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24.1 INTRODUCTION

Predictive policing is revolutionizing law enforcement.[1] New place-based predictive analytic technologies allow police to predict where and when a crime might occur.[2] Data-driven insights have been operationalized into concrete decisions about police priorities and resource allocation.[3] In the last few years, place-based predictive policing has spread quickly across the nation, offering police administrators the ability to identify higher crime locations, to restructure patrol routes, and to develop crime suppression strategies based on the new data.[4]

This change in strategy has been driven by new technology. Small start-up companies vie with large technology powerhouses to convince police departments that their technology is better, more accurate, or more effective.[5] Vendors sell. Departments buy. Communities react. The focus remains on the technological promise of the different predictive systems. Debates over data inputs or promises about machine learning and "accountable algorithms" obscure the basic strategy question at the heart of all policing: namely, what do we want police to do?

This chapter suggests that the debate about technology is better thought about as a choice of policing theory. In other words, when purchasing a particular predictive technology, police should be doing more than simply choosing the most sophisticated predictive model; instead they must first make a decision about the type of policing response that makes sense in their community. Foundational questions about whether we want police officers to be agents of social control, civic problem-solvers, or community partners lie at the heart of any choice of which predictive technology might work best for any given jurisdiction.

This chapter examines predictive policing technology as a choice about policing theory and how the purchase of a particular predictive tool becomes – intentionally or unintentionally – a statement about police role.[6] Interestingly, these strategic choices map on to existing policing theories. Three of the traditional policing philosophies – hot spot policing,[7] problem-oriented policing,[8] and community-based policing[9] have loose parallels with new place-based predictive policing technologies like PredPol,[10] Risk Terrain Modeling (RTM),[11] and HunchLab.[12] This chapter discusses these leading predictive policing technologies as illustrative examples of how police can choose between prioritizing additional police presence, targeting environmental vulnerabilities, and/or establishing a community problem-solving approach as a different means of achieving crime reduction.[13] Behind each of these predictive policing theories is the same basic goal – reduce crime through a better understanding of criminal patterns, data, and insights. But

the strategic choice of technology to reach that crime reduction goal deserves more sustained consideration. Fundamental questions of individual dignity, community security, and police relationships are at stake and can be altered by the choice of technology.

24.2 THE RISE OF PLACE-BASED PREDICTIVE POLICING

The short history of predictive policing begins with the long history of criminology. The idea that crime patterns can be studied, mapped, and analyzed has deep roots.[14] Place-based criminology can be traced back to the mid-1800s with researchers studying particular areas of localized crime.[15] Twentieth-century researchers expanded on this early work developing empirical studies and theories to explain place-based crime patterns and the appropriate police response.[16] Now familiar ideas such as "routine activities theory,"[17] "crime mapping,"[18] "near repeat models,"[19] "social disorganization theory," and "hot spot policing"[20] gained currency among scholars and police.

The modern era of crime analysis parallels the modern history of computing, with greater computer capacity increasing the reliance on digital crime mapping and analytics.[21] The above-mentioned criminology theories began to be studied and tested by examining previously collected crime data.[22] With more data came evaluation of the various theories in academic and other settings. Encouraged by the National Institute of Justice, and buoyed by new computer capabilities, the idea of using past crime information to predict future crime patterns morphed into what we now understand as "predictive policing."[23]

The development of predictive policing is, thus, of relatively recent origin, arising from experiments with police data collection in New York City[24] and the creation of predictive algorithms that could model how certain crime patterns repeat in cities across California.[25] In 2010, the City of Santa Cruz and the Los Angeles Police Department (LAPD) experimented with the first tests of a technology that would eventually become formalized into the company PredPol. After some initial successes were highlighted in the media,[26] other cities soon adopted the technology, and new companies offering predictive policing services were born.[27]

Predictive policing is now spreading across the country. According to a 2016 report by the consultancy Upturn, twenty of the largest fifty police departments use predictive policing (40%), and 36% of the remaining thirty departments are exploring options to use the technology.[28] Major cities have redesigned their police patrols based on predictive policing models.[29] In some cities, officers are provided daily computer-generated maps of areas to patrol,[30] and in other jurisdictions, patrol car mobile devices provide almost real-time updates of crime patterns as they patrol.[31] The advent of predictive analytics and collected crime data (and other environmental factors) can take the seemingly random chaos of criminal activity and order it into actionable policing strategies. At its best, it can increase police efficiency and reduce crime in targeted areas. At its worst, it can create a proxy for racially biased police presence in already over-policed neighborhoods and generate increased police-citizen tension.[32]

In practice, predictive policing companies or risk forecasting tools share many similarities. All are data-driven, focusing on collecting inputs in an attempt to study and then forecast crime pattern outputs. All are relatively new, with most continuing to evolve and change as the information or technology improves. All are relatively untested, with only a handful of studies, reports, or empirical validation across jurisdictions. All are necessarily limited in what they promise, cognizant that they provide tools to forecast a heightened risk of crime, not magic solutions to prevent future crime. Some of the technologies are proprietary, owned by private entities that sell and market their services in competitive market. Some of the technologies are based out of

universities and are provided free or through a licensing arrangement.[33] And, a few technologies are associated with large multinational technology firms with deep financial pockets.[34]

Police procurement decisions have remained largely in the shadows given little attention by citizens or scholars.[35] Traditionally, how police use their budgets for particular services, what technologies they purchase, or how they choose among other bureaucratic options rarely ever becomes a contested political issue. As such, the general practice has been that a police administrator would make a decision about a predictive policing technology through established, albeit opaque, local procurement rules.[36]

Lost in this decision is the fact that the choice of technology is also a choice of strategy that could shape how police interact with citizens, communities, and alleged criminal actors. The next part will detail the workings of three leading predictive policing technologies, examining their theory, implementations, and successes. Section 24.4 will then take these illustrative technologies and map them on the traditional policing theories that they most resemble in an attempt to examine the choice of strategy that comes along with the choice of technology.

24.3 ILLUSTRATIVE PREDICTIVE POLICING TECHNOLOGIES

Predictive policing technologies can work in many different ways, utilizing many different inputs and variables. For example, in 2014 when the RAND Corporation decided to conduct an empirical study to see if place-based predictive policing could work in Shreveport, Louisiana, it did not use an existing technology.[37] Despite the availability of various start-up companies and large tech behemoths, RAND decided to build its own model to test the idea that crime can be predicted by place and time.[38] As part of the project, RAND engineers, analysts, and experts designed a predictive model to forecast crime using the following inputs: areas of property crime, the presence of residents on probation or parole, the previous six months of tactical crime (daily reports of crime patterns), forecasts of tactical crime patterns, 911 calls for disorderly conduct, vandalism, juvenile arrests, and a weighted analysis of the last fourteen days of tactical crime.[39] The goal was to build a standalone model for the Shreveport, Louisiana Police Department. When RAND tested the model, however, they found no obvious improvement over traditional policing methods. RAND concluded, "Overall, the program did not result in a statistically significant reduction in property crime, as envisioned. This could be because the program does not work, the program was not implemented as intended, or that there was insufficient statistical power to detect the effect."[40] The experiment did, however, show that changes in patrol patterns did impact police and community attitudes on the ground.

Similarly, in 2016 the National Institute of Justice funded the *Real-Time Crime Forecasting Challenge* for the City of Portland, Oregon, which solicited data-savvy competitors to create their own place-based predictive systems.[41] Portland opened up its historic crime data and other city data to the competitors, and each of the entrants designed what they thought could be an optimal predictive technology. Dozens of competitors entered the contest offering a variety of different predictive models and theories. Students, individuals/small businesses, and large businesses all competed based on the same dataset of calls for service and available geospatial information.[42]

The point of this introduction is to show that predictive policing technology is not one thing that can be categorized, but involves different approaches, technologies, and theories. This chapter uses three of the most established but relatively small independent predictive policing technologies as examples of the type of technologies at issue. These companies/technologies were chosen because they are well respected, have been adopted by police forces, and have a

track record of transparency and engagement in the predictive policing marketplace. Of course, new entrants emerge into the predictive policing space every year, and the field remains quite fluid and competitive.[43]

24.3.1 *PredPol*

What if you could lower arrest rates and crime rates by signaling to would-be criminals that a particular place was not the spot to commit their next crime? What if you could place a police car in exactly the right block at exactly the right time to deter crime? This is the goal of predictive policing programs like PredPol that tell police to be on the lookout for particular crimes at particular times and locations.[44] The idea is that the deterrence effect of that well-placed police car will shift crime patterns with little disruption to ordinary police patrols. The theory is to target the forecast locations with additional police presence and the result will be a reduction in crime.

PredPol is a small private company that has led the nation in predictive policing technologies.[45] The company began as one of the earliest entrants, expanded quickly, and has developed a strong brand in predictive policing circles. PredPol offers several predictive services, but the best known predictive policing product forecasts areas of likely criminal activity focused on three crimes: burglary, automobile theft, and theft from automobiles.[46]

PredPol's product runs on an algorithm inspired by seismology, and the fact that certain crime patterns follow similar predictable aftershocks like earthquakes.[47] Research has shown that certain property crimes like burglary tend to have an almost viral, contagious quality, where one burglary will lead to several more similar offenses near in time and place to the original offense (the aftershock effect).[48] This criminal contagion is thought to occur because either the same group is committing the burglaries or information gets out about certain environmental vulnerabilities that encourages further crime. PredPol's algorithm operationalizes this insight into precise forecasts of crime about similarly contagious property crimes.

The only inputs in PredPol's system are incident records, crime type, time, and place.[49] It is a minimalistic data approach that limits the variables (and noise) in the analysis. In addition, because of concern over possibly reifying existing policing practices, PredPol does not use arrests as inputs. Arrests involve police action or suspicion; whereas calls for service or incident reports involve actual reports by victims of property crimes. These inputs are analyzed as data, and specific hot spots are forecast on a daily timeline.

PredPol acts as a patrol management system. For police, the data-driven forecasts become operationalized through computer-generated maps of predicted crime. Handed out at roll call or available on computers in police squad cars, these target maps tend to forecast precise areas (500 by 500 square feet), and represent an elevated risk of a particular crime.[50] As a general matter, police are advised to patrol those areas when possible. The strategy being to increase police presence at certain places at certain forecast times. PredPol can track the time officers spend in an area through GPS devices and then report that information to police administrators.

The theory behind why this forecast might work is that increased visibility in areas vulnerable to crime will presumably deter crime at that location. For example, if a parking lot is forecast to be the scene of a car theft because of a pattern of car thefts near in time and place, then sending a police car to that identified location will deter the potential car thief. The goal may not even be to arrest individuals in the area but simply to provide a visible deterrence symbol that police are present and are not going to allow the vulnerability to continue. Reducing victims, more than increasing arrests, has been the stated goal of predictive policing under the PredPol model.[51]

The results of PredPol's strategy, like all predictive policing, are open to debate. Examining crime rates in areas that have rolled out PredPol's technology provides several success stories and some failures.[52] Criminal patterns in urban centers have many causes and few magic solutions. Upticks in crime cannot be blamed on a particular technology any more than reductions in crime can be attributed to new computer models. The founders of PredPol – who include academic researchers and scientists – published the first peer-reviewed study of the technology.[53] The researchers compared the crime prediction skills of the PredPol algorithm to existing crime analysts. Over the course of 117 days, the police in one particular Los Angeles district took turns following PredPol's prediction and the crime analyst's prediction. "In Los Angeles, the crime analysts predicted 2.1% of the crimes, and the algorithm predicted 4.7% of the crimes … In Los Angeles, the PredPol model demonstrated a predictive accuracy 2.2 times greater than the control."[54]

While all academic studies are necessarily limited, the positive conclusion of this initial study provides some evidence that the theory behind predictive policing may work. In addition, anecdotal evidence has helped to convince more jurisdictions to adopt the PredPol product.[55] If predicted accurately, putting police in the right spots at the right moment should reduce the forecast crime.

24.3.2 *RTM*

What do laundromats, convenience stores, and abandoned homes/lots have in common? In Atlantic City, New Jersey, they turned out to be the key to reducing violent crime. Why? Because the intersection of these environmental factors encouraged drug crime and the violence associated with that criminal activity. As discovered by criminologists Joel Caplan and Les Kennedy through their system of Risk Terrain Modeling (RTM),[56] individuals who wanted to buy drugs followed a predictable pattern. First, buyers were solicited at convenience stores which provided a good place for dealers to hang out, then the buyers were directed to laundromats where the transactions would take place, and finally they were sent to nearby vacant houses where the users would shoot up the drugs and become targets for violence.[57] The story behind the crime patterns (the "risk narrative") arose after crunching the data and studying the geographic risk-factors of area. The data drove an assessment of what happened, which allowed analysts to predict where it would happen next, which in turn led to interventions to stop it happening again. RTM was able to predict the risk, and then offer suggestions to the city government to fix the environmental vulnerabilities so as not to have the crime happen again at that location.

Based out of Rutgers University, Newark, RTM is a strategy that examines the risk environment of an area to figure out why crimes are occurring.[58] The RTM model sees the physical reality of a city as a terrain of overlapping risks, the more risks in close proximity to each other leads to a heightened risk of forecast crime.[59] The RTM Model identifies places of "spatial vulnerability"[60] that encourage particular types of crimes. So, for example, in Atlantic City, RTM focused on why the overlap of three otherwise unconnected environmental fixtures encouraged a vulnerable space for violence.

As another example, in Glendale, Arizona the RTM model found that people were getting robbed for money near ATM machines on weekdays (but not on weekends), and that there were robberies around convenience stores (especially of cell phones) on weekends (but not really weekdays), and both patterns overlapped with an increase in calls for service around the sale of drugs.[61] The question was why did these physical objects/spaces attract crime? The answer was

not that complicated, but neither was it recognizable without the data. As to the ATMs, many employees received their paychecks electronically through payroll debit cards, with the check clearing on Thursday. Individuals addicted to drugs targeted the ATM machines when payday wages were retrieved and robbed people of their money. By the weekend, ATMs were not the source of drug money, but convenience store "recycle kiosks" where one can get cash for a used cell phone turned out to be places where people were robbed of their phones to get money for drugs.[62] The same interest in finding quick cash for drugs drove both patterns. In each circumstance, RTM looked for fixed place-based factors as inputs to create a risk narrative for particular crimes.

The goal of modeling risk is to find ways to mitigate those risks. RTM also proposes government strategies to reinvest in locations to "enhance positive spatial influences of known protective features."[63] So, one could fix up the abandoned homes in Atlantic City or provide better surveillance or deterrence around ATMs or convenience stories in Glendale. Whatever the chosen strategy, the goal is to remedy the place-based risks under the theory that just as spatial environments can encourage criminal behavior, so can fixing those same spaces reduce criminal acts.

The big idea behind RTM is to rethink police organizations "as risk management agencies that address vulnerabilities and exposures in the communities that they serve through strategies that go beyond specific deterrence of offenders."[64] Solutions require police to work in collaboration with the government and the community because the vulnerable places need more than police help. Early studies have shown strong crime reduction results across several cities.[65] For example, in Atlantic City, violent crime dropped 20%,[66] and in Glendale, robberies dropped 42%.[67]

24.3.3 *HunchLab*

What if you could encourage police officers to engage the community by using technological nudges? What if a computer could suggest police tactics based on the precise crime forecast for an area? What if you could break down a city into different risk generators and then shape patrol patterns to put police in the right spot (without even telling the police why they were being sent to those locations)?[68] Patrol officers would be "nudged" to shift their routine in a way that unknowingly put them in forecast crime areas at the correct times. What if, by using a service like HunchLab, you could inform a community approach to stopping crime with an understanding of community crime patterns? Crime will decrease without any alteration of the ordinary practice of policing, and community understanding will increase with better data and feedback.

HunchLab calls itself a "patrol management system" that combines elements of the technologies underlying PredPol and RTM and adds in other factors. The system both forecasts areas of criminal risk and also suggests targeted policing tactics to address those risks. Like other systems, the model begins with crime data and algorithms to sort that data.[69] In addition, non-crime data sets are added in about temporal cycles and events (seasonality, days of the week, holidays, sporting events, etc.). The model even includes information about known offenders, socio-economic factors, and weather patterns.[70] With more variables, the model is more complicated than others (with accompanying risks and rewards).

HunchLab uses machine learning techniques to analyze the crime data, train and test the data (so there can be datasets to compare), and then model the data for use in forecasts. These forecasts then get turned into patrol allocation suggestions. Crimes are reweighted

by severity and patrol efficacy in order to balance out the predictions (so that more serious crimes get more weight, even if they are less frequent) and to maximize police effectiveness. Because HunchLab focuses on direct patrol responses, it weights crimes that respond better to direct patrols more heavily. So, for example, a gun crime might have a higher severity weight (because of the risk to the community), and an aggravated assault charge might have a low police efficacy weight (because those impulsive, violent crimes are less deterred by police patrol).

Police officers utilizing HunchLab are provided information about where to patrol (based on the forecast) and then also provided suggested tactics to improve efficiency in those particular areas. These tactics focus on how a police officer should interact with those around her to combat particular crime risk. For example, a police department that wanted police to get out of their patrol cars and engage the community would suggest tactics to encourage conversation more than tactics like stops, frisks, or other deterrence-type strategies. Other tactics might involve less police intervention, recognizing that sometimes police-citizen tension can be exacerbated by direct policing approaches.

As a technological matter, HunchLab has built mobile devices (handheld and tablet-based) to allow police officers to see in real time the areas to patrol, and to prompt officers about appropriate tactics.[71] The data collection mechanisms involve both pushing information to officers and also collecting information from officers about their actions. Early testing of HunchLab has shown positive results in Chicago[72] and Philadelphia[73] in reducing crime, but the findings have not been published in any peer-reviewed journals.

24.3.4 *Commonalities and Challenges*

Each of the three representative technologies involves several commonalities. First, all are focused exclusively on place-based predictive analysis. Second, all recognize that crime risk is connected to environmental vulnerabilities. Third, all posit that some police intervention – be it presence, correction, or interaction – will lower crime rates. Finally, all require lots of crime data and city data to provide the predictive power that has made the technology so alluring to police.

This chapter does not engage the potential problems with data-driven policing. In other works, I have raised the issue of constitutional rights, racial bias, accuracy, transparency, and whether society really wants to embrace a future of predictive policing.[74] Predictive policing, like traditional policing, involves real risks when it comes to justice, equality, and protecting individual liberty.[75] While not the subject of this chapter, these technologies raise serious and unanswered questions about the fairness of how these strategies impact communities of color and less powerful members of society.

This chapter also does not address the choice of model, or complexity in the models. The baseline decision to choose variables obviously will impact the outcomes, and this article does not seek to compare the modeling choices and practical implications.

24.4 PREDICTIVE POLICING AND POLICING THEORY

Predictive policing technologies are obviously informed by criminology and policing theory. Yet, despite this influence, there is little discussion or open acknowledgment of how different predictive policing technologies mirror existing policing theory. This section looks to examine traditional conceptions of policing through the lens of existing predictive policing technologies.

Of course, policing in the real world is not static or theory-bound.[76] All police departments do all types of policing, and labels only reveal so much. In fact, the history of policing theory and practice has been one of experimentation, with politics and local personalities having as much influence as theory. That said, the reason for putting the linguistic and analytical framework around different types of policing is to expose the underlying theories animating them. This section will discuss hot spot policing, problem-oriented policing, and community-oriented policing, providing an all-too-brief overview, and then explain why the representative predictive policing technologies discussed (more or less) fit these labels.

24.4.1 *Hot Spot Policing and Predictive Policing*

Hot spot policing is built around the insight that certain identifiable places tend to generate much higher levels of crime than the overall community.[77] By identifying these precise locations through crime data, police can direct time and attention to these hot spots of crime.[78]

> The specific geographic area that makes up a hot spot has varied across studies, ranging from individual addresses or buildings, to single street segments (i.e. both sides of a street from intersection to intersection), to small groups of street segments with similar crime problems, such as a drug market. Hot spots are smaller than the units police departments have traditionally used to divide up patrol resources, such as patrol beats, zones, or sectors.[79]

While initially perceived as a counter-intuitive approach to the traditional, reactive method of responding to calls for service, this proactive, data-driven strategy has become quite commonplace.[80] Most police departments are now guided one way or another by targeting the more troubled spots in a jurisdiction, rather than just continuing random patrols or responding to emergencies.

Hot spot policing involves not just the identification of a target location but a police response to the area. In its most traditional form, it involves additional police presence through foot patrols, direct patrols, saturation patrols, heightened surveillance, or fixed police presence.[81] One well-defined approach has been to put extra police in the hot spot as a physical means of discouraging crime.[82] Of course, all sorts of responses can be imagined to an identified hot spot, and many other problem-solving or person-based solutions have also been implemented in addition to simply directing more officers to the hot spot.

> [I]ncreasing stops or arrests, do not appear to be a necessary component of hot-spot policing. To the contrary, in one leading study, the authors noted approvingly that officers in the treatment condition (i.e., engaged in hot spot policing) were not evaluated on their stop count, but rather were held "accountable for reducing citizen calls for service and for ameliorating social and physical incivilities in targeted hot-spot areas."[83]

Numerous studies have corroborated the effectiveness of hot spot policing. As Aziz Z. Huq concluded in 2017, "A range of studies and metastudies suggests that the highly localized deployment of officers has a meaningful and statistically significant effect on crime rates."[84] These studies date back decades and largely demonstrate the effectiveness of targeted policing.[85] Experts who study "evidence-based policing" cite hot spot policing as one of the clear successes in newer policing strategies.[86]

Predictive policing strategies like PredPol can be seen as something akin to future-oriented hot spot policing. Micro areas – identified by boxes on the map – are forecast using an algorithm, and more police presence is encouraged in those areas. A company like PredPol which

forecasts precise areas and suggests more police presence is simply bringing hot spot policing to the big data age. Further, because many PredPol predictions are based on past crime data, the overlaps between retrospective analysis and future predictions are not insubstantial. What a crime analyst might have identified as a potential past hot spot, might on occasion be similar to what PredPol would forecast as a location with a higher risk for crime (although obviously not always leading to the argument that computer predictions are superior to human predictions).

More importantly, the remedy is the same. Once identified, the forecast area is targeted for more police deterrence. Police officers make their presence known in an effort to deter criminals. Police wait in the box, looking to reduce the environmental vulnerability through their physical presence. This police presence remedy is simple, easy to fit into existing patrol structures, and relatively uncontroversial. Police have always patrolled, and the predictions only provide a guide as to where to go during their free time on patrol. As such, PredPol and other companies that focus on targeted deterrence have been easily adopted as merely an evolution of what police have been doing under a hot spot policing strategy. In choosing to add prediction to hot spots, predictive policing companies like PredPol can point to the successes of past theory as an argument for future effectiveness.

24.4.2 *Problem-Oriented Policing and Predictive Policing*

Problem-oriented policing shifts the focus from responding to criminal incidents to addressing the underlying social and environmental systems and structures ("the problems") that encourage criminal acts. In a seminal article on the subject, Herman Goldstein argued that fixing root problems in the community, and not simply responding to emergencies, would be a more effective approach to long-term crime reduction.[87] By focusing on the goals of policing (overall crime reduction) rather than the means of policing (various crime suppression tactics), police departments could harness their expertise to address repeated patterns of criminal activity and use their power to engage a wider range of resources to address those same problems.[88]

Problem-oriented policing has two key components: (1) shifting the focus to understanding why crime is occurring in a particular place, and (2) recognizing that a policing remedy may not be sufficient to address those underlying social, economic, or other problems. While police may have always intuitively understood those ideas, problem-oriented policing provided a policing philosophy to meet those goals.

First, problem-oriented policing involves envisioning crime as a structural problem, not merely an individual act. Criminal activities find fertile encouragement in certain environments, and seeing these environments as problems to be fixed is the first step. Building off research into routine activities theory and rational choice theory, the first step is to see existing environmental vulnerabilities as a crime problem to be solved.[89] As Cynthia Lum and Daniel Nagin have written, "Much of problem-oriented policing is based on the premise that crime can be averted by changing malleable features of the social or physical environment or people's routines that contribute to criminal opportunities."[90]

Such structural environmental change, of course, is beyond the normal capacity of police officers or even whole police departments. Traditionally, police have the job of law enforcement, with other governmental agencies responsible for social services and structural economic redevelopment. Recalibrating the role of the police to become problem-solvers leads to the second change in strategy, namely leveraging police information to fix underlying community problems.

[P]roblem-oriented policing also demands that the police look beyond their traditional law enforcement powers and draw upon a host of other possible methods for addressing the problems they define. In problem-oriented policing, the tool box of policing might include community resources or the powers of other government agencies.[91]

More specifically, police and local partners might try to fix environmental vulnerabilities by repairing run-down structures, adding lighting to streets, increasing neighborhood surveillance, or investing in other economic improvement projects.[92] In cooperation with the community, governmental officials following a problem-oriented policing strategy can redirect resources to disrupt the places and spaces of repeated crime patterns.[93]

Researchers examining the effectiveness of problem-oriented policing have run into difficulty in proving that it works. This limitation has less to do with the theory behind the problem-solving approach as it does with defining what constitutes a problem-oriented strategy that can be measured. A recent National Academy of Sciences examination of proactive policing concluded that, "[d]espite the popularity of problem-oriented policing as a crime prevention strategy, there are surprisingly few rigorous program evaluations of it."[94]

A notable exception to the proof problem is the use of the predictive modeling strategy behind Risk Terrain Modeling (RTM). While not explicitly billed as a problem-oriented predictive policing tool, RTM mirrors the basic theory of a problem-oriented approach. For example, as described in the examples about the Atlantic City laundromats, convenience stores, and abandoned lots, RTM first seeks to understand the problem behind crime. While RTM uses a model to forecast areas of heightened crime it also attempts to create a "risk narrative" to explain that forecast. The goal is not a black box prediction, but an analysis of why particular areas are at higher risk for particular crimes in order to fix those vulnerable terrains.

Similarly, the proposed remedy is not merely a physical police presence supporting a deterrence theory (although police presence is certainly one part of the strategy), but one of problem-solving with an expanded network of government actors. Police cannot alone fix up an abandoned lot in Atlantic City. But, with city and social services resources, the environmental problem – the abandoned lot – can be turned into a less problematic area (like a public park). Police departments that want this type of holistic approach to crime suppression and are open to city-wide partnerships might see the problem-oriented methods of RTM as more aligned with their views.

RTM-like, problem-oriented strategies thus offer a broader and more complex approach to crime suppression. While predictive analytics can identify the problems for everyone to see, the solutions require cooperation with other government agencies and actors.

24.4.3 *Community-Oriented Policing and Predictive Policing*

Community-oriented policing (COP) is a broadly defined policing theory that emphasizes building community relationships and connections as a method of strengthening police-citizen trust. As Samuel Walker summarized:

> COP involves a rethinking of the police role, with an emphasis on closer relations with communities and neighborhoods. The key organizational changes involve the decentraliza-tion of police services and the development of crime and disorder policies tailored to each neighborhood.[95]

While many types of local police operations fall under this label, the values of community part-nership and community awareness help to distinguish community-oriented policing from other related strategies.

Community-oriented policing became a national issue in 1994 in response to President Bill Clinton's demand to reinvest in policing.[96] Formalized as a federal priority, the federal government through the COPS (Community Oriented Policing Services) program provided $13 billion in grants from 1995–2008 to fund local experimentation with community-oriented officers.[97] Unsurprisingly, many manifestations of programs calling themselves "community-oriented" have been developed over the years.

As a general (if oversimplified) matter, community-oriented policing involves a localized strategy which requires police officers to be seen as a part of the community, not as alien to the community.[98] The goal is less "warrior cop," than "guardian of the community."[99] The philosophy of community-oriented policing involves a local power structure that responds to community needs, rather than offering top-down leadership or strategies.[100] In such a partnership, tactics are designed to inform police about the community needs,[101] or as Dr. Cedric Alexander, a former police chief has written:

> [C]ommunity policing is as much about officers getting to know the community as it is about the community getting to know the police. It is about transforming stereotypes into people, about humanizing instead of demonizing. Community policing is a powerful means of increasing cultural understanding between police and communities, especially diverse communities.[102]

The results can mean that community priorities are not only emphasized, but the community is enlisted to develop things like citizen-led oversight groups or community-driven crime suppression campaigns.[103]

This change in philosophy also impacts practical operations and the tactics police use to interact with the community. As Michael Reisig has written:

> [C]ommunity policing requires police officers regularly to seek out face-to-face interactions with the general public. Two strategic elements aid officers in this endeavor. First, police officers spend less time in their squad cars by adopting alternative patrol strategies (e.g., foot and bike patrol). Second, police officers are assigned to specific beats for extended periods. These two elements not only help officers develop positive relationships with local residents but also familiarize them with neighborhood concerns. Breaking down the social distance between the police and public can pay off in the form of increased levels of public trust and support.[104]

This focus on community interaction and positive relationships can be contrasted with the more command and control tactics, saturation tactics, paramilitary tactics, or stop and frisk tactics that have been used by police in certain areas.[105] It also can be contrasted with the pure hot spot deterrence model. That said, community-oriented policing shares many similarities with problem-oriented policing, and many times one of the prescriptions for a community-oriented policing approach is to implement problem-oriented strategies.[106]

Because of its expansive and protean definition, community-oriented policing has been difficult to evaluate.[107] The recent National Academy of Sciences report canvassed several decades of research and came to no definitive conclusion.[108] Concerns with weak evaluation designs, a lack of empirical evidence, and continued confusion over definitions hampered the analysis.[109]

In the predictive policing space, HunchLab is not a self-styled community-oriented policing company and could easily be considered to be following a problem-oriented strategy or even a hot spot strategy because the company incorporates some of all of the theories in practice. In fact, HunchLab offers different patrol management solutions depending on the problem. Sometimes it is a short-term hot spot solution; sometimes it is a more longer term problem-solving approach. But, unlike problem-oriented policing, HunchLab works primarily with police (not larger city government services), and unlike hot spot policing, HunchLab offers

more targeted remedies to particular predicted areas (beyond mere deterrence). And, similar to the shifting nature of the community-oriented policing approach, HunchLab shares enough characteristics of community-oriented policing to fit within the broad definition.

First, several of the innovations HunchLab has designed map nicely on to community-oriented policing theory. For example, HunchLab adds very community-specific details as data inputs, including offenders living in the community, socioeconomic indicators, and even things like time of the year, weather, or community-specific events. In addition, HunchLab weights criminal offenses by a perceived harm value, meaning that depending on the community, the type of crime (e.g. theft/aggravated assault) might be weighed differently. In some communities, certain crimes may be more of a priority than others, with the relative values adjusted accordingly after community input.

Community-oriented patrol tactics are also influenced by HunchLab. An officer following a HunchLab predicted map will be given the option of several tactical suggestions upon arriving at the forecast area. These tactical prompts can be created by departments to influence particular community engagements. So, for example, in one police district in Chicago, a police commander who wanted to encourage more positive police-citizen interaction used HunchLab to nudge his officers into more pro-social actions.[110] By adopting a technology that measured and encouraged police interaction with the community, police began changing officer behavior. While the technology could have been used to just measure the time officers spent in the predicted area, with HunchLab, police administrators could also encourage other metrics for evaluation.[111] Commanders have data about compliance with mission areas, time spent, selected tactics, offering feedback to officers, and information to police commanders. If you view community-oriented policing as a mechanism to shift police emphasis toward engagement with the community at the street-level, developing a computer program that monitors and encourages that type of interaction certainly fosters the goal.

Finally, like all of the predictive policing technologies, HunchLab seeks to inform the community of its role and mission. In its promotional materials "A Citizen's Guide to HunchLab,"[112] the company speaks directly to the big data fears of the community, discussing concerns about racial bias, community distrust, and the construction of the underlying computer model. That makes it a notable symbolic gesture in itself as an attempt to engage the community and their fears. The document also emphasizes the goal of mitigating "the risk of harm from police presence itself."[113] In other words, HunchLab recognizes that heightened police presence (even if data-driven) may have the unintended effect of creating the perception of harassment and thus actually de-legitimatize the police in the community. So, for example, for some crimes HunchLab might recommend a non-policing response. Again, from the Citizen's Guide:

> To add a more holistic, community-focused approach to policing, we also recommend using diverse tactics that involve community engagement. For example, if thefts from motor vehicle are a problem in your department, a department might enter three tactics: simple vehicle patrol, placing flyers on cars warning of the thefts, or speaking to employees at local businesses. Although all three tactics are a police response, two of the three tactics do not involve patrolling in the traditional sense and build positive interaction with the community.[114]

As may be evident, this police-focused, but non-traditional approach to crime reduction – localized to particular problems – is a very community-oriented approach. And, because HunchLab changes patrols based on risk, it can manage the amount of officers in any one place

at one time. Administrators using the technology can see which areas are being saturated and pull back patrols to avoid unintentional over-policing responses.

This brief summary of traditional policing theories and existing predictive policing models is not meant to essentialize or categorize in misleading ways. The lines separating the different theories blur and have always overlapped in practice. The technologies also borrow and morph in their suggested remedies. All the technologies encourage some form of hot spot targeting *and* problem-oriented policing *and* community-oriented engagement. But, as a way to rethink technology as policing theory, this analysis might offer new insights for police administrators, cities, and communities debating what type of predictive policing technology to utilize.

24.5 WHAT DO WE WANT POLICE TO DO? TECHNOLOGY AND THEORY

This chapter has suggested that the decision about predictive policing technology is really one about strategic goals and that these goals happen to map onto existing policing theories. Thinking about the effectiveness of different policing theories, rather than different predictive technologies, opens up a space to publicly debate the choices and also to acknowledge the real financial, political, and cultural constraints that exist. This section provides some guidance for how police administrators should think about the purchase of predictive policing technologies focused on questions of crime control, community, and cost.

24.5.1 *Crime Control – The Choice of Policing Theory*

Police respond to crime in every jurisdiction in America. But, how police respond to crime is different in each place. The "how" is guided in part by the theory of what we expect police to do. Do you want officers to be a physical presence to deter the opportunity for crime? Do you want officers to be investigating the targeted areas? Do you want officers stopping individuals and frisking them as a sign of social control, or do you want their presence to reduce victims, but not increase arrests? Perhaps you want police to connect with business owners or community groups as a unified show of force against disorder. All might be tactics that could result from place-based predictive policing. And, as discussed throughout the chapter, depending on the technological nudge chosen you might get different outcomes.

For example, when RAND ran its own independent study, it found that patrol officers began acting like detectives, trying to figure out why crime was occurring in a particular area, which unintentionally had the effect of slowing down their response times to actual emergencies and calls for service.[115] PredPol changed police behavior by changing what was measured from the number of arrests, to the reduction of victims in the predicted areas.[116] RTM in Glendale focused on police-business contacts with leaflets and community outreach.[117] And finally, HunchLab's experience in Chicago encouraged community contacts, and at least one District Commander believed that this action of getting out of the car and engaging the community reduced crime.[118] The important point is that the technologies altered policing with the changes emerging from a technological push, not necessarily a policing need.

The process of technology driving policing without an accompanying theory may be ill-advised. Police decision-makers should first decide the type of policing they want to encourage and then look for the technology that helps them implement that theory. Theory should guide technology, not the other way around.

Such a thought process should, of course, be guided by efficacy. While this chapter does not seek to compare the different technologies, contracting jurisdictions should research the evolving success rates and scientific studies around them. It may also be the case that a combined approach using parts of each theory may, in the final analysis, be the most effective.

24.5.2 *Community – The Choice of Community Priorities*

All police interact with the community, but not all police tactics create positive connections with the community. Predictive policing technologies can change the emphasis on these connections.

Obviously, community-oriented policing is intentionally focused on community interests and encourages community input. Other technologies might feel less community connected. For example, a physical presence, deterrence-oriented approach might create tension with the local community which could resent the additional police presence. The idea of more police patrols and more police visibility might increase, not decrease community friction. Similarly, a focus on business check-ins might prioritize certain parts of the community (shop owners) over others, thus exacerbating class or socioeconomic tensions. Community policing rarely examines "which community" one is talking about in improving community-police relationships. Many times there are several conflicting community interests without clear consensus on priorities.

A related community concern might involve the transparency or the perceived racial impact of any predictive technology. A community might demand to know how the algorithm works, which depending on the openness of the company may not be forthcoming. Some predictive policing companies protect the proprietary nature of the technology, and others embrace a more open approach. A police chief in a community concerned with transparency might opt for a more open technology; whereas such considerations might not matter to a more hands-off, trusting community.

A concern about racial bias might also impact the choice of technology. Communities scarred by racial tension may demand measures to ensure that the predictive policing technologies do not replicate racial bias. Technologies like PredPol, RTM, and HunchLab do not use race as a variable, and they have been very conscious about the racial impacts of their technologies. But, decision-makers choosing a technology may need more assurances that structural socio-economic inequality will not get reified into predictive outputs. One academic study examined drug arrests filtered through a predictive algorithm and found not surprisingly that when focused only on drug arrests, predictive policing had a racially discriminatory effect.[119] Essentially, the technology was really just predicting policing patrols (where the drug arrests were occurring), not necessarily the actual crimes (where the drugs were being used).[120] A failure to address the concerns of racial bias could negatively impact the legitimacy of the technology and its acceptance in the community.[121]

Finally, a choice of technology may shape how police officers treat the community and how the community feels about the police. One unintended consequence of the RAND study in Shreveport was that police officers felt more positive connection with the community because they were interacting with them more.[122] Even something as simple as the number of times community members waved hello to them was noticed as a small but significant sign of improved community relations.[123] Predictive technologies that guide officers to use tactics that show respect and increase a sense of procedural justice might be more attractive to police departments seeking to teach those values.[124] Similarly, technologies like HunchLab which take into account the cost of over-policing certain communities for certain crimes, might also be more attractive to departments. Finally,

maybe evaluation systems that incorporate other factors like officer happiness, fewer complaints, or more mutual respect will shape community responses to the technology.

24.5.3 *Cost: Financial, Training, and Coordination Costs*

Police departments operate within fixed financial constraints, although these economic realities change depending on the jurisdiction. Some police departments have flexible budgets and a tradition of collaborating with other agencies to solve city-wide problems, but many do not. In fact, the overly fragmented structure of local law enforcement makes coordination quite difficult.[125] Some police departments are tiny with limited jurisdictional reach and even less natural interaction with local, state, or federal services. These interlocking economic and governmental constraints limit the ability to change the police role to anything other than the traditional responsive model.

The consequences of this reality may impede collaborative projects to fix structural environmental vulnerabilities. For example, a problem-oriented approach will not work as well without close connections between police and city services. Nor would it work with a jurisdiction that cannot afford to improve the identified problems. It does little good to identify the risk narrative and point out solutions, if financial constraints or cooperation issues make fixing those problems impossible. Even something as simple as redirecting officers to a forecast area may not be possible in jurisdictions with severe limits on officers or patrol cars.

One question to ask, then, involves what financial or systemic limitations exist to implement any new predictive policing strategy. Again, a problem-oriented policing strategy likely will not work without the financial will to fix the problem. Jurisdictions with poor histories of interagency cooperation or dire financial circumstances might not really have the luxury to focus on underlying societal problems, rather than triaging crime. Those agencies may recognize that with current limitations, all they can do is focus on the immediate policing aspects of the job and save problem solving or community improvement to other government entities.

In addition to significant financial outlays to fix underlying structural or environmental vulnerabilities, some jurisdictions might also be unwilling to invest in the cost of training police to change their roles. Without adequate training, it might not be a constructive approach to have officers get out of their cars and engage the community. It could, in fact, exacerbate tensions in certain communities with longstanding trust issues regarding the police. So cost involves not just the money for the technology or the proposed remedies from the technologies, but also the associated training that goes with the change in role.

24.6 conclusion

This chapter has explored the rise of place-based predictive policing and how it has shaped and will continue to shape policing as a matter of technology and policing theory. The goal is to start a conversation at the outset of any predictive policing purchase about why the particular technology makes sense for the desired strategy. Because these systems codify the underlying choices, they create an opportunity to discuss old debates anew.

Even asking these questions opens up the debate in important ways. The rise of predictive policing technologies has not resulted in an equivalently strong public debate about their use. Police administrators purchase the technologies through allocated budgets or federal grants without significant community oversight.[126] As a result, police departments have not been forced to think through what type of policing they are trying to accomplish at the front end and how

that technology might fit within the already designed strategy. Engaged citizens may have a role in guiding police to the appropriate policing theory for their neighborhoods.

This purchase of technology can, thus, be a moment of reflection for police administrators. If thought of as buying a policing theory and not a computer program, different questions can be asked at the outset. Even without any formal knowledge of theory, police can ask whether they want to focus on police presence, problem solving, or community connections – or, perhaps, all three (or something else). The answers will not only guide their purchasing decisions, but define the optimal role of police in the community.

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