africa.

Antony Cooper is a GIS consultant for MIKOMTEK. Recently, he has been involved in projects related to crime mapping and analysis, standards for GIS and mapping the distribution of fatal and nonfatal nonnatural injuries. He has bachelor's degrees in Information Processing and Computer Science from Rhodes University, a Management Development Programme (Marketing Management) from UNISA and a master's degree in Computer Science from the University of Pretoria. Cooper has represented South Africa on two Commissions of the International Cartographic Association (ICI), co-chairs an ICA Working Group and is active in ISO/TC 211 Geographic Information/Geomatics. Effective April 2000, Cooper will become one of the first two Divisional Fellows in MIKOMTEK.

Andrew Davidson has been with the South Africa Police Service since 1981, serving as a detective inspector at the Peninsula Murder and Robbery Unit since 1992. His investigations include murder, armed robberies and serial murder cases.

Kevin Rossouw joined the Department of Justice in May 1981. He holds bachelor's and master's degrees in law from the University of Stellenbosch and was authorized to practice as an advocate of the High Court of South Africa in November 1986. Rossouw was appointed a prosecutor to the Regional Court of Cape Town in August 1987 and was later appointed Regional Court Control Prosecutor of Cape Town. In March 1989, he was appointed a State Advocate to the Office of the Director of Public Prosecutions of the division of the Cape of Good Hope in Cape Town and has been a Senior State Advocate in that office since 1991.

