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RTM IS SMARTER POLICING

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A New Era of Policing

Innovation is a human aspiration that pervades many different fields such as medicine, education, and law enforcement. Within the realm of law enforcement, innovation typically refers to practices that are modern or advanced beyond the standard in the field ("Reducing crime," 2012; Sever, Garcia, & Tsiandi, 2008). Although law enforcement has a history of embracing technological innovation (Taylor, Kowalyk, & Boba, 2007), the 1970s and 1980s were the decades that witnessed an apparent conceptual shift in policing strategy. Curiosity in criminological concepts and empirical research grew and although it met resistance in the policing community, it eventually laid the groundwork to a scientific era of smarter policing ("Reducing crime," 2012; Taylor et al., 2007). Crime analysis was one such product from this burgeoning scientific curiosity.

To many, crime analysis is a completely foreign and unknown profession. Yet, it remains one of the most data intensive and analytical aspects of law enforcement (Emig, Heck, & Kravitz, 1980; O'Shea & Nicholls, 2003). Although the analysis of crime and the use of crime analysis techniques have existed throughout the history of law enforcement (Harries, 1999; Santos, 2014; Sever et al., 2008), it did not bolster official recognition as a needed profession until the 1970s. Also, it was not until the 1990s that an integrated crime analysis function was adopted by large agencies (Emig et al., 1980; O'Shea & Nicholls, 2003). By definition, crime analysis is the systematic study of crime, disorder, and other police-related issues in order to help with criminal apprehension, crime and disorder reduction, crime prevention, and evaluation (Gorr & Kurland, 2012; Santos, 2014; Taylor et al., 2007).

In 1994, CompStat was created by Police Commissioner William Bratton of the New York City Police Department (NYPD) in an effort to reduce crime and better manage police personnel and resources (Peterson, 2005; "Reducing crime," 2012). CompStat attempted to adopt a scientific approach to crime in order to spatially interpret crime events and identify emerging patterns and trends ("Reducing crime," 2012; "Why RTM," 2015). Unfortunately, CompStat led to conflict between law enforcement and the public ("Why RTM," 2015) and empirical research has never confirmed that CompStat reduces crime (Santos, 2014). Nonetheless, CompStat was one of the earliest attempts to analyze data for smarter policing ("Reducing crime," 2012; Taylor et al., 2007).

American intelligence-led policing (ILP) is another concept that emerged from this scientific era of smarter policing. It arose after the terrorist attacks on September 11, 2001 and it was greatly influenced by the British National Intelligence Model and CompStat. American ILP attempts to analyze multijurisdictional crime threats in order to maximize the number of law enforcement personnel who can identify and respond to threats (Peterson, 2005; "Reducing crime," 2012). The key factor in American ILP, however, is intelligence, which is more than just collected data (Peterson, 2005). Intelligence requires analysis of collected data, which is ultimately a

"thoughtful contemplation that results in conclusions and recommendations" for law enforcement (Peterson, 2005, p. 3). By this definition, crime analysis is a key player in American ILP.

Crime analysis utilizes techniques in order to analyze data and draw conclusions. It should be noted that crime analysis itself is not a crime reduction or crime prevention strategy. During the crime analysis process, information leads to actionable intelligence, which can then be used to advise crime reduction or prevention efforts ("Crime analysis," 2008; Santos, 2014). Some tools and techniques in the crime analyst's toolkit include data mining, statistical analysis, crime mapping, and use of statistical and mapping software (Gorr & Kurland, 2012; Sever et al., 2008). Crime mapping, however, is one of the more well-known areas of crime analysis that has received a lot of attention in recent years (Balogun, Okeke, & Chukwukere, 2014; Cho, 2012; Hart & Zandbergen, 2014; Levine, 2006; Wells, Wu, & Ye, 2012; Wing & Tynon, 2006).

With the advent of technology, crime mapping has evolved from the traditional paper map with color-coded pins to a digitized format that is easily manipulated with a desktop computer (Harries, 1999; Mamalian & LaVigne, 1999; "Mapping and," 2016). Today, crime analysts typically use a Geographic Information System (GIS), which is a "computer application that stores, retrieves, and displays spatial data on maps" (Gorr & Kurland, 2012, p. 3). By visually displaying crime data, crime analysts can highlight a relationship between crime and environmental factors (Harries, 1999). For instance, crime mapping can reveal a connection between different phenomena (e.g. crime, land uses, demographics, etc.) and/or reveal a common factor across a particular crime type (e.g. two burglaries occurring in two locations with similar characteristics) (Harries, 1999). Such information can be vital when advising patrol officers, investigators, and police managers. However, crime maps can also be used by courts, corrections, policymakers and community organizations ("Crime analysis," 2008; Harries, 1999).

As technology advances and interest in crime analysis grows, many have started to envision a proactive police force. To many, the idea of a proactive police force sounds much better than a police force that reacts after the damage has been done. As a result of such thought, the field of predictive policing has emerged and captured the attention of law enforcement. Predictive policing uses analytical techniques to perform advanced analysis of information to help anticipate, prevent, and respond more effectively to future crime (Pearsall, 2010; Perry, McInnis, Price, Smith, & Hollywood, 2013; "Predictive policing," 2014; Uchida, 2010). At first glance, predictive policing appears to be a flawed and unsettling approach because it implies prediction. Prediction is typically associated with subjective and individual biases that cannot be reproduced in a scientific setting. However, true predictive policing involves forecasting, which is objective, scientific, reproducible, free from individual biases, and subject to error analysis (Perry et al., 2013). However, the term *predictive policing* is more commonly used than the term *forecasting policing* (Pearsall, 2010; Perry et al., 2013; Uchida, 2010).

> "Clearly there is a deep interest in linking environmental factors to crime"

Predictive policing capitalizes on current police strategies, such as American ILP and crime analysis, in order to forecast crime. For instance, statistical analysis is a major aspect of crime analysis. Yet, it is has also led to the development of predictive analytics and statistical algorithms that are used in the field of predictive policing (Berk, 2011; Malik, Maciejewski, Towers, McCullough, & Ebert, 2014; Zeng, 2015). Predictive policing also uses various crime mapping techniques in its effort to forecast crime (Pearsall, 2010; Perry et al., 2013; "Predictive policing," 2014; Uchida, 2010). In the effort to forecast crime, the discovery of new and unexpected relationships can occur. Such discoveries of unknown patterns and trends help expand law enforcement's understanding of crime, thus improving American ILP. Therefore, predictive policing compliments and enhances rather than replaces current police strategies (Pearsall, 2010; "Predictive policing," 2014; Uchida, 2010).

The Place and "Why" of Crime

Place-based analysis of crime (i.e. environmental criminology) has been of major interest in the field of criminology (Kleemans, Soudijn, & Weenink, 2012; Leclerc, Chiu, & Cale, 2016; Pizarro, Corsaro, & Yu, 2007; Wartell & Gallagher, 2012) and other fields of research (Cozens, 2011; Rondeau, Brantingham, & Brantingham, 2005). Most interestingly, however, is the fact that it appears crime analysts have already adopted an understanding of environmental criminology without any formal or academic training (Wartell & Gallagher, 2012). Clearly there is a deep interest in linking environmental factors to crime and there have been several attempts to develop techniques to achieve this interest. For instance, hotspot mapping and near-repeat analysis are two place-based analysis techniques that are often employed in forecasting future crime (Ferguson, 2012; Haberman & Ratcliffe, 2012; "Hot spot policing," 2009; Weisburd & Mazerolle, 2000; Wells et al., 2012).

Hotspot mapping is a mapping technique that illustrates crime hotspots in a given area. *Hotspots* are basically areas with a greater than average concentration of crime, which may result in a greater than average risk for victimization. The goal is to identify hotspots and execute a strategic response to these areas in order to reduce crime in the hotspot and surrounding areas (Eck, Chainey, Cameron, Leitner, & Wilson, 2005; "Hot spot policing," 2009). Near-repeat analysis, on the other hand, is a place-based analysis technique that emphasizes a temporal factor. The idea is that if a crime occurs at a location, the chances of a new crime occurring in the same location or nearby locations increases for a certain period of time (Caplan, Kennedy, & Piza, 2013; Kennedy, Caplan, & Piza, 2012). Studies have validated this near-repeat phenomenon. Near-repeat analysis allows crime analysts to use past crimes to forecast future crimes within a certain time period. (Bowers & Johnson, 2005; Haberman & Ratcliffe, 2012; Johnson et al., 2007; Wells et al., 2012).

Unfortunately, hotspot mapping and near-repeat analysis are missing one key factor: the "why" of crime. In other words, both techniques fall short in explaining why crimes occur at certain locations. Hotspot analysis may illustrate crime concentrations in a given area, but it does not explain why crimes cluster in certain locations. It also falls short on the temporal factor in that it has a tendency to link together two crime incidents despite the fact that they may have occurred at vastly different time periods (e.g. a burglary that occurred on January 1 and a burglary that occurred on December 31 of a given year) without much support for that linkage other than a common geography. Near-repeat analysis accommodates the temporal factor by providing a timeframe during which to anticipate crime. Yet, much like hotspot mapping, it still lacks the ability to explain why crime occurs during these designated timeframes (Kennedy et al., 2012).

Explaining the "why" of crime helps identify the risk factors or characteristics in a given area that generate the opportunity for crime to occur (Kennedy et al., 2012). This information is invaluable in the fields of intelligence-led policing, crime analysis, and predictive policing. Explaining the "why" of crime is a level of analysis that transforms collected data to actionable intelligence, which is information that helps make decisions or provide direction on how to execute a plan (Carter & Carter, 2009). In essence, crime analysts can use this information to develop conclusions and recommendations to law enforcement or crime prevention efforts. By knowing these risk factors and recommendations on how to act upon them, law enforcement can anticipate where crime is likely to occur and develop a strategic response to all areas that have these risk factors (Kennedy et al., 2012). This entire process represents the very essence of predictive policing (Pearsall, 2010; Perry et al., 2013; "Predictive policing," 2014; Uchida, 2010).

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Risk Terrain Modeling

When it comes to embodying all of the necessary elements of this new era of policing, Risk Terrain Modeling (RTM) is one of the few techniques that lives up to this expectation. RTM is a spatial risk analysis technique invented by Leslie Kennedy and Joel Caplan at Rutgers University (Kennedy & Caplan, 2015). RTM examines multiple datasets that share the same geographical area in order to identify the environmental features, or risk factors, that influence or enable crime to occur. In the end, RTM illustrates on a map the areas where crime is statistically likely to occur based on the similar environmental conditions shared by those areas (Kennedy et al., 2012; Kennedy & Caplan, 2015). However, RTM is not equivalent to a mere assumption that an environmental feature (e.g. ice cream shops) is tied to a certain crime (e.g. robberies) based on a blind interpretation of the data. It is a technique grounded in criminological theories that have been empirically studied since the advent of criminology (Caplan & Kennedy, 2010; Lilly, Cullen, & Ball, 2015; Kennedy et al., 2012; Kleemans et al., 2012; Leclerc et al., 2016; Wartell & Gallagher, 2012). Also, RTM requires the crime analyst to prove that the correlation between a risk factor and crime is statistically significant, or at least derived from empirical research that supports a statistical significance (Caplan & Kennedy, 2010; Kennedy et al., 2012).

Much like hotspot mapping and near-repeat analysis, RTM is a manifestation of the interest in place-based analysis. RTM's roots are embedded in environmental criminology and criminological theories that reflect on the relationship between the environment and criminal opportunity. However, unlike hotspot mapping and near-repeat analysis, RTM explains why certain crimes concentrate in specific areas by identifying the environmental risk factors of a certain crime. According to RTM's theoretical framework, all areas are at risk for crime. However, some areas are more risky than others by comparison. The riskiness of a given area is determined by the clustering of risk factors, which are environmental features that influence crime to occur. The greater the cluster of risk factors, the greater the risk for experiencing a certain crime due to the greater influence for the crime to occur in that area (Caplan & Kennedy, 2010; Caplan, Kennedy, & Miller, 2011; Caplan et al., 2013; Kennedy, Caplan, & Piza, 2011; Kennedy et al., 2012).

If crimes are drawn to areas that have certain risk factors, then risk factors help explain why crimes occur at certain areas (Caplan & Kennedy, 2010). As previously mentioned, explaining the "why" of crime transforms collected data into actionable intelligence (Carter & Carter, 2009). RTM enables the crime analyst to identify the risk factors that are important to crime, thus explaining why crimes occur in one location as opposed to another location that lacks the identified risk factors. RTM can also illustrate the clustering of risk factors and the different levels of risk onto a multicolored map. Crime analysts can use this new information to develop recommendations to law enforcement on how to distribute its resources and/or how to address the criminal threat (i.e. intelligence-led policing) (Caplan & Kennedy, 2010). For example, crime analysts can recommend increased patrols in areas with high concentrations of check-cashing locations after finding that check-cashing locations are a major risk factor for street robberies. Furthermore, the multicolored RTM map can act as a guideline for law enforcement by highlighting the areas for patrols to focus on. As an added bonus, RTM identifies all locations that share the same risk factors, thus forecasting where crime is likely to occur based on the calculated risk (i.e. predictive policing). RTM can also incorporate as many risk factors as desired and give different weight or significance for specific risk factors based on how influential they are to the crime in question (Caplan & Kennedy, 2010). RTM is a technique that intertwines crime analysis, intelligence-led policing, and predictive policing.

It should be noted, however, that RTM fulfills the need to incorporate scientific methods and empirical research into law enforcement. As previously mentioned, CompStat was an early effort to introduce scientific analysis for smarter policing. However, it led to discord between law enforcement and the public ("Why RTM," 2015) and empirical research was unable to determine if it was an effective crime reduction measure (Santos, 2014). There is also the issue of making sure law enforcement is adopting an objective and scientific approach (i.e.

forecasting) rather than a subjective and biased approach (i.e. prediction) (Perry et al., 2013). RTM addresses all of these concerns.

"RTM is innovation in law enforcement"

At its foundation, RTM is based on criminological theories that have been rigorously tested by empirical research for decades (Caplan & Kennedy, 2010; Lilly et al., 2015; Kennedy et al., 2012; Kleemans et al., 2012; Leclerc et al., 2016; Wartell & Gallagher, 2012). Aside from its strong theoretical foundation, RTM's conceptual framework and forecasting ability have also been rigorously tested (Caplan et al., 2011; Caplan et al., 2013; Caplan, Marotta, Piza, & Kennedy, 2014; Gale & Holleran, 2013; Kennedy et al., 2011; Kennedy, Caplan, Piza, & Buccine-Schraeder, 2015). For instance, when applied to assaults in Chicago, it was discovered that as risk factors increased in number and clustered together in a location, the number of aggravated assaults in the same location increased as well. These results support the concept that risk factors can help determine the likelihood of crime occurring at certain locations (Kennedy et al., 2015). Caplan et al. (2014), on the other hand, tested RTM's ability to identify areas at risk of felonious batteries against police officers in Chicago. Results showed that the top 5% of the highest risk areas identified by RTM had at least a 62.53% higher chance of experiencing a felonious battery against police officers in comparison to other locations (Caplan et al., 2014). Aside from validating RTM's forecasting ability, Caplan et al. (2014) also demonstrated a new and innovative use for RTM (e.g. officer safety).

Aside from testing its conceptual framework and forecasting ability, RTM has also been tested against retrospective maps, such as hotspots (Caplan et al., 2011; Kennedy et al., 2011). Kennedy et al. (2011) tested RTM against hotspot mapping and discovered that as much as 36% more shootings occurred in high-risk cells identified by RTM than in areas identified by hotspot mapping. Furthermore, RTM continued to maintain better forecasting than hotspot mapping for various time periods (Kennedy et al., 2011). Caplan et al. (2011) also tested RTM against hotspot mapping and came to the conclusion that RTM is "substantially more accurate than retrospective hot spot mapping" (p. 374). Therefore, not only does RTM address the shortcomings of retrospective mapping techniques, it is also more accurate in forecasting future crime by comparison.

RTM is innovation in law enforcement. It is one of the few place-based analysis techniques out there that fully embraces a variety of environmental criminological theories from the academic community. It requires a crime analyst to prove that the correlation between a risk factor and a crime is statistically significant or at least derived from empirical research that supports a statistical significance. A common practice in the world of academia is to test the validity of new ideas by applying them to the scientific method of analysis. Yet, RTM has been rigorously tested by the scientific method of analysis and confirmed to be an objective, reproducible, evidence-based technique. In essence, RTM brings the theories, the empirical research, and the scientific method from the world of academia into the world of law enforcement. RTM also embodies an interconnection of intelligence-led policing, crime analysis, and predictive policing. In all, RTM is a tried and true scientific technique that leads to smarter policing.

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