Dr. Kim Rossmo - Geographic Profiling

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Good morning everybody. It's been said in terms of real estate that the three most important elements are location, location, location. In terms of criminal investigation I wouldn't want to go that far, but crime scene locations can give us some important insights into where an offender may be based, and help us focus the criminal investigative process. That's what geographic profiling is all about.

We solve about eighty-five per cent of our homicides in Canada, we have a little better clearance ratio than Britain, it's a little lower than the United States, but that clearance rate overall is much greater than we would expect to see for crime. There's a simple reason for that; most people are attacked by someone that they know. But as soon as we have a stranger-on-stranger crime, that nexus between victim and offender is broken. Rather than working out from the victim, looking at husbands, wives, boyfriends, girlfriends, sometimes both, we have to work in, and what I mean by that is that we take a look at every sex offender or every parolee, maybe every male over the age of puberty that lives in a community. This is something that produces a big challenge for the police investigative process. It produces the problem of information overload. To the south of where I live in Seattle, they still have an unsolved series of forty-nine prostitute murders. They've collected after a decade of investigation about eighteen thousand names, but have only had time to investigate twelve thousand of them. Probably the record though goes to this country, where the Yorkshire Ripper enquiry collected two hundred and sixty-eight thousand nominals by the time they were done. This is the classic needle in a haystack problem, and profiling can play a role in assisting the investigation.

Geographic profiling is best thought of as an information management strategy to assist in serial violent crime investigations. It doesn't give you an "X" that marks the spot but it does allow you to focus investigative efforts, and it can be thought of as a support service, a type of analysis, and also an investigative procedure on its own. I want to be clear that, at least in North America, profiling is used to describe analysis focusing on individual offenders as opposed to collections of large numbers of crimes that may be committed by different individuals.

The whole investigative process is based on the intelligent collection, analysis and sharing of information. If we haven't done that, plus a whole lot of other things that we have to do, then we haven't done our job, and this is the basis of it. If we don't get our information, that information needs to come from our records, from the public, from patrol officers, if we don't properly analyse it, and then if we don't properly distribute and share it to those people that need to know it, then we don't have a good chance of clearing our cases.

I spent a number of years as a patrol officer working in some of the less desirable parts of Vancouver, and when I was a young trainee we got a call one day of an assault. I attended with my field trainer, we went up to the third floor in the Continental Hotel where an old man said that he had been assaulted by an individual. So, being just out of the police academy and very carefully and diligently writing down all of the details in my notebook, I get to the point of asking him for the description of the offender, he says "Constable, I can do better than provide you with the description. I've drawn a composite sketch of the

man." I looked up at my field trainer, a little uncertain - do most victims supply us with composite sketches I think it may .provide me with guidance so I said "Well, sir, I would very much like to take a look at that." He goes over to a chest of drawers, pulls one open, rummages underneath his shirts and sweaters, comes up with a piece of paper which he very carefully proudly hands to me. This is what was on the piece of paper. *(audience laughter at a picture of a matchstick man)* Uncertain what to do, I just said "Well, sir, if we ever see anybody like this we'll be sure to stop and talk to him." That was not useful information. That did not help the investigation. So we have information of varying levels of quality as well.

We've been very good in the past, in terms of putting up crime scene tape and looking within it for all sorts of clues, hair and fibre, DNA, ballistics, footprints, fingerprints, but sometimes we haven't stopped to consider the fact that for that crime to have occurred the offender and the victim had to come together in time and space. And by considering that question we can sometimes get a perspective on where the offender's coming from, where he's based.

Suitable crimes for geographic profiling are those that are serial in nature, murder, rape, robbery, arson, bombings, predatory crimes where there's hunting behaviour on the part of the offender such as we might see in sex homicides or child molestings, what we call multiple location crimes - locally we had a man who murdered a teenage girl on one of the suburban streets, then he made a series of taunting phone calls to the police from telephone kiosks. By the time he was done we had ten locations available for analysis, which allowed us to predict his home within six tenths of a square mile. Similarly, we have victims who have bank cards or credit cards stolen, which are then used in retail outlets or to make withdrawals from automated teller machines. We can use that type of information. Then, finally we've had some success in very specific types of cases, where we have a missing person that's a suspected homicide victim, we're trying to determine where the body might be.

Okay, the geographic profiling process. We have a series of crimes. Well, our traditional investigative methods, as Bill pointed out earlier, are amongst our best. They should be tried. But if they don't work, perhaps there's some support that can be provided by the behavioural sciences. The first is linking crimes together. In Canada we use a national computer database called VICLAS, Violent Crime Linkage Analysis System, to assist us in linking sex and violent homicides together. There's also a necessary step for the investigators, and maybe the profilers, to sit down at the end of the day to make some hard decisions, but this gives you more information, it literally gives you more pieces of the puzzle. Next step might be the development of a psychological profile, the "who", and maybe it's appropriate for geographic profile, the "where". The bottom line though is that we need to provide new strategies to the investigators. They're our customers, and if we can't give them something to run with, we can't give them a handle, then we've not properly done our job.

Just before I leave this slide I'd like to say can we consider the behavioural science response to be threefold - linking crimes, psychological profiling, geographical profiling.

All right, we have a murder here, what the papers might call a "random homicide". Well, to a mathematician randomness has a very specific meaning, and I would suggest to you that most such crimes, while they might be stranger on stranger, or be motiveless in terms of our understanding of what's going on in the offender's head, they are not random.

There is a pattern that if we can discern, or a logic that if we can understand, can assist us. So we can have the most pathological offender doing the most heinous acts to his victims but there still is a non-pathological method of looking for victims, hunting for them, and if we understand that we can work backwards.

One of the things that geographic profiling is concerned with is what we call “distance to K” functions. This means that most individuals will travel fairly limited distances to do certain things. There’s a large body of research called journey to crime research that shows that criminal’s will tend to commit their crimes fairly close to where they live. Now there’s variations; older offenders will travel further than younger offenders, bank robbers will travel further than burglars, whites will travel further than blacks, but it’s a good rule that’s been studied in a number of different contexts over a number of different time periods and with a number of different types of criminals. And this applies to everyone in this room; we don’t go any further than we have to to accomplish our goals. Psychologists give this a fancy name, they call it the “least effort principle”, geographers, to be different, they give it their own name, they call it the “nearness principle”, but the point is that the same patterns of behaviour that McDonalds will study when they’re trying to determine where to place a new restaurant, or that a government may look at in terms of the optimal location for a new hospital or fire hall, also apply to criminals. There is one important difference though, and that’s what we call a “buffer zone”, the existence of an area that if you get too close to the offender’s home suggests the probability of crime interaction goes down. And so at some point where the desire for anonymity and the desire to operate in one’s comfort zone balance, that’s your area of peak probability.

The work that I did on geographic profiling was part of my PhD studies at Simon Fraser University School of Criminology. I was fortunate to have had two professors there to study under, Paul and Patricia Brantingham, who had developed a theoretical model that looked at where crimes were most likely to occur, based on where an offender lived, worked and played. And so what they said, and I’m being very over-simplistic here, is that every one of us has an activity space, the areas that we live in, work in, play in, and our movement patterns around the city. Where they intersect with suitable target sites, that’s where crimes will occur.

So the first instance the offender has to know about an area before he’s going to start selecting crimes. The Brantingham work had largely been applied to crime prevention. What I was interested in was reversing what they had done, answering the opposite question, “if we know the location of the crimes what can we say about where the offender might live?” And I wanted that to be of assistance to the investigative process.

Okay, I’ve been talking about crime sites, but I think it’s important to realise that we have different types of crime sites. We have, say on a homicide, an encounter site between the offender and the victim, an actual attack location, the point where he first makes his evil intentions known, the murder scene itself, and then the body dump site - though they may all be clustered together, as they were in the apartments of the unfortunate victims of Albert DeSalvo, the Boston Strangler, or they may be spread out. Occasionally we’ll have other types of crime locations as well, and we can notice very strong similarities in the geographical modus operandi of offenders. They’ll tend to pick a similar pattern. So in this example, between the encounter and the attack, the murder and the body dump sites, we can see that one possible method is “all crime events take place at one location”. By contrast, Paul Bernardo in Ontario encountered and attacked young teenage girls on the

street, he murdered them in his home, and then he dumped the bodies in yet another location. So the point is that the geography of a crime is complex, it can have many different sites with different meanings to the offender, and we need to be aware of that.

I'll go through some examples, and then I'll talk about some of the investigative strategies that we use with geographic profiling. This is the crimes of Manley Ng, a serial arsonist in the Saanich area. The red dots are the locations of the crimes and the green dot is where he lived. He was a strange fellow, he would dress up sometimes as a ninja, sometimes he cross-dressed, he would wander round at night on his bike or on foot and he would torch first of all newly constructed homes, then schools and businesses and then finally occupied dwellings.

What we use in terms of geographic profiling are the locations of these crimes. The co-ordinates, the latitude and longitude if you will, serve as input into a computer system which we'll talk about a bit later, which will do something upwards of the order of about a million calculations to produce for us what we call a "jeopardy surface". A jeopardy surface is a probability surface that shows us where the offender most likely lives. Here's the example of the jeopardy surface in this particular case. So, this axis here is north-south, this is east-west, and the Z-axis is likelihood of offender residence. To make any sense of this we have to place it on top of the area where the crimes occurred, a map, to reference it. So the first step, just imagine please being in a helicopter, you're looking straight down on this surface. This is what we get, it's like a topographic map, and there's a scale on the right which indicates through colours the various probabilities or likelihoods of offender residence. And we see we've got two peaks for this particular example.

The next slide has this same surface placed over top of the street map. We can work with this, we can prioritise individual blocks and streets, and do a variety of different investigative strategies accordingly. So again I would like to say geographic profiling doesn't give you an "X" that marks the spot, what it does give you is an optimal search path. So if we were trying to find this offender, rather than trying to look from the north-west to the south-east we should first of all look in the dark orange, then in the yellows, then in the greens etcetera, and we work our way down. Now that search can be physical, by putting police cars out there or knocking on doors in a canvas effort, or it can be a search through information space. Rather than prioritising suspects alphabetically, or processing tips chronologically, we can do it based on their address, or their postal code, or some other such measure. One of the strengths of geographic profiling is the fact that it's been estimated that eighty-five per cent of the information that we have in society has an address or location attached, and probably about one hundred per cent of police records do. By the way, Mr. Ng lived right there, and then up in the second red area was the location of his probation office.

Okay, another case, Canada's most infamous serial killer, Clifford Robert Olsen. He attacked and murdered eleven children very close to Simon Fraser University and he committed a number of sex assaults while he was doing this. This is the jeopardy surface and Mr. Olsen lived right about there, if you can see it on the red dot. Interesting thing about this case is this analysis I'm showing you right now is based on the encounter sites with his victims, and if we analyse his body dump sites, which were in different locations, we get a different pattern. The encounter sites focus in on his home, and he searched for victims almost daily, going by bus stops, arcades or shopping areas which

were likely spots, fishing holes, good spots to find victims. By contrast the body dump sites, that was an activity he only had to do once a month. He was willing to travel further distances because he had different criteria, he wanted to hide the bodies. The analysis of his body dump sites, by the way, focuses in on a prison that he used to be incarcerated in. This is a fellow that committed approximately eighty rapes in Greater Vancouver. We know from undercover policewomen who were in his home when he was identified as a suspect that he actually had a map up on the wall of his apartment, his flat, and on the map he had marked up the locations of his attacks. He was trying very carefully not to leave a pattern, and he was successful, he got away with this for a decade. But the geographic profile focuses in on his residence within about one per cent of the total area, and he lived right where that black dot is. The locations of the other black dots are his other major activity sites, where his father lived, where his girlfriend lived, what his former residence was, his workplace, and we can see that he's almost leaving behind a fingerprint subconsciously of his mental map.

This is an interesting case, this is a nurse that was murdered on her way to a bus stop on a very cold January morning in 1969. She was pulled into this alley here, laid down in a snow bank where she was sexually assaulted, then stabbed and left to bleed and freeze to death. A fellow by the name of David Milgard spent twenty-three years in prison for this particular crime. This case got reviewed by the Canadian Supreme Court. We were asked to do an analysis. There was a second suspect that was identified, a serial rapist that operated in the same community, and he used to catch the bus at the same stop as Miller did every morning. Our analysis suggested that the pattern geographically fit the rapist, Larry Fisher, much closer than it did Milgard, who was on a drug-buying trip to Saskatchewan where this occurred. We also caution that you don't convict or release people on the basis of a profile alone. The Supreme Court of Canada released Milgard, claiming that he should be retried, and the government said "after twenty-three years in prison we're not going to bother". This was destined to be one of those cases that never got solved, but because of recent developments last year in Britain in DNA profiling they were able to analyse the nurse's uniform. The results were that Milgart\d was innocent, that Fisher had committed the crime, he's currently charged and before the courts. So we're indebted to the United Kingdom for solving one of our long-standing murder mysteries.

The case I mentioned earlier, this is Paul Bernardo, he had a lot of media attention in Canada and the United States. He attacked, amongst a series of other crimes including a series of rapes, he attacked two teenage girls in the Golden Horseshoe area of Ontario, just south of Toronto. One victim was encountered there, her body was found there, the second victim was attacked there near a local high school, and then her body was dumped there. One victim was cut up in bits, put in concrete blocks and thrown into a lake; the other victim was dumped into an area where there was a lot of refuse and was shortly found by a scavenger.

Our thoughts on this case were that the body dump site where he was trying to hide the victim was much closer to his home than the first, the other body dump site, in other words that he lived in the St. Catherine's community here. We then looked at the catchment areas for the various high schools, provided this map of offender residence, the victim disappeared from there, and this where he lived. So its just an example of looking from the offender's hunting perspective.

Okay. This is another case we worked on involving a murder of a teenage boy and a teenage girl while they were parked in a rural community in New Brunswick. The offender was identified through ballistics, but in the time delay for the lab to process his rifle, he disappeared. He was being seen with the girl in Maine, Toronto, Halifax, in other words all over eastern Canada and the United States. We felt that he had committed suicide and that his body was likely either in the area of high probability, second area of high probability or third area of high probability, and his remains were found approximately where the blue dot was. So we can sometimes provide help in these kind of cases, but only under very special circumstances.

I'm sure people in this room are familiar with this case. This is an example of an investigation going awry because of geography. The tape that was sent to the investigators from someone claiming to be the Yorkshire Ripper led to analysis of the accents, they felt there was a Geordie accent, the person was from the Sunderland area, and they focused on that part of England which was about a hundred miles away from where the crimes were occurring. That was wrong. Sutcliffe lived close to the area. Interesting, and I'm not sure how many people are aware of it, but shortly before Sutcliffe's arrest through work by some patrol officers, a Home Office scientist by the name of Stuart Kine did a sort of basic geographic analysis of the crimes and was quite successful as it turned out in his predictions.

There's a number of considerations that we take into account when we do a profile - the type of offender, their hunting style, how the targets are arranged and spaced, especially with things like prostitutes, you don't have them uniformly distributed in a given city. What's the zoning and land use, commercial, residential, industrial? Area demographics - sex offenders in particular are concerned with victims often of a certain race type and culture, ethnic groups are distributed differently geographically. Arterial routes - we don't travel through the city as the crow flies, we have to move along street patterns, or, if we're walking we may have to consider things like the tube or bus routes. Physical and mental barriers - physical barriers are obvious, it could be a river or a ravine, a highways. Mental barriers could be a black offender not wanting to go into a white neighbourhood, or someone from a lower socio-economic status not wanting to go into a rich neighbourhood. Finally displacement - that's where the offender moves as a result of something the police have done. We have to be careful what's been out in terms of the media and what's been obvious in terms of uniformed police patrol presence. A good example of this is Wayne Williams, the Atlanta child killer. The press reported that the investigations were covering fibre evidence. That led to him dumping the bodies of his victims in rivers, which changed the geography dramatically.

We break the hunt for a victim down into two components, the search for a victim and the attack of the victim. I don't have time to go into the details of the different categories, however I'll give you an example of how the difference can be important. This is what we call a "raptor", someone who attacked a victim more or less upon encounter. This is the most common and our example here, we have three victims, they encountered the offender where their activity spaces cross, that's where the crimes occurred.

By contrast this is what we call a "stalker", who at some fishing hole usually will find his victims, then follow them back to their homes and that's where the crimes occur. So the locations of these crimes are not connected to the offender's activity space and this is more complex to analyse. One of the things we try to do is determine whether there's any

overlap in the victim's routine activities. One example was a rapist who attacked nine victims, and the police were able to determine that each of the victims had visited the same car dealership, spoken to the same car salesman, who they'd provided their information to. They were able to resolve the case by finding that overlap in their activities.

Any investigative methodology needs to meet four requirements. It has to valid, it has to be reliable, we need to know the limitations of our work, and then it has to have utility for the investigators. We can estimate what we're likely to predict the offender's residence in, based on the number of crimes. The more crimes the greater the focus. And this is a result of any probabilistic-based system - the more information, the greater your accuracy.

Okay, investigative strategies. Well, obvious ones include putting police cars or surveillance into areas of interest. Another one is searching through police record systems, whether it's computer-aided dispatch or records management systems. If it has an address that's something of real value to geographic profiling. Sex offender registries, which we have in the United States, unfortunately not in Canada, and I understand are being implemented to some degree in Britain, these are very powerful tools. Seattle, again just to the south of us, has ten registered sex offenders for every square mile. I don't believe these people get better. It would be asking like someone who was heterosexual to switch. The best we can do is keep track of them.

We can prioritise postal codes or zip codes through geographic profiling and do things like mail-outs. This is often done in an attempt to get information from the public, you get a better response and it's higher-quality information because it's coming from people who most likely live in the area where the offender does. We can also do searches at the Department of Motor Vehicles. So in one case involving a child sex killer, the last victim was taken out of her back yard. Her four-year-old friend could only describe the vehicle as a red station wagon. Well, even with that limited information we could still do a three-parameter search in the Department of Motor Vehicles' records. Vehicle colour - red, vehicle type - station wagon, registered owner address - don't know that but we can put in the postal codes, and that allows us to go from a city with about three quarters of a million people to about sixty-five autos that just match those three parameters. So it's a useful winnowing tool. We've even been successful in the mail-outs in getting those into the offender's home, which makes you wish you were a fly on the wall.

Okay, task forces can generate hundreds or thousands of suspects very quickly. We can help prioritise that. We can assist in door-to-door canvasses, or area and grid searches. Peak attention polygraphy often uses a geographic component, and we can provide support for that method. One of my favourite stories involves a man who had murdered his wife and he had shot her, he'd thrown the gun away. The police were suspicious and he agreed to a polygraph test, after they found that he claimed the gun was stolen by a burglar. They put a map of Victoria up on the wall, covered with grids, and kept pointing to successive squares and saying "is your gun here?" He kept saying "no", but when they got to one square there was a peak attention in the response. They blew that square up and repeated the process, and continued to do this about four times, narrowing in to a very small part of the city. Why the idiot didn't get up and walk out I don't know, but you catch lots of stupid criminals. That area included the harbour; they put divers down

and recovered the handgun. The registration matched the weapon owned by the husband and ballistics matched with the slug from the wife. They had their murder case.
We've talked about victim activities overlap. We can also provide support for search warrant affidavits, and sometimes provide extra court evidence. Finally something that's mainly done in Britain is bloodings or mass DNA screenings. These are very expensive, time-consuming processes, and we can help focus them.
I mentioned briefly to you about the computer system. The original system I wrote for PhD research purposes was not adequate. We've been doing profiles since 1990 and the demand has been growing steadily. We now work regularly on cases across Canada, the United States, Britain, it's been also on continental Europe. Development of a proper computer system to increase our productivity was very important, and this is, you can actually see the system because it is under the ECRI banner in the vendor display, and this system runs on a Sun UltraSparc workstation, it is an incorporation of GIS, Geographic Information Systems, database manipulation, imaging and of course the analytic engine which is the most important.
So just as a case example, this is thirty-two armed robberies that took place in the city of Vancouver. These robberies took place over the course of a year of insurance agencies. What we did was we did a geographic profile, the results will come up here in a second, and this allows us now to prioritise certain areas for investigative focus. We did three things in this case, we tried three strategies. The first was we searched basically in the area of the yellow through our department's record management system using descriptions of the offenders and looking for people with antecedents of robbery. This was not successful, it turned out the offenders did not have a record for robbery. The second thing we did was we simplified the map and we gave it to patrol officers and we said "when you get a new robbery don't just send units to the scene of the crime, also put units into the area where the offender most likely lives, because we know from research that's the number one spot they're likely to return to". We considered also the arterial routes between the two. This didn't work because we never had a good suspect vehicle description. The offenders were using stolen vehicles. Last thing we tried was we released the results of the profile on Crimestoppers which I think is analogous to your Crimewatch show, and they were a little too specific for my liking, they said "the offender lives near the intersection of Knight and Kingsway", we can't do that type of precise prediction. It turned out though that the offender did live near Knight and Kingsway, lived where the black dot is. So there is a little bit of fortuitous luck there but in any event the robberies, which had been taking place once every ten days on average for a year, overnight they stopped. So the detectives were very happy and they were able to assess their suspects and come to a resolution. That's the results of the probability surface.
We can also work, because we do a lot of work for other agencies, we scan maps because we don't always have GIS files, this is from a place in the south-western United States, a series of sex assaults. And that concludes the presentation except for one quick story I'd like to tell you. A couple of summers ago, a young girl by the name of Mindy Tran was abducted and murdered in the town of Kelowna in the interior of British Columbia, and before her body was found she was a missing person and there was a lot of concern, a lot of media attention, posters up everywhere, this type of thing. The RCMP detachment, the Royal Canadian Mounted Police in Klona were responsible for the case. A psychic lady

came in to them, she said “I can help you find Mindy Tran’s body”. Also a hair-finder guy came in to them and he said “I can help you find Mindy Tran’s body”. Do you know what a hair-finder is? No? Okay, you have a little plastic film canister and you take the hair of the person you’re looking for and you put it in that plastic film canister, you attach that to a stick, and it takes you to the person you’re looking for.
So the RCMP figured they would get rid of two nuts at once, took some hair from Mindy Tran’s hairbrush which they gave to the hair-finder guy, and they put him together with the psychic lady and they said “go do your thing”. So the psychic lady stood on top of a hill in Kelowna, and she did her thing, and she said “I believe Mindy Tran’s body is in that park”. They walked down the hill to the park, and the hair-finder guy did his thing, and he wandered around the park for several hours, with his hair-finder, and he found Mindy Tran’s body. It’s a true story, I can’t explain it, I only tell you that because those people could put us out of business.