

CSIR expertise clinches judgement in murder case

USING TIME AND SPACE MAPPING AS A FORENSIC TOOL

THE CRIMINAL JUSTICE SYSTEM called on the CSIR's expertise in the state's case against the suspected killer of Taliep Petersen, a famous South African musician and playwright who was murdered in his home in December 2006.

Petersen was tied up and killed by a single shot to the head, but the firearm used was never found by the detectives, and they could not determine from the suspects who had fired the fatal shot. The leading detective and state prosecutor in the Petersen case then contacted the CSIR for assistance. "I had been involved in presenting evidence in previous court cases, so I realised that I had to present the scientific evidence in a way easily understood by the court," says the CSIR's Dr Peter Schmitz.

On passing judgement two years later in the High Court, Judge Siraj Desai (Desai, 2008:184, Paragraph 378) said: "The cell phone records afford compelling corroboration of the state's case. It supports the evidence of Hendricks in several material respects. Its impact emerges graphically from the evidence of Peter Schmitz, a very competent witness whose evidence was not seriously challenged."

"I started analysing and mapping the movement and communication between the state witness and the suspects, using cell phone records," recalls Schmitz. The aim was to use mapped time and space information independently to corroborate the evidence given by the state witness regarding the events leading up to the murder.

"The data I obtained from the cell phone records showed the date and time calls were

made and received; the specific cell phone towers and phones involved; as well as the duration of calls. I used the coordinates of the towers – known as 'base stations' – as geographic reference points to establish and map communication between the suspects and the state witness."

When creating maps for court purposes, the only geographical reference available is the cell and base station used. This is indicated in cell phone records by the base station name followed by a number.

Using the sequence of the calls and the geographic location of the base stations used, Schmitz thus mapped time and space communication and movement of the suspects chronologically. These maps contributed greatly to the guilty verdict, with the suspects subsequently receiving prison sentences from seven to 28 years.

Schmitz worked closely with Advocate Shareen Riley of the National Prosecuting Authority and Detective Superintendent Joe Dryden of the SAPS. The time period chosen for analysis indicated the build up to and aftermath of the murder in terms of communication between the suspects and the state witness. Communication clearly intensified leading up to the murder, with very little communication between them after the murder had been committed.

Schmitz mapped each day separately and indicated each communication by a line that connected the base stations involved during the calls. Each line was also identified with a unique sequence number that could be linked to an accompanying table to determine the

time of the call and who communicated with whom. The line of communication was colour-coded for ease of reference.

"For my final presentation to court, I used a 'story board', guiding the court through the sequence of events. The time line was presented first, followed by the aerial photograph of the location and the rooms from which the various cell calls were made, and I concluded with the tables, maps and the space-time graph," explains Schmitz.

CSIR experts first used the mapping of cell phone conversations as forensic tools in the late 90s in the notorious New Year's Gang case that involved the hijacking of cars, kidnapping, hostages and murder. Subsequent successes in the use of space and time mapping of movement and conversations of suspects included a shooting incident at Cape Town's Waterfront and the hijacking of trucks carrying cigarettes.

Schmitz continues with research for forensic collaboration with the SAPS and prosecutors. At the CSIR, he also focuses on geostatistics to interpolate data between sample points that are irregularly spaced over very large distances and determining the optimal location of facilities based on accessibility analysis. He is involved with military and sugar industry supply chains as well as using data logistics to improve the spatial data production of GIS units to support disaster relief and humanitarian aid.

– Hilda van Rooyen

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Above left: The communication between and movement of the suspects and state witness on the day of the murder

Centre: The directions from the crime scene to the nearest cell towers (Image from Google Earth, 2008)

Right: Space-time graphs of the accused and state witness on the day of the crime and the subsequent day. These include the space-time graph of each of the accused and the state witness to indicate the movement before and after the murder was committed

“The cell phone records afford compelling corroboration of the state’s case.” – Judge Siraj Desai

Dr Peter Schmitz at the ‘CSIR cell tower’, as this cell phone base station is known

Modelling and analysis strengthen crime prevention and justice system

BY THEO STYLIANIDES

IN ADDITION TO WORKING CLOSELY with the South African Police Service (SAPS) on a number of crime analysis and mapping initiatives, CSIR researchers in logistics and quantitative methods assist other government bodies in the justice cluster to forecast resources requirements. They also provide decision support for improved service delivery in the administration of justice. Some of the CSIR's contributions over a number of years are outlined briefly in this article.

South Africa's undesirable crime statistics have been highlighted in numerous fora. For effective performance, safety and security-related organisations from the public and private sectors depend increasingly on accurate and timely information.

The CSIR has a proven track record in the application of mathematical modelling and analysis in the crime prevention and detection arena. In many cases, the CSIR has provided crucial assistance to safety and security organisations. Researchers achieve this through analysing and interpreting data and information; formulating mathematical models; and proposing

ways to improve performance, optimise results and guide decisions.

Crime analysis and prevention

CSIR research resulted in a milestone being reached within the SAPS when crime analysis and mapping were introduced for the first time and piloted successfully in selected offices.

The CSIR developed analytical methods and decision support tools and transferred skills in geographic information systems and crime mapping. This large project was coordinated by the CSIR, with input from the Human Sciences Research Council, the Medical Research Council and Delft University in the Netherlands.

Recognised as being among world-leading initiatives in this area, the research helped crime prevention officers gain a better understanding of crime in their areas of jurisdiction, improve data accuracy and reduce crime in certain cases.

Another facet of the project involved the CSIR's use of geographic profiling and crime mapping in several court

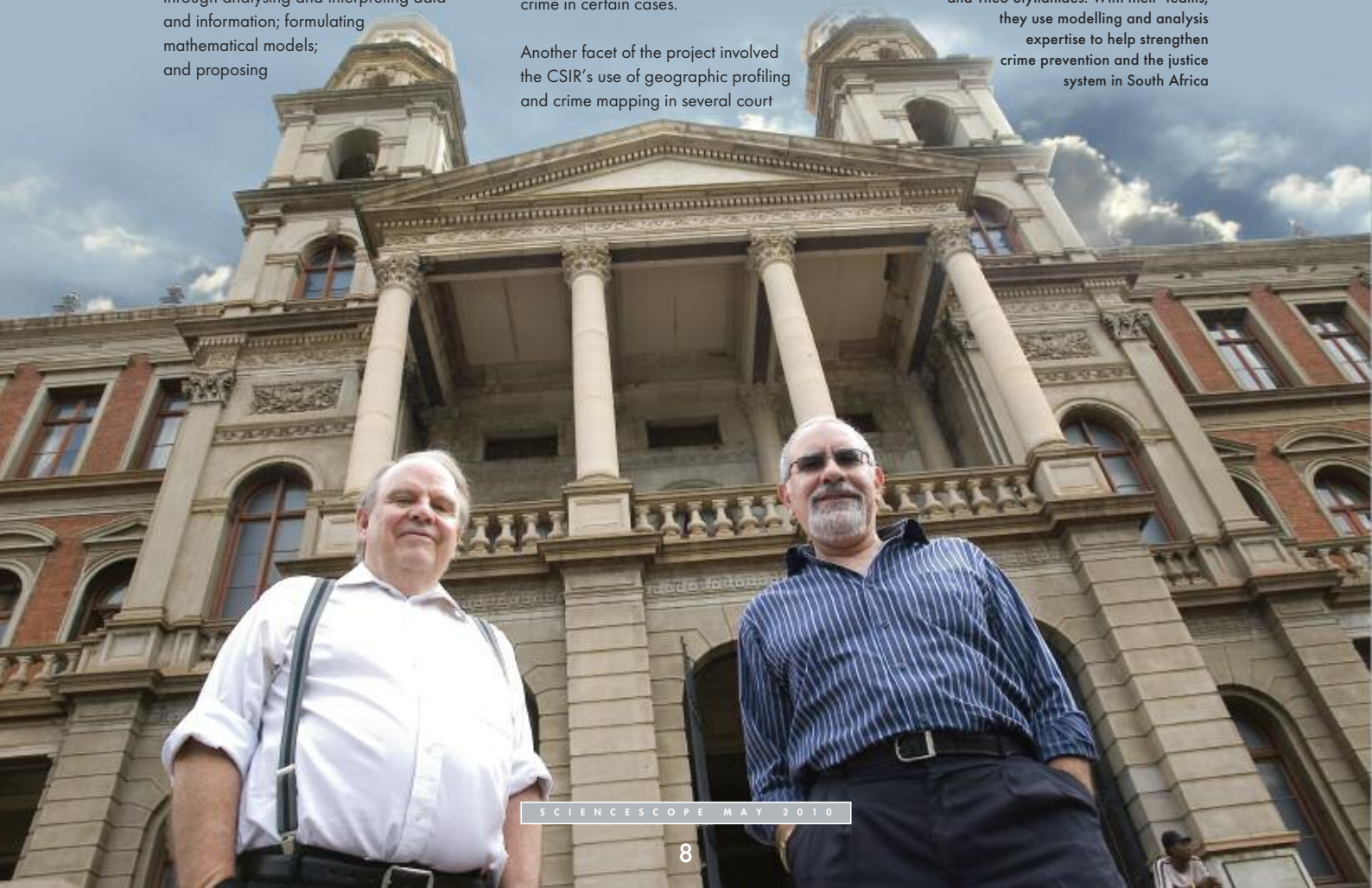
cases across the country. This contributed to the conviction of a number of murderers and serial criminals. (See article on the Taliep Petersen murder case on page 6.)

The CSIR provided training to researchers of the SAPS Crime Information Analysis Centre, resulting in the successful use of methods to understand and analyse crimes such as child abuse.

Some key activities undertaken during the project include:

- The application of a CSIR-developed system for the placement of police stations in rural areas
- Piloting procedures for automated geocoding of crime scenes
- Investigating the most useful crime forecasting methodologies and optimal allocation of resources
- Piloting statistical analysis to explain crime.

In front of the Palace of Justice – the High Court – in Pretoria: The CSIR's Dr Chris Elphinstone and Theo Stylianides. With their teams, they use modelling and analysis expertise to help strengthen crime prevention and the justice system in South Africa



With past support from the Innovation Fund, the CSIR furthermore investigated decision support tools used in crime prevention and policing worldwide, examined the information systems of the SAPS and made recommendations regarding tools for operational, tactical and strategic purposes. Such tools involve computerised systems that assist informed decision-making within a specific environment.

Prosecuting capacity

Prosecuting authorities need to forecast service demand for capacity planning. CSIR researchers are currently working on a three-year project to assist the National Prosecuting Authority (NPA) of South Africa in this regard. The aim is to provide the NPA with a long-term capability to forecast fluctuating service demand and then match resources.

The CSIR uses quantitative techniques, such as statistical forecasting and discrete event simulation, in this project. Crime trends and future developments in crime markets are also taken into account.

Special operations

The former Directorate of Special Operations commissioned the CSIR in the early 2000s to provide support for a multi-year project. This included training and operational technology support for cyber forensics.

As a result, researchers formulated and implemented a strategic information systems plan for the Scorpions. This included the regular review and update of the strategy to meet information needs. An inventory was developed of relevant software tools for policing, crime intelligence, justice, support and administration.

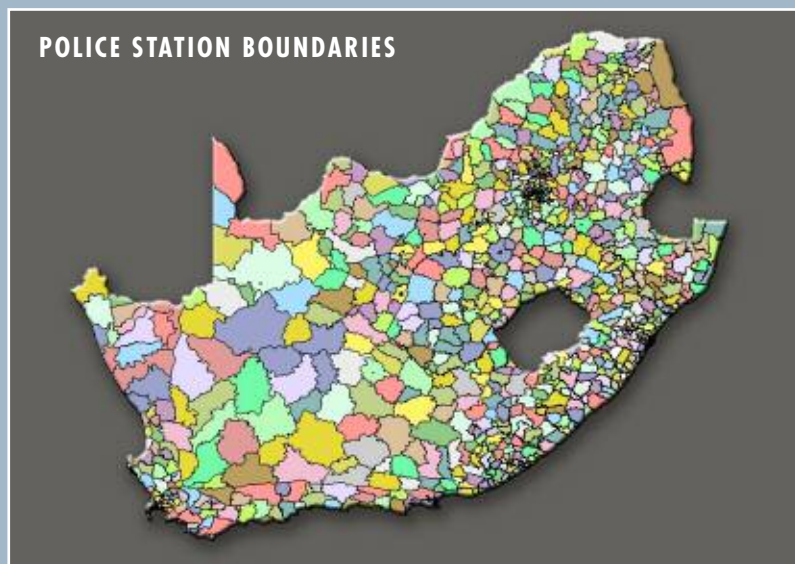
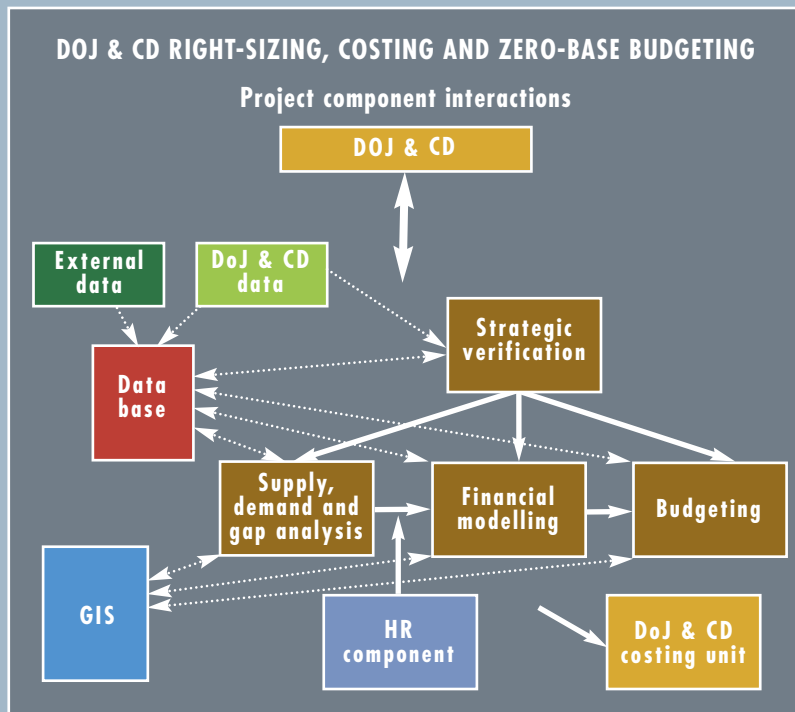
Justice footprint

The justice system of a country is enhanced through prediction of the time required for activities such as criminal work, civil and family court work and admission of guilt. Data needed for such a model include population size, employment status, GDP and total reported crime.

The supply and demand of staff and other resources of the Department of Justice and Constitutional Development were investigated by the CSIR. In this 'justice footprint' study, researchers developed a model for predicting the demand on various offices using external information on crime, demographics and the economy, and comparing it with existing service delivery.

Court Nerve Centre

Effective court management and service delivery are key for maintaining momentum and the smooth running of the justice administration system.



Recognising this, the Department of Justice and Constitutional Development engaged the CSIR's expertise to establish a Court Nerve Centre. Researchers investigated issues critical for the long-term sustainability of such a centre, including IT infrastructure, human resources and training, as well as performance measurement instruments and information products. On an operational level, attention focused on existing data and the production of management reports on the various aspects of court operations.

The project resulted in a fully-staffed and operational centre with analytic and reporting capabilities. The CSIR was instrumental in developing a framework for a court services scorecard, an integrated data analysis capability and skills transfer.

Way forward

With ever-increasing computing capabilities and awareness among stakeholders about the usefulness of quantitative methods, researchers will be able to advance mathematical modelling and analysis for improved crime prevention and detection, informed forecasting in the justice arena and improved service delivery in the administration of justice. The CSIR has made a significant contribution in laying this foundation in South Africa and is committed to making a difference.

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