PREDICTIVE POLICING AND REASONABLE SUSPICION

Andrew Guthrie Ferguson[*]

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[*] Assistant Professor of Law, University of the District of Columbia David A. Clarke School of Law. 2004 LL.M Georgetown University Law School, 2000 J.D. University of Pennsylvania Law School. With thanks and appreciation to Professors Christopher Slobogin, David Rudovsky, Arnold Loewy, Cara Drinan, Steven Morrison, George Mohler, Jeffrey Brantingham, Joel Caplan, and Leslie Kennedy. Special thanks to Jake Dworkin for his research assistance.

> Very soon we will be moving to a Predictive Policing model where, by studying real time crime patterns, we can anticipate where a crime is likely to occur.[1]

INTRODUCTION

The future of policing blinks on a computer screen in downtown Los Angeles.[2] On that screen, police have predicted the next area of potential criminal activity.[3] Based on crime data collection, analysis, and computer modeling, the Los Angeles Police Department (LAPD) is directing patrol officers to a targeted block of expected crime.[4] In the LAPD's Real Time Analysis and Critical Response Division, a new concept of "predictive policing" is being developed based on past crime patterns and sophisticated computer algorithms.[5] Promoted as the next smart policing weapon in the war on crime, its promise is to predict crime before it happens.[6]

In another part of California, police stake out an area of predicted criminal activity. As described by the *New York Times*, in a parking garage forecast to be the location of future car thefts, two women are arrested after peering into car windows.[7] One has an open arrest warrant.[8] The other is caught carrying drugs.[9] Without the predictive tip, it is arguable that peering into windows in a

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[1] *A National Interoperable Broadband Network for Public Safety: Recent Developments: Hearing Before the Subcomm. on Commc'ns, Tech., & the Internet of the H. Energy & Commerce Comm.*, 111th Cong. 20 (2009) (statement of William J. Bratton, Chief, Los Angeles Police Department).

[2] Guy Adams, *The Sci-Fi Solution to Real Crime*, INDEPENDENT (London), Jan. 11, 2012, (World), at 32; Joel Rubin, *Stopping Crime Before It Starts*, L.A. TIMES, Aug. 21, 2010, at A1; Christopher Beam, *Time Cops: Can Police Really Predict Crime Before It Happens?*, SLATE (Jan. 24, 2011, 6:06 PM), http://www.slate.com/articles/news_and_politics/crime/2011/01/time_cops.single.html; *Weekend Edition Saturday* (National Public Radio broadcast Nov. 26, 2011), *available at* http://www.npr.org/2011/11/26/142758000/at-lapd-predicting-crimes-before-they-happen (discussing predictive policing in Los Angeles); *see also* Andrew Guthrie Ferguson, *"Predictive Policing" and the Fourth Amendment*, AM. CRIM. L. REV. BLOG (Nov. 28, 2011, 11:25 PM), http://www.americancriminallawreview.com/Drupal/blogs/blog-entry/"predictive-policing"-and-fourth-amendment-11-28-2011.

[3] *Weekend Edition Saturday*, *supra* note 2.

[4] *See id.*

[5] *See id.* The software used by the LAPD and the Santa Cruz Police Department was developed by Professors George Mohler, Jeffrey Brantingham, Martin Short, and George Tita. Erica Goode, *Sending the Police Before There's a Crime*, N.Y. TIMES, Aug. 16, 2011, at A11.

[6] Rubin, *supra* note 2. The idea behind predictive policing preemptive enforcement using crime data was named one of *Time*'s 2011 Fifty Best Inventions of the Year. Lev Grossman et al., *The 50 Best Inventions of the Year*, TIME, Nov. 28, 2011, at 55, 82 (discussing preemptive policing).

[7] Goode, *supra* note 5.

[8] *Id.*

[9] *Id.*

parking garage is sufficient reason to be stopped and detained by police.[10] But with the predictive technologies the constitutional questions become more difficult. Can a computer program that predicts the probability of future crime locations change Fourth Amendment protections in the targeted area? Are data-driven "hunches" any more reliable than personal "hunches" traditionally deemed insufficient to justify reasonable suspicion?[11] What measures exist to examine the reliability and accuracy of these new policing tools?[12] These questions, and more, are raised by the use of any predictive policing strategy.

This Article addresses the Fourth Amendment consequences of this police innovation, analyzing the effect of predictive policing on the concept of reasonable suspicion. More broadly, this Article addresses the theoretical and doctrinal impact of predictive policing on the Fourth Amendment, leaving for future projects an empirical study of the program's effectiveness or practical results. In its current form, the technology is too new to make any definitive conclusion on its merits as a crime suppression technique.[13] Yet, as can be seen by the growing interest in the concept of predictive policing in the form of test programs, major government grants, national news articles, and awards, the future is now, and the constitutional implications of that future must now be addressed.[14]

This Article examines predictive policing in the context of the larger constitutional framework of "prediction" and the Fourth Amendment. Many aspects of current Fourth Amendment law are implicitly or explicitly based on

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[10] *See* Tessa Stuart, *The Policemen's Secret Crystal Ball*, SANTA CRUZ WKLY., Feb. 15, 2012, at 9 (arguing that "the two women from *The New York Times* article were first stopped because they were in violation of a municipal code called the parking lot trespass law").

[11] *See, e.g.*, United States v. Arvizu, 534 U.S. 266, 274 (2002) (requiring more than a mere hunch for a police stop); *see also* Albert W. Alschuler, *The Upside and Downside of Police Hunches and Expertise*, 4 J.L. ECON. & POL'Y 115, 122–23 (2007).

[12] *See infra* Part IV.

[13] In both Los Angeles and Santa Cruz, the formal rollout of the predictive policing experiment is not even a year old. As such, the results, while positive, are preliminary. *See* Goode, *supra* note 5; Josh Koehn, *Algorithmic Crimefighting*, SANJOSE.COM (Feb. 22, 2012), http://www.sanjose.com/news/2012/02/22/sheriffs_office_fights_property_crimes_with_predictive_policing ("[D]uring the first half of 2011, Zach Friend, a spokesman for the Santa Cruz Police Department, says that after using its predictive policing algorithm, the department reported a drop in property crimes ranging somewhere between 4 and 11 percent.").

[14] Predictive policing has been featured in the *New York Times*, made the front cover of *Popular Science*, and drawn national and international interest. Goode, *supra* note 5; POPULAR SCI., Nov. 2011; *see also* Beam, *supra* note 2 ("In November 2009, the National Institute of Justice held a symposium on 'predictive policing,' to figure out the best ways to use statistical data to predict micro-trends in crime."). In addition, the federal government, through the Justice Department, has sponsored millions of dollars of research grants on the subject. *Id.*

prediction.[15] Search warrants are predictions that contraband will be found in a particular location.[16] Investigative detentions are predictions that the person is committing, or about to commit, a crime.[17] Fourth Amendment concepts like probable cause, reasonable suspicion,[18] informant tips,[19] drug courier profiles,[20] high crime areas[21] and others are based on evaluating levels of probability that criminal activity will occur or is occurring.[22] Predictive policing both fits within this established tradition and also challenges it in novel ways. As will be argued, predictive policing may, in fact, necessitate a reconsideration of some of the existing reasonable suspicion doctrine, as well as point to refinements in future application.[23]

The Article concludes that in its idealized form, predictive policing will impact reasonable suspicion analysis and become an important factor in a court's Fourth Amendment calculus. While never enough alone, this predictive information will be used to justify stops under existing Fourth Amendment precedent. Evolving from a rich academic tradition of criminological insights around "crime and place" and building on real-world experiments with "hotspot" policing, the theory of predictive policing has both academic and practical grounding.[24] In addition, in its initial implementation—focused on specific types of property crime in specific locations under controlled tests—the predictions appear to have positive results in reducing crime.[25] At the same time, the underlying rationale of why predictive policing may be effective for certain crimes and areas may actually lead to a limitation on its applicability. These limitations should inform future Fourth Amendment analysis in determining reasonable suspicion. Further, these limitations raise deeper

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15 *See infra* Part III.

16 United States v. Grubbs, 547 U.S. 90, 95 (2006).

17 *See* Terry v. Ohio, 392 U.S. 1, 30 (1968) (allowing police to stop a suspect based upon a conclusion "that criminal activity may be afoot").

18 *Terry*, 392 U.S. 1.

19 Florida v. J.L., 529 U.S. 266, 268 (2000); Alabama v. White, 496 U.S. 325, 330 (1990).

20 United States v. Sokolow, 490 U.S. 1 (1989).

21 Illinois v. Wardlow, 528 U.S. 119, 123–25 (2000).

22 Illinois v. Gates, 462 U.S. 213, 238 (1983).

23 *See infra* Part IV.

24 *See infra* Part II.

25 *See* Stephen Baxter, *Modest Gains in First Six Months of Santa Cruz's Predictive Police Program*, SANTA CRUZ SENTINEL (Feb. 26, 2012, 4:59:09 PM), http://www.santacruzsentinel.com/ci_20050377 ("From the program's start in Santa Cruz in July 2011 to Jan. 1, 2012, car burglaries and residential burglaries declined by 4 percent compared with the same period a year earlier, according to Santa Cruz crime analyst Zach Friend. Vehicle thefts remained about the same. 'The goal of the program has not been to arrest people, it's to deter and prevent crime from occurring,' Friend said. Having said that, there were roughly 13 suspects arrested during predictive police patrols.").

questions about the reliability, transparency, and application of the technology. Articulating and framing those theoretical and practical limitations is the task of this Article.

Part I of this Article canvasses the current state of predictive policing in the United States. Placed within the context of a two-decade evolution to data-driven and intelligence-led policing, predictive policing is the next logical step in using crime data and mapping technologies to reduce crime.[26] This Part briefly examines the history, theoretical background, and current research on predicting crime patterns, with a focus on the types of crimes that police departments and researchers are using to test the predictive policing model.

Part II of this Article examines prediction as a significant, if unexamined, aspect of the Fourth Amendment doctrine. Predicting criminal activities based on probabilities rests at the core of Fourth Amendment concepts such as probable cause and reasonable suspicion.[27] In addition, the Supreme Court has addressed the predictive value of information—including informant tips, profiling, and high crime areas—in a range of cases.[28] This Part distills the principles emerging from these cases in an effort to ground an analysis of predictive policing.

Part III applies the relevant Fourth Amendment analogies to the problem of predictive policing. Depending on the Fourth Amendment analogy chosen for analysis (tips, profiles, high crime areas), different problems arise. Notably, however, under any of the analogies courts will come out with the same answer under current law. As will be argued, predictive policing will alter the reasonable suspicion analysis in a direct way, changing the current calculus to favor a finding of reasonable suspicion. Whether viewed positively or negatively as a constitutional matter, this shift points to larger problems with a weakened reasonable suspicion standard. If a law enforcement computer algorithm can change Fourth Amendment freedoms, then courts have an extra responsibility to ensure that the technology meets reasonable standards of reliability and accuracy.

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[26] *See generally* SPENCER CHAINEY & JERRY RATCLIFFE, GIS AND CRIME MAPPING 8 (2005); KEITH HARRIES, NAT'L INST. OF JUSTICE, MAPPING CRIME: PRINCIPLE AND PRACTICE 92–94 (1999); DEREK J. PAULSEN & MATTHEW B. ROBINSON, CRIME MAPPING AND SPATIAL ASPECTS OF CRIME 154 (2d ed. 2009); Luc Anselin et al., *Spatial Analyses of Crime*, *in* 4 CRIMINAL JUSTICE 2000, at 213, 215 (2000).

[27] United States v. Cortez, 449 U.S. 411, 418 (1981) (observing that the question of reasonable suspicion deals "with probabilities").

[28] *See infra* Parts II, III.

Part IV of the Article addresses the present and future concerns with using predictive policing technologies. First, this Part looks at the importance of understanding why predictive technologies work, and it links the underlying research on prediction to the Fourth Amendment analysis that courts will soon be required to make. In general, the predictive theories that have been studied focus exclusively on property crimes. One concern with the adoption of these technologies is that they may become divorced from the underlying logic of why certain crime locations can be predicted. In other words, the studies that focus on property crimes in fixed areas could be applied unthinkingly to other crimes in other contexts. In addition, this Part looks at ways to assess the reliability, transparency, and accuracy of the programs, as well as the need to create mechanisms to avoid manipulation, bias, or uneven application. Predictive policing, like many new law enforcement strategies, raises issues of class-based and race-based targeting, as well as general civil liberty concerns. Finally, this Part looks at some of the potential unintended consequences of this technology that may actually make certain police stops more difficult to justify as a constitutional matter.

I. PREDICTIVE POLICING: AN INTRODUCTION

"Predictive policing refers to any policing strategy or tactic that develops and uses information and advanced analysis to inform forward-thinking crime prevention."[29] More objective than a patrol officer's hunch about an area, predictive policing uses the power of "big data" to isolate patterns in otherwise random acts.[30] Predictive policing has become a generic term for any crime fighting approach that includes a reliance on information technology (usually crime mapping data and analysis), criminology theory, predictive algorithms, and the use of this data to improve crime suppression on the streets.[31] In simple terms, predictive policing involves computer models that predict areas of future crime locations from past crime statistics and other data.[32]

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[29] CRAIG D. UCHIDA, NAT'L INST. OF JUSTICE, NO. NCJ 230404, A NATIONAL DISCUSSION ON PREDICTIVE POLICING: DEFINING OUR TERMS AND MAPPING SUCCESSFUL IMPLEMENTATION STRATEGIES 1 (2009) (emphasis omitted).

[30] As will be discussed *infra*, the parallel between police hunches and computer forecasts is central to determining an appropriate Fourth Amendment analogy.

[31] Beth Pearsall, *Predictive Policing: The Future of Law Enforcement?*, NAT'L INST. JUST. J., June 2010, at 16, 16 ("Predictive policing, in essence, is taking data from disparate sources, analyzing them and then using results to anticipate, prevent and respond more effectively to future crime.").

[32] In its 2009 call for proposals on "predictive policing models," the Department of Justice's National Institute of Justice included several specific targets within the broad category, including: (1) "[s]tatistical analysis to forecast Compstat-like performance"; (2) "[a]dvanced statistical models to determine the risk of

A simple predictive policing model might take historical data about a particular type of crime, the location and time of that crime, and plot those past crimes in a way that would inform crime analysts about an unusual cluster of crimes.[33] As will be discussed later, research studies support the accuracy of this historically based prediction for certain crimes under certain circumstances.[34] A more complex predictive policing model might involve event-based concerns—such as arrests, calls for service, or incident reports—in combination with place-based concerns, such as addresses of known gang members, arrestees, parolees, or places of frequent violence or unrest.[35] This information could be weighted by types of crime (violent crime, property crime) and even include information about particular individuals,[36] gang activity, traffic patterns, environmental factors, and other local information.[37] A computer algorithm would then analyze the data by searching for patterns in

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offending or victimization of particular individuals or groups to inform suppression, problem-oriented, or community policing methods of intervention"; (3) "[a]dvanced analytical tools, including social network analysis tools and intelligent decision support systems for use in investigation to determine nonobvious relationships among suspects, victims, and others or to visualize criminal incidents and relationships"; (4) "[g]eospatial tools to analyze trends including demographics, land use, income, and other sources to predict future needs for allocation of police resources"; and (5) "[c]rime prediction models that use a variety of input variables and that can be used to inform city or neighborhood planning activities to promote long-term public safety outcomes and benefits." NAT'L INST. OF JUSTICE, DEP'T OF JUSTICE, SL NO. 000877, SOLICITATION: PREDICTIVE POLICING DEMONSTRATION AND EVALUATION PROGRAM 6 (2009).

[33] Koehn, *supra* note 13 ("'The most common time [vehicle and residential] crimes were occurring were Tuesdays and Thursdays between 5pm and 8pm,' says Damon, who works out of a sheriff's office substation in Cupertino. 'We put together hot spots and victim profiles to give officers an idea what to look for. In May of 2010, we started seeing a significant decrease. It was pretty immediate once we got our patrol units in the right place at the right time.' As a result, from 2010 to 2011, property crimes in the West Valley patrol area for the sheriff's office—Cupertino, Saratoga, Los Altos and unincorporated zones that include parts of Los Gatos—dropped 23 percent." (alteration in original)).

[34] *See infra* Part I.A.1.

[35] Leslie W. Kennedy et al., *Risk Clusters, Hotspots, and Spatial Intelligence: Risk Terrain Modeling as an Algorithm for Police Resource Allocation Strategies*, 27 J. QUANTITATIVE CRIMINOLOGY 339, 345–46 (2011) ("The Newark Police Department maintains an extensive Geographic Information System (GIS) encompassing numerous data layers. The digitized fields include Part I crime incidents, officer activity (such as arrests and summonses), persons of interests (e.g. 'Known Burglars' and 'Confidential Informants'), locations of interest (e.g. 'Gang Territory'), and business/retail establishments and infrastructure (e.g. Public Housing and Liquor Stores)."); *see also* Brigitte Gassaway et al., *Engaging the Community: Operation Heat Wave*, GEOGRAPHY & PUB. SAFETY, Oct. 2011, at 8, 9.

[36] Tom Casady, *Police Legitimacy and Predictive Policing*, GEOGRAPHY & PUB. SAFETY, Mar. 2011, at 1, 1.

[37] *See* JIE XU ET AL., RUTGERS CTR. ON PUB. SEC., CRIME GENERATORS FOR SHOOTINGS IN URBAN AREAS: A TEST USING CONDITIONAL LOCATIONAL INTERDEPENDENCE AS AN EXTENSION OF RISK TERRAIN MODELING 1 (2010) (examining the "spatial distribution effects of certain urban features (specifically, bus stops, middle and high schools, and public housing) acting as 'generators' of gun shootings" in two jurisdictions: Newark and Irvington, New Jersey).

areas of statistically more probable criminal activity.[38] Most relevantly, this predictive information would then inform police administrators about how to allocate resources to target that specific type of crime. And, in some sophisticated programs, this information would be provided to officers patrolling the streets in real-time through a squad car computer or mobile device.[39]

As an example, currently the Los Angeles Police Department has undertaken an ambitious pilot project to test the feasibility of predictive policing.[40] Under the leadership of former Police Chief William Bratton, and with the collaboration of scholars at several California universities, the police have begun to test the effectiveness of predictive policing focusing on certain crimes in certain areas.[41] As developed by LAPD Captain Sean Malinowski, and based on the algorithms created by UCLA Professor Jeffrey Brantingham and University of Santa Cruz Professor George Mohler, the project focuses on three specific types of property crime—burglary, automobile theft, and theft from automobiles.[42] Based on three years worth of data, weighting more recent crimes more than older crimes and observing patterns, the algorithm seeks to identify 500-by-500 foot areas of probable criminal activity.[43] Officers are then directed to those areas of predicted crime. Initial results have been successful, as non-violent crime has dropped in those areas. Further testing is being done in a controlled experiment to test the reliability of the results.[44]

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[38] Jeffrey S. Paul & Thomas M. Joiner, *Integration of Centralized Intelligence with Geographic Information Systems: A Countywide Initiative*, GEOGRAPHY & PUB. SAFETY, Oct. 2011, at 5, 7 ("[G]eographic profiling gives the ICTF [Intelligence Crime Task Force] the ability to use heuristic algorithms to delineate specific regions that have higher probabilities of containing an offender's residence, place of employment, or leisure space. From these probabilities, we prioritize these areas and develop a list of likely suspects based on the GIS data that falls within our search radius.").

[39] Rubin, *supra* note 2 ("For patrol officers on the streets, mapping software on in-car computers and hand-held devices would show continuous updates on the probability of various crimes occurring in the vicinity, along with the addresses and background information about paroled ex-convicts living in the area.").

[40] *Weekend Edition Saturday*, *supra* note 2; *see also* Adams, *supra* note 2; Rubin, *supra* note 2; Beam, *supra* note 2.

[41] *See generally* Adams, *supra* note 2; Rubin, *supra* note 2; Beam, *supra* note 2; *Weekend Edition Saturday*, *supra* note 2. The genesis of the applied predictive policing research arose from the work of Jeffrey Brantingham (UCLA), George Mohler (UC Santa Cruz), and George Tita (UC Irvine) who collaborated on the technological architecture now being applied in both Santa Cruz and Los Angeles, California. *See* E-mail from Jeffrey Brantingham, Professor, Dep't of Anthropology, Univ. of Cal. L.A., to author (Mar. 26, 2012) [hereinafter Brantingham E-mail] (on file with author).

[42] Rubin, *supra* note 2, at A17; *see also* E-mail from Sean Malinowski, Captain, L.A. Police Dep't, to author (Feb. 9, 2012) [hereinafter Malinowski E-mail] (on file with author).

[43] Adams, *supra* note 2; Malinowski E-mail, *supra* note 42.

[44] Adams, *supra* note 2. The LAPD experiment involves a double-blind randomized control model. *See* Brantingham E-mail, *supra* note 41.

A similar experiment is being conducted in Santa Cruz, California. In Santa Cruz, officers are provided daily "crime forecasts" every morning at roll call, which direct them to patrol certain designated areas.[45] Each forecast has a specific prediction—for example, there is a 10.36% likelihood of a car theft in a particular downtown garage on a particular day.[46] The times when those car thefts are most likely to occur are also listed.[47] Based on the research conducted by Professor George Mohler, the predictive policing algorithm is modeled on seismic aftershock theory and demonstrates that certain property crimes (again burglary, auto theft, and theft from auto) can be identified and predicted in small 500-by-500 foot areas.[48] Police officers are then sent to patrol those areas as part of their regular beats.[49] According to a Santa Cruz spokesperson, thirteen people have been stopped in the designated areas in the first six months of the experiment.[50] It is those individuals stopped within a predicted area that are the subject of this Article. Whether or not predictive policing works as a matter of crime suppression, it raises Fourth Amendment challenges for individuals stopped in those areas.

The Los Angeles and Santa Cruz Police Departments may be ahead of other cities in testing the predictive policing model, but they are by no means the only law enforcement agencies using the technique. Jurisdictions as diverse as Palm Beach County, Florida;[51] Memphis, Tennessee;[52] Chicago, Illinois;[53]

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[45] Stuart, *supra* note 10.

[46] *Id.*

[47] Baxter, *supra* note 25 ("In July, the Santa Cruz Police Department became the first law enforcement agency in the nation to implement a predictive policing program. With about eight years of data on car and home burglaries, an algorithm predicts locations and days of future crimes each day. Police are given a list of places to go to try to prevent crime when they were not responding to calls for service.").

[48] *Id.*; *see also* G. O. Mohler et al., *Self-Exciting Point Process Modeling of Crime*, 106 J. AM. STAT. ASS'N 100, 100–01 (2011); Stuart, *supra* note 10.

[49] Stuart, *supra* note 10, at 13–14.

[50] Baxter, *supra* note 25; *see* Kalee Thompson, *The Santa Cruz Experiment*, POPULAR SCI., Nov. 2011, at 38, 50 ("By the end of July, [early results of the LAPD test showed] property crime was down 27 percent from the year before, an impressive drop, especially given the 25 percent rise in the first six months of the year. What's more, seven criminals had been discovered inside the hot spots."); Koehn, *supra* note 13.

[51] Jerome Burdi, *Police Looking to Predict Crimes in Palm Beach County*, PALM BEACH SUN SENTINEL (Oct. 30, 2011), http://articles.sun-sentinel.com/2011-10-30/news/fl-predictive-policing-20111030_1_violent-crime-police-stake-police-agencies ("Predictive policing is among the initiatives under study by the Palm Beach County Law Enforcement Exchange Program, a countywide effort to share data among police agencies. The program could be underway next year.").

[52] Andrew Ashby, *Operation Blue C.R.U.S.H. Advances at MPD*, MEMPHIS DAILY NEWS (Apr. 7, 2006), http://www.memphisdailynews.com/editorial/Article.aspx?id=30029 ("Operation Blue C.R.U.S.H. (Crime Reduction Using Statistical History) involves using mapping and statistical information to target crime hot spots and chronic perpetrators. 'It's putting the right people in the right places on the right day at the right time,' said Dr. Richard Janikowski, an associate professor in the Department of Criminology and Criminal

Minneapolis, Minnesota;[54] and Dallas, Texas,[55] are testing predictive policing tactics. With federal seed money from the Department of Justice, other jurisdictions are testing the technology.[56] In addition, cities with particularized crime problems are using predictive policing to combat those specific issues.[57]

There are at least three reasons why predictive policing has drawn national attention and federal financing.[58] First, it is cost-effective in an era of shrinking municipal and state budgets.[59] Second, it offers promise of a high-tech,

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Justice at the University of Memphis."); Burdi, *supra* note 51 ("John F. Williams, crime-analysis manager for Memphis police, said the city was plagued by violent crime until its predictive-policing technology, nicknamed Blue Crush, came online. Since then, crime is down 30 percent, he said.").

[53] *News Briefs: Chicago Police Department Adopts Predictive Crime-Fighting Model*, GEOGRAPHY & PUB. SAFETY, Mar. 2011, at 14, 14 ("In April 2010, the Chicago Police Department began piloting a crime prevention strategy called predictive analytics."); Burdi, *supra* note 51 (noting that Memphis, Chicago, Edmonton, British Columbia, and Northern Ireland now use predictive policing).

[54] Matt McKinney, *The Next Crime*, STAR TRIB. (Minneapolis), Jan. 23, 2011, at 1A (describing the predictive policing units in Minneapolis).

[55] Gassaway et al., *supra* note 35, at 8 ("TAAG [Targeted Area Action Grids] areas are geographic hot spots within the city where conditions are favorable for crime to occur. Twenty-seven areas have been identified and represent approximately 7% of the city, or about 26 square miles, and have about 30% of the total Part I crimes. The model uses a multivariate method that improves the forecasting effectiveness of geographic information systems (GIS) compared to conventional or retrospective mapping methods because it looks at more than just crime. The variables or indicators themselves do not create crime; they simply point to locations where, if the conditions are right, the likelihood of victimization and criminal behavior increases. The TAAG areas produced will assist in strategic decision making and tactical action by showing where conditions are favorable for crime to occur in the future.").

[56] Vince Beiser, *Forecasting Felonies: Can Computers Predict Crimes of the Future?*, PAC. STANDARD, July/Aug. 2011, at 20.

[57] DAVID ALAN SKLANSKY, THE PERSISTENT PULL OF POLICE PROFESSIONALISM 8–9 (2011), *available at* http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/pdfs/centers-programs/programs/criminal-justice/ExecSessionPolicing/NPIP-ThePersistentPullofPoliceProfessionalism-03-11.pdf ("One commonly cited example of predictive policing is the 'data mining' that police in Richmond, Va., employed to address the problem of gunfire on New Year's Eve. Categorizing each complaint of gunfire by time and location, the police discovered that most of the shots occurred in four neighborhoods during a narrow time window around midnight on December 31. By concentrating its patrol officers in those areas and that time window, the department was able to reduce gunfire complaints, boost seizures of weapons and cut overtime expenses. Backers of intelligence-led policing and predictive policing can sometimes be dismissive of the old 'dots on a map' style of analysis, but this amounted to dots on a map and on a timeline. As the consultant who helped the Richmond Police Department devise its new strategy points out, '[t]his wasn't complicated at all; this was just simple descriptive statistics.'" (alteration in original) (footnotes omitted)); Pearsall, *supra* note 31, at 17 (discussing innovations in Richmond, Virginia).

[58] A predictive policing summit was held in November 2009. Pearsall, *supra* note 31, at 16.

[59] Charlie Beck & Colleen McCue, *Predictive Policing: What Can We Learn from Wal-Mart and Amazon About Fighting Crime in a Recession?*, POLICE CHIEF, Nov. 2009, at 18, 18 ("Predictive policing allows command staff and police managers to leverage advanced analytics in support of meaningful, information-based tactics, strategy, and policy decisions in the applied public safety environment. As the law enforcement community increasingly is asked to do more with less, predictive policing represents an opportunity to prevent crime and respond more effectively, while optimizing increasingly scarce or limited

progressive-sounding plan to stop crime, which offers significant public relations benefits.[60] Third, from early tests in admittedly small areas, the strategy appears to reduce crime with minimal disruption to regular policing responsibilities.[61] While the jury is out on the accuracy[62] and cost savings attendant to adopting a predictive policing model,[63] there is little doubt that adoption of the terminology and the data-driven technology is growing and will influence police departments, courts, and criminal suspects for years to come.[64]

A. Predictive Policing: In Context

Predicting future crime patterns from past crime statistics is neither as futuristic nor as far-fetched as it might initially sound. In fact, predictive policing can be viewed as part of an evolution to intelligence-driven policing techniques that rely on scientifically grounded principles and decades of criminological theory on crime and place.[65] This section briefly sets out the

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resources, including personnel."); *id.* at 20 ("Risk-based deployment supports the optimization of public safety resources and assets, including personnel." (footnote omitted)).

[60] SKLANSKY, *supra* note 57, at 9 ("Part of the reason technology tends to be over-hyped is that there is money to be made from selling it. Another part of the reason is simply that gear and gadgets are sexy: shiny video screens, interactive maps, and 'mathematical prophesy' have allures that are not shared by, say, a poorly attended community meeting in a church basement." (footnote omitted)).

[61] Paul & Joiner, *supra* note 38, at 5, 7 ("This proactive approach has led to successful results in Morris County. Since 2007, the total crime index in the county has decreased by 11%, violent crime by 21%, and property crime by 7%.").

[62] Kate J. Bowers & Shane D. Johnson, *Who Commits Near Repeats? A Test of the Boost Explanation*, W. CRIMINOLOGY REV., Nov. 2004, at 12, 21 ("[P]rospective mapping is significantly more accurate than extant methods, correctly identifying the future locations of between 64%–80% of burglary events for the period considered."); *see* Beck & McCue, *supra* note 59, at 19 ("With new technology, new business processes, and new algorithms, predictive policing is based on directed, information-based patrol; rapid response supported by fact-based prepositioning of assets; and proactive, intelligence-based tactics, strategy, and policy. The predictive-policing era promises measureable results, including crime reduction; more efficient police agencies; and modern, innovative policing.").

[63] *See* Pearsall, *supra* note 31, at 17 ("George Gascón, chief of police for the San Francisco Police Department, noted that predictive policing is the perfect tool to help departments become more efficient as budgets continue to be reduced. 'With predictive policing, we have the tools to put cops at the right place at the right time or bring other services to impact crime, and we can do so with less,' he said.").

[64] *See* SKLANSKY, *supra* note 57, at 3 ("The newest approaches to policing pushed by the federal government are 'intelligence-led policing' and 'predictive policing.' . . . Like intelligence-led policing, predictive policing has been proclaimed 'the next era in policing' . . . ." (footnotes omitted)).

[65] *See* Nina Cope, *'Intelligence Led Policing or Policing Led Intelligence?': Integrating Volume Crime Analysis into Policing*, 44 BRIT. J. CRIMINOLOGY 188, 191 (2004) ("Analysis converts raw information into actionable intelligence by seeking patterns in crime data, linking criminal events or constructing detailed suspect profiles."); O. Ribaux et al., *Forensic Intelligence and Crime Analysis*, 2 L. PROBABILITY & RISK 47, 48 (2003) ("The evolution of policing strategies and new technologies has dramatically increased the role of intelligence in law enforcement agencies."); *id.* at 54 ("A combination of exploratory, statistical and

history, theory, and research studies that support the predictive policing model. While current models of predictive policing do not purport to be directly based on these theories, this criminological research informs any evaluation of its legitimacy as a tool that could have constitutional consequences.

1. Intelligence-Led Policing and Theories of Crime and Place

In recent years, intelligence-led policing has become an influential theory in the growing study of law enforcement practices.[66] Distinct from other theories such as "community policing"[67] or the "broken windows" theory of policing,[68] intelligence-led policing focuses on crime data, analysis, and targeted police efforts in response to that data.[69] Large cities such as New York City, Los Angeles, and Chicago have embraced crime mapping technologies using objective crime data to determine police staffing and patrols.[70] Problem areas are identified through crime statistics, and significant police resources are directed at those particular areas.[71] As evidenced by a significant drop in crime

visualization methods help[s] reveal patterns in large quantities of information. The information itself is an integration of a broad variety of data representing for example crime incidents, physical environments, socio-economic and demographic features of a population, or physical traces.").

[66] *See* SKLANSKY, *supra* note 57, at 3 ("Intelligence-led policing—trumpeted by its supporters as a 'new paradigm in policing,' 'rapidly growing' into a 'worldwide movement'—emphasizes the use of intelligence collection and data analysis to guide the selection and implementation of police policies." (footnote omitted)); Kennedy et al., *supra* note 35, at 358 ("Problem Oriented Policing relies on intricate 'scanning' and 'analysis' of crime problems in the development of strategies and stresses rigorous 'assessment' of program impact.").

[67] Debra Livingston, *Police Discretion and the Quality of Life in Public Places: Courts, Communities, and the New Policing*, 97 COLUM. L. REV. 551, 562–63 (1997).

[68] Bernard E. Harcourt & Jens Ludwig, *Broken Windows: New Evidence from New York City and a Five-City Social Experiment*, 73 U. CHI. L. REV. 271, 276 (2006); James Q. Wilson & George L. Kelling, *Broken Windows*, ATLANTIC, Mar. 1982, at 29.

[69] *See* SKLANSKY, *supra* note 57, at 3 ("Like intelligence-led policing, predictive policing puts intelligence collection and data analysis at the center of police decision-making, emphasizing 'directed, information-based patrol; rapid response supported by fact-based pre-positioning of assets; and proactive, intelligence-based tactics, strategy, and policy.'").

[70] Andrew Guthrie Ferguson & Damien Bernache, *The "High-Crime Area" Question: Requiring Verifiable and Quantifiable Evidence for Fourth Amendment Reasonable Suspicion Analysis*, 57 AM. U. L. REV. 1587, 1627 & n.251 (2008) (noting that many cities, including Los Angeles and Chicago, utilize crime mapping technologies); James J. Willis et al., *Making Sense of COMPSTAT: A Theory-Based Analysis of Organizational Change in Three Police Departments*, 41 LAW & SOC'Y REV. 147, 148, 172 (2007) (noting that New York utilizes crime mapping technologies).

[71] *See generally* Andrew Guthrie Ferguson, *Crime Mapping and the Fourth Amendment: Redrawing "High-Crime Areas"*, 63 HASTINGS L.J. 179, 182–84 (2011) ("Simply stated, these GIS crime-mapping technologies can produce almost perfect information about the frequency and geographic location of crimes in any given area. The crime data can be broken down and analyzed by location, crime, and time period. . . . Typically, the data collection, storage, and analysis are done by police administrators to determine staffing needs or allocate resources." (footnotes omitted)).

rates in these cities, these types of smart-policing tactics have been widely hailed as successful innovations in the law enforcement community.[72]

At one level, predictive policing is merely the next iteration of this intelligence-led policing concept.[73] Analysts have moved from identifying past crime patterns to predicting the next crime location within that pattern.[74] To take an easy example, if there are assault arrests every Saturday evening at a particular bar at closing time, then it would not be difficult to predict that on a future Saturday night there might be a bar fight at that location. Stationing a police officer at the door at closing time might prevent future fights. The theory of predictive policing is that by aggregating all reported crimes with similar time, place, and crime criteria, important insights into larger crime patterns in a jurisdiction could be obtained.

This focus on identifiable places of criminal activity exists within a well-developed theoretical construct that criminologists have been developing for decades. It is now generally acknowledged that crime does not randomly disperse across a geographic area.[75] Instead, crime is clustered in particular areas that usually can be explained as a function of certain environmental factors that create vulnerabilities for victims at certain times.[76] These "hotspots" of crime have been well-documented in academic literature and

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[72] Rosamunde van Brakel & Paul De Hert, *Policing, Surveillance and Law in a Pre-Crime Society: Understanding the Consequences of Technology Based Strategies*, 20 J. POLICE STUD. (Belg.), no. 3, 2011 at 163, 173 (recognizing that new technologies allow for preemptive profiling of individuals as the combination of predictive strategies and increased surveillance allow for more targeted profiles).

[73] *See* Kennedy et al., *supra* note 35, at 358 ("Hotspots policing relies on the identification, primarily through GIS analysis, of distinct places experiencing crime concentrations.").

[74] *Id.* at 340 ("[A]s better data and more sophisticated mapping techniques have come available, opportunities have emerged to move beyond approaches that rely on density mapping to empirical and evidence-based strategies that forecast where crime will emerge in the future.").

[75] Bowers & Johnson, *supra* note 62, at 12 ("[S]tudies demonstrate that rather than being random, crime tends to cluster in space, and that directing police or crime prevention resources to such 'hotspots' can have a crime reductive effect." (citations omitted)); Spencer Chainey et al., *The Utility of Hotspot Mapping for Predicting Spatial Patterns of Crime*, 21 SECURITY J. 4, 5 (2008) ("Crime also does not occur randomly. It tends to concentrate at particular places for reasons that can be explained in relation to victim and offender interaction and the opportunities that exist to commit crime.").

[76] *See* Chainey et al., *supra* note 75, at 5 ("[Crime] tends to concentrate at particular places for reasons that can be explained in relation to victim and offender interaction and the opportunities that exist to commit crime.").

confirmed by daily police reports.[77] The result is that crime disproportionately affects certain victims at particular places.[78]

Traditionally, this type of hotspot analysis would involve a retrospective mapping of crime clusters in a particular area. Reported crimes would be mapped by coordinates on a searchable computer map, and areas of heightened criminal activity would be noted.[79] Use of hotspot technology has resulted in some surprising results.[80] For example, half of the crime in Seattle over a fourteen-year period could be isolated to only 4.5% of city streets.[81] Similarly, researchers in Minneapolis, Minnesota found that 3.3% of street addresses and intersections in Minneapolis generated 50.4% of all dispatched police calls for service.[82] This type of analysis can be broken down by type of crime and location. Researchers in Boston found that only 8% of street segments accounted for 66% of all street robberies over a twenty-eight-year period.[83] Traditional hotspot analysis can also isolate patterns in time of crime[84] or locations of crime.[85] To be clear, traditional hotspot mapping does not directly

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[77] *Id.* at 5 ("These concentrations or clusters of crime are commonly referred to as hotspots—geographic locations 'of high crime concentration, relative to the distribution of crime across the whole region of interest.'").

[78] Wim Bernasco, *Them Again?: Same-Offender Involvement in Repeat and Near Repeat Burglaries*, 5 EUR. J. CRIMINOLOGY 411, 412 (2008) ("Since the introduction of victimization surveys in the 1970s, it has become widely recognized that crime is concentrated among relatively few victims. A significant number of people become repeat victims, some of them over and over again." (citation omitted)).

[79] JOEL M. CAPLAN ET AL., RUTGERS CTR. ON PUB. SEC., JOINT OPERATIONAL UTILITY OF HOTSPOT, NEAR REPEAT AND RISK TERRAIN MODELING TECHNIQUES FOR CRIME ANALYSIS 1 (2011), *available at* http://www.rutgerscps.org/rtm/JointOperationalUtility_Brief.pdf ("Hotspot mapping is the use of cartographic techniques to create and visualize crime clusters. Conventional hotspot mapping uses the locations of past events to predict locations of future similar events . . . .").

[80] *See* Anthony A. Braga et al., *The Relevance of Micro Places to Citywide Robbery Trends: A Longitudinal Analysis of Robbery Incidents at Street Corners and Block Faces in Boston*, 48 J. RES. CRIME & DELINQ. 7, 9 (2011) ("Criminological evidence on the spatial concentration of crime suggests that a small number of highly active micro places in cities—frequently called 'hot spots'—may be primarily responsible for overall citywide crime trends.").

[81] *Id.* at 10 ("[A] research team from the University of Maryland analyzed crime incidents at the level of street segments in Seattle over a 14-year period and found that, year to year, about 50 percent of the crime was concentrated in approximately 4.5 percent of street segments.").

[82] Lawrence W. Sherman et al., *Hot Spots of Predatory Crime: Routine Activities and the Criminology of Place*, 27 CRIMINOLOGY 27, 37 (1989).

[83] Braga et al., *supra* note 80, at 9 ("In fact, roughly 8 percent of street segments and intersections in Boston are responsible for nearly 66 percent of street robbery incidents between 1980 and 2008 even when controlling for prior levels of robbery and existing trends.").

[84] Lisa Tompson & Michael Townsley, *(Looking) Back to the Future: Using Space–Time Patterns to Better Predict the Location of Street Crime*, 12 INT'L J. POLICE SCI. & MGMT. 23, 25 (2010) (U.K.) (studying how time of day can add predictive accuracy to crime hot spotting).

[85] Braga et al., *supra* note 80, at 11 ("Studies of the spatial distribution of robbery in urban environments have also revealed that a small number of micro places generate a disproportionate number of robberies.

present a theory to predict future crime. Clearly repeated patterns of localized crime suggest an inference that the environmental conditions are ripe for future crime,[86] but the identification of hotspots does not necessarily involve prediction. Predictive policing takes this traditional retrospective analysis and applies it prospectively.

Different theories have been posited for why concentration of criminal activity occurs. Event-based theories like the routine activities theory suggest that crime is likely to occur "when motivated offenders converge, suitable targets exist, and capable guardians are lacking."[87] Place-based theories focus instead on vulnerabilities in the location as the reason for the criminal activity.[88] These vulnerabilities can include simple factors such as poor lighting, lack of police surveillance, attractive victims, or easy escape routes, among many other possibilities. Of course, a place does not create crime,[89] so more contextual theories have been developed, such as pattern theory, which examines the "environmental backcloth"[90] as inviting a space for criminal activity.[91] Other scholars have offered an opportunity theory that focuses on

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Certain high-risk facilities, such as bars, convenience stores, and banks, at particular places also tend to experience a disproportionate amount of robbery.").

[86] Tompson & Townsley, *supra* note 84, at 24 ("Research has repeatedly demonstrated that offenders prefer to return to a location associated with a high chance of success instead of choosing random targets.").

[87] Joel M. Caplan, *Mapping the Spatial Influence of Crime Correlates: A Comparison of Operationalization Schemes and Implications for Crime Analysis and Criminal Justice Practice*, 13 CITYSCAPE, no. 3, 2011, at 57, 60.

[88] *Id.* at 58–59 ("Location matters when assessing the likelihood of crime because crimes cluster at certain locations."). "Crime control and prevention activities must consider not only who is involved in the criminal events, 'but also the nature of the environments in which these activities take place' because opportunity for crime is an attribute of all places." *Id.* at 61 (citation omitted).

[89] *Id.* at 69 ("Qualities of places themselves do not create crime. They simply point to locations where, if the conditions are right, the risk of crime or victimization will be high.").

[90] The terminology of an *environmental backcloth* is used to describe the dynamic realities of areas of heightened crime:

> This backcloth is dynamic and can be influenced by the forces of "crime attractors" and "crime generators" which contribute to the existence of crime hotspots. Attractors are those specific things that attract offenders to places to commit crime. Generators refer to the greater opportunities for crime that emerge from increased volume of interaction occurring at these areas. The concentration of crime at specific places or hotspots is consistent with the idea of an environmental backcloth [and] is well supported by research . . . .

Id. at 60 (citations omitted).

[91] Shane D. Johnson et al., *Space–Time Patterns of Risk: A Cross National Assessment of Residential Burglary Victimization*, 23 J. QUANTITATIVE CRIMINOLOGY 201, 203–04 (2007).

the availability of criminal targets as the determining factor for criminal acts, since criminals tend to stay local and look for easy opportunities.[92]

No matter the chosen theory, the recognition that the risk of crime increases because of identifiable environmental factors has clear implications for predictive policing.[93] If police can identify a location of potential crime, and understand the relevant environmental factors for that predicted crime, then police can focus their resources on those locations as future problem areas for police attention.[94]

This insight about place and crime answers a critical question for any policing theory—in asking why people commit particular crimes at particular locations, we generate information not only about when they may commit the next crime but also how to stop it. For example, applying routine activities theory to a pattern of residential burglaries requires the presence of an offender, a target, and the absence of a guardian.[95] An offender will target a home or homes in an area if vulnerabilities exist, such as the absence of law enforcement, weak structural protections, or a lack of community vigilance.[96] Adding a guardian (a police officer) to the location of those burglaries will likely remove the vulnerability, decreasing the likelihood of another burglary. Similarly, the opportunity theory might argue the following:

> Having targeted a particular home for the first time, a burglar acquires knowledge to inform future targeting decisions. This may concern the internal layout of a burgled property, the ease of access

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[92] *Id.* at 203. Opportunity theory holds "that crime rates will be highest in locations that contain the best opportunity for crime." *Id.* "An important finding in this body of research [on opportunity theory] was that criminals did not travel far to exploit opportunities for crime." *Id.*

[93] Joel M. Caplan et al., *Risk Terrain Modeling: Brokering Criminological Theory and GIS Methods for Crime Forecasting*, 28 JUST. Q. 360, 364 (2011) ("While a crime event occurs at a finite place, risk is a continuous dynamic value that increases or decreases intensity and clusters or dissipates in different places over time, even places remote from a crime event. Valuations of risk are tied to geography and, regarding crime, risk values are the measure of a place's potential for a crime event to occur. Geographic risk is determined by a nexus of certain factors and it changes only as the characteristics and interactions of those factors vary. Sometimes all of those factors must interact at the same place and time for the event to occur.").

[94] Theories of criminology have always utilized a predictive element. Routine activities theory is a prediction that if certain factors exist there is more of a risk of crime. *See* Elizabeth R. Groff, *Adding the Temporal and Spatial Aspects of Routine Activities: A Further Test of Routine Activity Theory*, 21 SECURITY J. 95, 98–99 (2008) (studying the theory of street robbery "based on routine activity theory").

[95] Lawrence E. Cohen & Marcus Felson, *Social Change and Crime Rate Trends: A Routine Activity Approach*, 44 AM. SOC. REV. 588 (1979); Johnson et al., *supra* note 91, at 203 (postulating that "crime would not take place unless a motivated offender comes into contact with a suitable target (opportunity for crime) in the absence of a capable guardian (often, though not always, within a socially disorganized community)").

[96] *See* Bowers & Johnson, *supra* note 62, at 12, 21.

> and escape, the products that may be found were the offender to return, the risks of identification, and so on. This knowledge is likely to reduce uncertainty about nearby homes.[97]

Changing the ease of access or escape or adding uncertainty in the form of locks, police presence, security lights, etc., may alter the calculus for a potential opportunity thief. Understanding why people commit the crimes by understanding the environmental vulnerabilities can affect decisions about how to stop the next crime before it happens.

Predictive policing applies these criminological insights in two ways. First, it recognizes that the past patterns identify an opportunity to ask *why*. What in the environment of that space has increased the risk of that particular crime? Second, by directing law enforcement personnel to that area, the environmental vulnerability may be removed. By disrupting the routine activities, the pattern, or the opportunity, police may be able to prevent the next crime.[98] As a pure law enforcement matter, this disruptive/preventive effect may be the most important result. Crime may go down simply by establishing a police presence in an area.

2. Predictive Models of Crime

The general theory of crime and place has been refined by scholars who have looked at different crime patterns as predictors of future crime.[99] This research gives legitimacy to the theory behind predictive policing, even if the research is not directed at any formal examination of predictive policing itself.[100] In time, of course, researchers will evaluate the reliability and validity of official predictive policing strategies. At this time, however, one can only look at analogous research studies to examine whether the predictive policing model offers a reliable and valid method of prediction that will survive Fourth

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[97] Shane D. Johnson et al., *Offender as Forager? A Direct Test of the Boost Account of Victimization*, 25 J. QUANTITATIVE CRIMINOLOGY 181, 184 (2009).

[98] CAPLAN ET AL., *supra* note 79, at 5 ("Prospective mapping of violent crimes, therefore, must incorporate both the spatial-temporal patterns of recent known violent crime incidents and the environmental risks of micro-level places if it is to yield the most efficient and actionable information for police resource allocation and crime prevention efforts.").

[99] *See generally* CHAINEY & RATCLIFFE, *supra* note 26, at 8; HARRIES, *supra* note 26, at 92–93 (describing the history of crime mapping); PAULSEN & ROBINSON, *supra* note 26, at 154; Anselin et al., *supra* note 26 (describing analytical methods for studying the relationship between location and crime).

[100] Mohler et al., *supra* note 48, at 104 (analyzing the predictive accuracy of forecasts created using crime patterns); Martin B. Short et al., *Dissipation and Displacement of Hotspots in Reaction-Diffusion Models of Crime*, 107 PROC. NAT'L ACAD. SCI. U.S. AM. 3961, 3964 (2010) (describing how research suggests hotspot policing strategies are effective at reducing crime).

Amendment scrutiny. As will be discussed in Part IV, if the predictive methods are not reliable, valid, and transparent, they will not be able to support the level of suspicion required for a constitutional stop.

Two representative predictive models are addressed below: near repeat theory[101] and risk terrain modeling.[102] Both offer sophisticated theories about why police might be able to predict certain types of crime in certain locations. A key point in understanding these studies and, thus, the reliability of analogous predictive models is to identify the limitations inherent in the studies. As will be discussed, the predictive policing model may only work for certain types of crimes in certain areas.

a. Near Repeat Theory

Near repeat theory seeks to identify and explain the phenomenon that certain crimes seem to generate repeat criminal activity at the same place.[103] The theory posits that once a particular location has been subject to a crime, it is statistically more likely that that location and the close environs will be subject to additional, similar crime events during a brief time frame after the initial crime.[104] Residential burglary, automobile theft, and theft from automobiles share certain characteristics that make reliable prediction more likely.[105]

Significant research has been done on residential burglary, which has consistently demonstrated a near-repeat pattern.[106] In the most exhaustive

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101 See *infra* Part I.2.a.

102 See *infra* Part I.2.b.

103 Bowers & Johnson, *supra* note 62, at 12 ("Research demonstrates that prior victimisation is a very good predictor of future risk and that when it occurs, repeat victimisation tends to occur swiftly." (citations omitted)).

104 CAPLAN ET AL., *supra* note 79, at 2 ("Near repeat refers to when a crime incident occurs nearby a precursory crime location within a specific period of time. Near repeat analysis adds a temporal aspect to point pattern and hotspot analysis by suggesting—with a certain level of statistical confidence, that new crimes happen within a certain distance of past crimes and within a certain period of time from the prior incident.").

105 Bernasco, *supra* note 78, at 412; Bowers & Johnson, *supra* note 62, at 13 ("[T]he (communicated) risk of burglary to nearby properties (within 400m of each other) was shown to be elevated for a short period of time, typically one-month, after which risks returned to pre-event levels. This pattern of space–time clustering has been referred to as the 'near repeat' phenomenon to reflect the association with repeat victimisation."); Johnson et al., *supra* note 91, at 215; Jerry H. Ratcliffe & George F. Rengert, *Near-Repeat Patterns in Philadelphia Shootings*, 21 SECURITY J. 58, 58 (2008) ("The near-repeat phenomenon states that if a location is the target of a crime such as burglary, the homes within a relatively short distance have an increased chance of being burgled for a limited number of weeks.").

106 *See, e.g.*, GRAHAM FARRELL & KEN PEASE, ONCE BITTEN, TWICE BITTEN: REPEAT VICTIMISATION AND ITS IMPLICATIONS FOR CRIME PREVENTION 21 (Gloria Laycock ed., 1993); Bernasco, *supra* note 78, at

study of ten different jurisdictions across an international spectrum, residential burglaries showed a near-repeat phenomenon despite different cultural environments.[107] Specifically, a successive burglary occurred within 100 meters and two weeks of the initial burglary at a statistically significant rate.[108] Noting the near-repeat studies, one scholar stated, "[B]urglary victimization appears to be contagious. In the wake of a burglary, properties near the victim's property run heightened burglary risks as well."[109] Studies from England and Canada show that the chance of near-repeat burglary victimization is four[110] to twelve[111] times higher than a random occurrence. While not definitive, these statistics show a pattern that might be useful for predicting future burglaries.[112] In fact, some proponents of predictive policing argue that with the appropriate technology they can "predict and deter about 15 percent of burglaries" in a given area.[113]

Two theories have been put forth to explain why the near-repeat phenomenon occurs in residential burglaries.[114] Flag theory posits that some properties are vulnerable and "effectively advertise their vulnerability."[115] Flag theory applied to burglaries means that "burglaries at the same location may simply be the work of different offenders who respond to similar signals of

412; Bowers & Johnson, *supra* note 62, at 12; Chainey et al., *supra* note 75, at 11, 19; Johnson et al., *supra* note 91, at 215.

107 Johnson et al., *supra* note 91, at 206–14, 215 ("[F]or every data set analyzed, more burglaries occurred close to each other in space *and* time than would be expected on the basis of chance, and the size of the effect typically conformed to expectation. It is important to note that the results do more than confirm that burglary clusters in space. They also demonstrate that when a burglary occurs at one location, a further burglary is likely to occur nearby and that it will do so swiftly. As time elapses, this communication of risk decays.").

108 *Id.* at 210.

109 Bernasco, *supra* note 78, at 414.

110 FARRELL & PEASE, *supra* note 106, at 21 (citing DAVID FORRESTER ET AL., THE KIRKHOLT BURGLARY PREVENTION PROJECT, ROCHDALE 9 (Kevin Heal ed., 1988)) ("[O]nce a house has been burgled, its chance of repeat victimisation was four times the rate of houses that had not been burgled at all.").

111 *Id.* at 8 (noting that one study in Saskatoon, Canada found that "'[t]he likelihood of a repeat burglary within one month was over twelve times the expected rate, but this declined to less than twice the expected rate when burglaries six months apart were considered. Analysis of the repeat burglaries within one month showed that half of the second victimisations occurred within seven days of the first'" (quoting Natalie Polvi et al., *The Time Course of Repeat Burglary Victimization*, 31 BRIT. J. CRIMINOLOGY 411, 412 (1991))).

112 *See* Bernasco, *supra* note 78, at 427–28 (suggesting that, based on the author's research, "if you want to prevent burglaries, focus on recently burgled properties and victims as well as on nearby properties and residents, react very quickly, and allocate resources elsewhere when the elevated risk has decreased").

113 Beiser, *supra* note 56.

114 Ashley B. Pitcher & Shane D. Johnson, *Exploring Theories of Victimization Using a Mathematical Model of Burglary*, 48 J. RES. CRIME & DELINQ. 83, 85–86 (2011) (discussing the flag and boost theories behind the near-repeat phenomenon).

115 Bowers & Johnson, *supra* note 62, at 12.

target attractiveness or accessibility. Attractive opportunities are overtly flagged for all to see."[116] Boost theory, in contrast, argues that repeat victimization occurs because some information learned by the original offenders enhances (boosts) the vulnerability of the home.[117] As one article has described:

> The rationale . . . was that having burgled one property, offenders would become more familiar with and, consequently, target nearby households. Good reasons for this hypothesis exist. For instance, houses nearest to each other are likely to share more features that may inform offender targeting decisions than those located further away. Such features include access and escape routes, internal and external architectural layouts, levels of natural surveillance, and the availability of desirable goods. As already noted, the results of the studies validated the hypothesis, demonstrating that burglary clusters in space and time.[118]

One reason for repeat victimization may be simply that it is the same individuals or gangs committing the crimes.[119] One researcher "found that 76% of the burglars he interviewed had gone back to a number of houses after a varying period of time to burgle them between two and five times."[120] However, the research also suggests that the boost theory may account for the change.[121] Essentially, certain kinds of crime might be considered communicable, like a contagious virus that infects not only the particular

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[116] Shane D. Johnson, *Repeat Burglary Victimisation: A Tale of Two Theories*, 4 J. EXPERIMENTAL CRIMINOLOGY 215, 217 (2008) (Neth.) (emphasis omitted).

[117] *See* Bowers & Johnson, *supra* note 62, at 12; Johnson, *supra* note 116, at 216; *see also* M.B. Short et al., *Measuring and Modeling Repeat and Near-Repeat Burglary Effects*, 25 J. QUANTITATIVE CRIMINOLOGY 325, 326 (2009) (noting that "event dependence suggests that some aspect of the burglar's previous experience victimizing the house increases their [sic] preference to return").

[118] Bowers & Johnson, *supra* note 62, at 13.

[119] Bernasco, *supra* note 78, at 423–25 (concluding that "both repeat burglaries and near repeat burglaries are much more likely to involve the same offender than are spatially or temporally unrelated burglaries"); Johnson et al., *supra* note 97, at 194 ("[F]or repeat burglary victimization, detected events were almost always cleared to the same offender. Moreover, events that occurred closest to each other in space and time were those most likely to involve one or more of the same offenders.").

[120] Johnson et al., *supra* note 91, at 204 (citing U. Ericsson, *Straight from the Horse's Mouth*, 43 FORENSIC UPDATE 23 (1995) (U.K.)).

[121] Bowers & Johnson, *supra* note 62, at 13 ("Consideration of the reasons typically given by offenders for returning to the same properties suggests that these are bounded by rational choices that are entirely commensurate with the boost account. These include familiarity with the house layout, the risks involved, and the known availability of saleable goods. Thus, the overwhelming evidence from the research undertaken is that the same perpetrators are responsible for the bulk of offences against the same target." (citation omitted)).

burglarized property, but also those in close proximity.[122] In boost theory, information about an environmental vulnerability spreads and a subsequent crime occurs because of that spread.[123] If accurate, this type of information can inform predictive theories and direct police resources to stop the spread of burglaries.[124]

Two caveats must be mentioned about these studies. First, while other crimes such as automobile theft[125] and theft from automobiles[126] have been analogized to residential burglary as having similar near-repeat effects, not all crime fits this category. Residences are not only fixed, but nearby residences may share similar designs, demographic factors, transportation infrastructures, housing density, and lighting issues.[127] Such similarities may not exist for other crimes.[128] The second limitation in the studies recognizes the temporal

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[122] *Id.* ("[R]esearch . . . suggests that the risk of victimisation is communicable, with the risk of victimisation following an initial burglary not only affecting the burgled home but, in a similar way to the spread of a communicable disease, also extending to properties nearby." (citations omitted)); *see* Johnson, *supra* note 116, at 216 ("The initial offence *boosts* the future likelihood of victimisation, and hence the observed correlation between historic and prospective victimisation is due to a contagion-like process." (citation omitted)).

[123] Bowers & Johnson, *supra* note 62, at 12 ("Thus, following an initial crime, the risk of victimisation is 'boosted.' Here, the assumption is that the same offender, or group of offenders, will be involved in the crime series and that experience gained during the first event is put to use later." (citation omitted)).

[124] *See* Johnson et al., *supra* note 91, at 202 ("The pattern of clustering in time and space has significant implications for the extent and choice of crime prevention measures as well as the value of any predictive work that could influence detection activity.").

[125] *See* Bernasco, *supra* note 78, at 412 ("It has recently been suggested that the elevated risk in the aftermath of victimization may spill over to the social and spatial environment. It was demonstrated that, in the wake of a domestic burglary, not only the property itself but also properties near the victimized property have an elevated burglary risk, and similar findings have been reported with respect to shootings and vehicle crime." (citations omitted)).

[126] *See* Johnson et al., *supra* note 97, at 197 ("The finding that TFMV [theft from motor vehicles] conforms to the same pattern as burglary suggests that this approach of *prospective mapping* may be useful for this type of crime also."); Johnson et al., *supra* note 91, at 216–17 ("Other acquisitive crimes such as theft from automobile are likely to share motivational factors with burglary and are committed with a high enough frequency to warrant study.").

[127] *See* Johnson et al., *supra* note 91, at 216 ("Besides housing density and transportation infrastructure, the communication of risk may also be influenced by social, demographic and physical factors that characterize residential areas.").

[128] *See* Johnson, *supra* note 116, at 236 ("To illustrate, consider that as homes are stationary, any burglar can decide to return to a preferred location so long as he can remember where it is. In the case of street robbery, an offender may not remember exactly what a particular victim looked like, or know where they are next likely to encounter them. Thus, in the case of the latter, the convergence in space and time of the victim and offender will often be the result of a more complex process over which the offender may have little control. In such cases, the contribution of a boost process (as currently conceived) may be small, and patterns of concentration at the victim level may be more strongly influenced by stable individual differences across potential victims." (footnote omitted)).

limitation of the near-repeat phenomenon.[129] A consistent finding in the studies was that "a large number of repeat incidents occur within 1 week of an antecedent, and the risk of repeat victimisation appears to decay over time."[130] Thus, any predictions of future burglaries would have to be within this limited window.

The conclusion from this brief overview is that the near-repeat pattern can be validated for some types of crime, but has not been for others. In fact, the very reason why the theory might work for property crimes, such as burglary and automobile theft, may make it inappropriate to apply to other interpersonal or violent crimes that are not so place-based. Similarly, while there has been consistency within the jurisdictions tested, this does not mean that the theory would hold for all jurisdictions.[131] Finally, it is important to note the relatively few studies done, and thus there is a justifiable caution about expanding the findings beyond the carefully controlled study areas.

b. Risk Terrain Modeling

A second predictive theory involves what is called risk terrain modeling. "[R]isk terrain modeling (RTM) offers a way of looking at criminality as less determined by previous events and more a function of a dynamic interaction between social, physical and behavioral factors that occurs at places."[132] RTM identifies particular risk factors for crime and maps them with a multi-layered computer mapping system.[133] As described by its creators:

> RTM assigns a value signifying the presence, absence or intensity of each risk factor at every place throughout a given geography. Each

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[129] *See* FARRELL & PEASE, *supra* note 106, at 22 ("From the time-course analysis, for maximum preventive effect, [resources] must be in place within twenty four hours. After victimisation there exists a 'heightened risk period' for revictimisation. The risk declines with time as the time-course smooths out at a low-level of revictimisation, and so a late response is less efficient to the point of uselessness."); Johnson, *supra* note 116, at 215–16 (finding that research shows that repeat victimization is a good indicator of future victimization, at least under short time frames).

[130] Johnson, *supra* note 116, at 226 & fig.2 (showing results indicating more repeat burglaries in the first two weeks than in later weeks); *accord* Pitcher & Johnson, *supra* note 114, at 85 ("[W]hen repeat burglary victimization occurs, it is more likely to do so swiftly than after some time has elapsed. In fact, the time course of repeat victimization fits an exponential decay function rather well. More recent work suggests that this phenomenon extends to nearby homes such that when one house is victimized, those nearby also appear to experience a temporary elevation in risk. When this occurs, it has been referred to as a *near repeat*." (citations omitted)).

[131] Almost all the studies mentioned in this Article caution against extrapolating too far from the findings included under the limited tests conducted.

[132] Kennedy et al., *supra* note 35, at 342.

[133] Caplan, *supra* note 87, at 68.

> factor is represented by a separate terrain (risk map layer) of the same geography. When all map layers are combined in a GIS [Geographic Information System], they produce a composite map—a risk terrain map—where every place throughout the geography is assigned a composite risk value that accounts for all factors associated with the particular crime outcome. The higher the risk value the greater the likelihood of a crime event occurring at that location.[134]

For example, in analyzing burglaries in Morris County, New Jersey, an RTM map was created using five variables: "(1) past burglaries, (2) the residential location of individuals arrested for theft or burglary between 2009 and 2011, (3) the proximity to major highways, (4) the geographic concentration of males between the ages of 16 and 24,[135] and (5) the location of apartment complexes and hotels."[136] The result led police administrators to redirect available police resources to those identified locations and ultimately to an overall decrease in both general crime and more specifically violent crime and property crime.[137] By isolating variables that correspond with past crimes and environmental factors, RTM was able to focus attention on the likely areas of criminal activity.

Beyond residential burglary, risk terrain modeling has been applied to violent crimes,[138] including shooting patterns in Newark, New Jersey[139] and Irvington, New Jersey.[140] Notably, by applying the theory to interpersonal and violent crime, RTM has broadened the reach of the predictive policing

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134 Kennedy et al., *supra* note 35, at 343.

135 Certain criteria used in data analysis could be critiqued as leading to gender or racial profiling. From an analyst's perspective, these data points are based on statistical correlations from past crime data. From a legal perspective, these types of profiles, while questionable, have not been deemed unconstitutional. *See infra* Part II.B.1.

136 Paul & Joiner, *supra* note 38, at 7.

137 *Id.*

138 Some near-repeat analysis holds for violent crimes. *See* CAPLAN ET AL., *supra* note 79, at 2–3 (noting that near-repeat analysis is useful in the "immediate aftermath of a new violent criminal event," and the validation of "nearest neighbor analysis and hotspot maps that violent crime incidents cluster spatially and temporally" (emphasis omitted)).

139 Kennedy et al., *supra* note 35, at 345–46 (noting that, to predict future shootings, researchers identified "seven risk layers that [they] believed would accurately forecast the locations of shooting incidents in Newark: locations of drug arrests, proximity to 'at-risk' housing developments, 'risky facilities,' locations of gang activity, known home addresses of parolees previously incarcerated for violent crimes and/or violations of drug distribution laws, locations of past shooting incidents, and locations of past gun robberies").

140 XU ET AL., *supra* note 37, at 2 ("Gun shootings are not randomly distributed throughout a terrain; but rather, are concentrated in a statistically significant way around certain features. In Newark and Irvington, these features are middle and high schools, bus stops, and public housing.").

model.[141] As a comparative academic matter, risk terrain modeling appears to predict future shooting incidents better than hotspot analysis.[142] As a practical matter for law enforcement attempting to address what would seem to be more geographically random types of crimes like shootings, RTM seems to offer great promise. For example, RTM researchers who studied shootings in Irvington, New Jersey describe:

> [Research indicates] four risk factors that previous empirical research found to be correlated with shooting incidents: Gang members; bus stops; schools; and facilities of bars, clubs, fast-food restaurants, and liquor stores.
>
> [Risk terrain modeling] . . . of places in Irvington that share the locations and spatial influences of all aforementioned shooting risk factors has high predictive validity. . . . [F]or every increased unit of risk, the likelihood of a shooting more than doubles . . . . Stated another way, the likelihood of a shooting happening at particular 100-foot-by-100-foot places in Irvington during 2007 increases by 143 percent as each additional risk factor affects that place.
>
> Looked at in a different way . . . more than 42 percent of all shooting incidents occurred in the top 10 percent of the highest risk places during calendar year 2007 . . . .[143]

While there may be some debate about the variables included in the algorithm, what would otherwise be considered random shootings were actually able to be predicted to a large degree.[144] While studies are limited and the technology new, one can see the attraction of this type of innovation that potentially reduces violent crime, as well as property crime.

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[141] *See id.* at 2–3.

[142] Caplan et al., *supra* note 93, at 374 ("As much as 21% more shootings occurred in high-risk cells predicted by the risk terrain map compared to the retrospective map. . . . The risk terrain innovation therefore doubles the number of shooting incident locations that were correctly predicted compared with the conventional approach."); Kennedy et al., *supra* note 35, at 352 ("[T]he risk terrain model outperformed retrospective maps across each high risk cell designation method and across all time periods.").

[143] Caplan, *supra* note 87, at 69–70 (citations omitted).

[144] *See* Caplan et al., *supra* note 93; Kennedy et al., *supra* note 35, at 344 (recognizing issues central to the validity of RTM including (1) "selection criteria used in determining which risk layers to include in risk terrain models" and (2) "best model[s]"); *New Technique Predicts Crime Risk*, INFORMANT (Kansas City Mo. Police Dep't, Kansas City, Mo.), Aug. 2010, at 1 ("[Risk terrain modeling] attempts to predict where crime will happen and then address it before it does. RTM uses crime-mapping software the police department already has but takes it to another level. Instead of just including historical information about crime hotspots, it incorporates a variety of other factors (like vacant buildings, where parolees live, or almost any other factor imaginable) to create a map that highlights areas at highest risk for crime.").

Risk terrain mapping for shootings offers two insights similar to the near repeat theory for residential burglaries. First, some predictions are focused on the offenders themselves who might engage in repeated or retaliatory actions.[145] The violent actions occur in a social fabric and patterns of risk are also communicable as gang reacts to gang, or individuals seek revenge on one another.[146] Second, some of the reasons for the violence are due to environmental factors that make those locations more conducive to shootings.[147]

This summary shows that sophisticated mapping and analysis technologies exist that may be able to address a broader range of crimes. Jurisdictions may adapt predictive policing techniques beyond property-based crimes to more complex and serious violent crimes. The question that remains, of course, is not whether these analytical models should be used, but whether law enforcement practices arising from these analyses will be applied consistently with constitutional rights.

B. Predictive Policing: Future Cases

While beyond the scope of this paper, predictive policing models are also being considered to address other identifiable risk environments. Predictive models can be used to locate areas for heightened surveillance or to mitigate risk by removing or altering environmental dangers.[148] In addition, predictive models are being used to target known human risk factors such as criminal gangs.[149] For example, one study has applied the place-based approach to gangs that also exist in an established (and usually contested) territorial geographic area.[150] It has not been determined whether the models hold for

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[145] Kennedy et al., *supra* note 35, at 347 ("Newark Police personnel identified two offender types as playing prominent roles in shootings: Gang members and parolees previously incarcerated for violent crime and/or drug distribution.").

[146] *See* Bernasco, *supra* note 78, at 412 ("Patterns of risk communication might also operate in social networks, so that family members, friends, classmates or colleagues of victims are 'infected' with a temporarily elevated risk of victimization.").

[147] CAPLAN ET AL., *supra* note 79, at 3 ("Risk terrain maps can be used to forecast areas with the greatest potential for violent crimes to occur in the future, not just because police statistics show that similar crimes occurred there in the past, but because the environmental conditions are ripe (if they remain unchanged) for violent crimes to occur there tomorrow.").

[148] This might include the placement of video surveillance systems or even aerial drone cameras.

[149] Vince Beiser, *Criminal Intent*, WIRED, Dec. 2011, at 60 (finding that police in Minneapolis, Minnesota could target gang activity near libraries because of gang member use of free internet access at local libraries).

[150] Joel Rubin, *UCLA Does the Math on Gang Crimes*, L.A. TIMES, Nov. 1, 2011, at AA3.

these types of crimes, but some jurisdictions are considering the possibilities.[151]

In addition, one could imagine that predictive policing models could also be established for individuals, or at least individuals on probation or parole.[152] In some jurisdictions, predictive evaluations of recidivism are factored into prison release monitoring.[153] In others, researchers are testing statistical models for recidivism of pretrial defendants.[154] The question remains whether one could really predict an individual's future crime without running into the limitations of a probability-based crime system. As predictive policing is still just being implemented under a property-based crime model, this Article does not analyze these future concerns, but merely raises them for consideration.

The next Part contextualizes the idea of prediction in the Fourth Amendment by looking at the various potential theories under which predictive policing could be analyzed.

II. PREDICTION AND THE FOURTH AMENDMENT

The Fourth Amendment protects against unreasonable searches and seizures, establishing both a reasonableness requirement and a warrant

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[151] M. Todd Henderson et al., *Predicting Crime*, 52 ARIZ. L. REV. 15, 27–28 (2010) ("In their book *Is Crime Predictable?*, Carolyn Block and Sheryl Knight attempt to predict future trends in specific types of crime based on data gathered from past criminal activity taking place in the Chicago area. The predictive accuracy of their model varied widely depending on the type of crime in question. For example, rates of larceny and theft were by far the most predictable, with the number of offenses in eleven cities predicted within 10% for the year 1982. In contrast, there were accurate predictions of burglary in only three out of the fourteen cities studied, and predictive success for aggravated assault varied widely, from very accurate predictions to completely unpredictable, depending on the city in question." (footnotes omitted)).

[152] Casady, *supra* note 36, at 1 ("Parolees, probationers, and registered sex offenders have been identified in computer databases, and their homes, workplaces, and treatment centers can be geographically mapped. We can visualize, measure, and define concentrations of such past offenders. We can also predict who is at greatest risk for criminal behavior—unemployed young men, gang members, or chronic truants, for example."); *cf.* Eric S. Janus & Robert A. Prentky, *Forensic Use of Actuarial Risk Assessment with Sex Offenders: Accuracy, Admissibility and Accountability*, 40 AM. CRIM. L. REV. 1443, 1454 (2003) (discussing the use of the actuarial method of risk assessment to determine the likelihood of recidivism in sex offenders).

[153] *E.g.*, Nadya Labi, *Misfortune Teller*, ATLANTIC, Jan./Feb. 2012, at 18, 19 (discussing Professor Richard Berk's work in predicting recidivism rates of parolees in Pennsylvania).

[154] *See, e.g.*, Shima Baradaran & Frank L. McIntyre, *Predicting Violence*, 90 TEX. L. REV. 497, 500–01, 522–24 (2012); Richard Berk, *Balancing the Costs of Forecasting Errors in Parole Decisions*, 74 ALB. L. REV. 1071, 1074 (2010/2011); *see also* Paul H. Robinson, Commentary, *Punishing Dangerousness: Cloaking Preventive Detention as Criminal Justice*, 114 HARV. L. REV. 1429, 1432 (2001) (discussing the shift towards the incarceration of dangerous offenders).

requirement for most searches, seizures, and arrests.[155] In order to interfere with a person's Fourth Amendment rights, law enforcement officers must have either probable cause to search or reasonable suspicion to seize an individual.[156] To establish that there is reasonable suspicion for a stop, police must "be able to point to specific and articulable facts which, taken together with rational inferences from those facts, reasonably warrant that intrusion."[157] Many times determining what is "reasonable" or whether sufficient probable cause exists in a given case involves a predictive judgment by a judge or law enforcement official.

In the search warrant context, a magistrate judge may have to determine whether "there is a fair probability that contraband or evidence of a crime will be found in a particular place."[158] That fair probability is a prediction based on available information.[159] It is always possible that the contraband will be gone, but there is a prediction that police will find it.[160] The prediction usually includes a temporal element because information can grow stale.[161] In addition, it is usually particularized to a specific area or person to be searched. The controlling standard of probable cause, as the name suggests, turns on probabilities.[162] Predicting those probable outcomes rests on predictive guesses about whether the evidence or person sought will be at a particular location at a particular time.[163]

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155 U.S. CONST. amend. IV.

156 *Id.*

157 Terry v. Ohio, 392 U.S. 1, 21–22 (1968) (defining the question of reasonable suspicion as whether "the facts available to the officer at the moment of the seizure or the search 'warrant a man of reasonable caution in the belief' that the action taken was appropriate").

158 Illinois v. Gates, 462 U.S. 213, 238 (1983).

159 *See* United States v. Grubbs, 547 U.S. 90, 95 (2006).

160 *Id.* ("In the typical case where the police seek permission to search a house for an item they believe is already located there, the magistrate's determination that there is probable cause for the search amounts to a prediction that the item will still be there when the warrant is executed.").

161 *Id.* at 95 n.2 ("[T]he probable-cause showing may have grown 'stale' in view of the time that has passed since the warrant was issued.").

162 Brinegar v. United States, 338 U.S. 160, 175–76 (1949) (defining probable cause).

163 *Grubbs*, 547 U.S. at 94. In fact, the availability of "anticipatory warrants" in which there is "probable cause that at some future time (but not presently) certain evidence of crime will be located at a specified place," demonstrates the central role of predictive judgments. *Id.* (quoting 2 WAYNE R. LAFAVE, SEARCH AND SEIZURE § 3.7(c), at 398 (4th ed. 2004)). As long as there is a fair probability that evidence of the crime will occur in a particular place (because of triggering conditions that also have a fair probability of occurring) then probable cause has been established. *Id.* at 95.

In non-warrant situations, prediction is also a critical element of analysis. Police officers regularly take action in anticipation of criminal activity.[164] Stakeouts, ongoing surveillance, and undercover investigations focus not only on past crimes, but also future crimes.[165] On the street, a *Terry* stop based on reasonable suspicion that "criminal activity may be afoot" is at base a prediction that the facts and circumstances warrant the reasonable prediction that a crime is occurring or will occur.[166] Again, the controlling legal standard speaks in terms of predictive considerations.[167] In others words, to justify a stop, the police have to predict that a person is actively committing a crime. That prediction comes from the available information, which in turn involves a judgment about the information's quality, source, and reliability among other factors.[168] The same temporal and individualized requirements exist, as does the recognition that sometimes the predictions are wrong.[169]

As will be discussed in the next sections, this predictive analysis changes depending on whether the prediction focuses on specific individuals suspected of crimes, identifiable groups suspected of criminal activity, or areas that generate criminal activity.[170] Because there are as of yet no reported cases on predictive policing in the Fourth Amendment context, this Part looks at possible analogies from which to analyze the constitutional issues. The focus is to distill principles to analyze the potential issues with predictive policing.

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164 *See* Daniel J. Steinbock, *Data Matching, Data Mining, and Due Process*, 40 GA. L. REV. 1, 38 (2005) ("The Fourth Amendment permits interferences with liberty and privacy based on predictions, often made by field officers, without notice to or consultation with the suspect.").

165 *See* Andrew E. Taslitz, *Fortune-Telling and the Fourth Amendment: Of Terrorism, Slippery Slopes, and Predicting the Future*, 58 RUTGERS L. REV. 195, 201 (2005) ("What is less often emphasized is that *Katz* faced the Justices with the question whether it is possible to authorize a search for non-existent evidence—evidence that may or may not come into being in the future. Specifically, [*Katz*] involved the warrantless use of an electronic listening and recording device attached to the outside of a telephone booth to monitor expected conversations concerning illegal gambling.").

166 Terry v. Ohio, 392 U.S. 1, 30–31 (1968); *accord* United States v. Sokolow, 490 U.S. 1, 7 (1989) ("[P]olice can stop and briefly detain a person for investigative purposes if the officer has a reasonable suspicion supported by articulable facts that criminal activity 'may be afoot,' even if the officer lacks probable cause." (quoting *Terry*, 392 U.S. at 30)); *see also id.* ("The Fourth Amendment requires 'some minimal level of objective justification' for making the stop." (quoting INS v. Delgado, 466 U.S. 210, 217 (1984))).

167 Illinois v. Gates, 462 U.S. 213, 241 (1983) ("[P]robable cause deals 'with probabilities.'" (quoting *Brinegar*, 338 U.S. at 175)).

168 Alabama v. White, 496 U.S. 325, 330 (1990) ("Reasonable suspicion, like probable cause, is dependent upon both the content of information possessed by police and its degree of reliability. Both factors—quantity and quality—are considered in the 'totality of the circumstances—the whole picture' that must be taken into account when evaluating whether there is reasonable suspicion." (quoting United States v. Cortez, 449 U.S. 411, 417 (1981))).

169 As with the nature of all probabilities, some predictions will be wrong.

170 *See infra* Part II.

First, focusing on prediction of specific individuals, the next section looks at "tip cases" in which police are provided a predictive tip that an individual will commit a crime or is committing a crime. The second section focuses on group suspicion and the use of "profiles" to predict future or current criminal activity at a location. The third section analyzes the courts' use of the "high crime area" designation to weigh suspicion in certain designated areas of predicted criminal activity.

While none of the analogies fit perfectly, they all independently point to the same outcome. Predictive policing technologies will alter Fourth Amendment reasonable suspicion analysis, adding to the totality of circumstances from which courts can find reasonable suspicion for a seizure. As will be discussed, following current precedent, predictive policing forecasts will end up being seen as a "plus factor" to find reasonable suspicion. However, the use of predictive policing forecasts alone will not constitute sufficient information to justify reasonable suspicion or probable cause for a Fourth Amendment seizure.

A. Tips: Predicting Criminal Activities of Specific Individuals

Most police investigation focuses on individual suspects. Perhaps police observation reveals criminal activity, perhaps police receive an informant tip, or perhaps circumstantial evidence suggests police focus on a particular individual. No matter the method of investigation, at some point police will need to interfere with the liberty interests of the individual and, thus, create a tension with Fourth Amendment protections.[171] Determining the level of suspicion necessary for a reasonable stop, seizure, or arrest is a predictive judgment. The legal standards of probable cause and reasonable suspicion are based on predicting probable outcomes from past information.[172]

To analyze the intersection of prediction and reasonable suspicion, it is useful to look at the anonymous tip and informant tip cases of the Supreme Court. As will be discussed, one way to analyze the constitutionality of predictive policing technologies is to consider the predictive algorithm

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[171] *See* Florida v. Riley, 488 U.S. 445, 463–64 (1989) (Brennan, J., dissenting) ("Justice Frankfurter once noted that '[i]t is a fair summary of history to say that the safeguards of liberty have frequently been forged in controversies involving not very nice people,' and nowhere is this observation more apt than in the area of the Fourth Amendment, whose words have necessarily been given meaning largely through decisions suppressing evidence of criminal activity." (alteration in original) (quoting United States v. Rabinowitz, 339 U.S. 56, 69 (1950) (Frankfurter, J., dissenting))).

[172] *See supra* notes 156–67 and accompanying text.

analogous to a data-driven "tip" that crime will occur. While the analogy is inexact, one could imagine a parallel situation to the predictive policing forecast, in which an informant calls police to predict that drugs will be sold on a certain block at a certain time, or that a particular house will be burglarized. How courts evaluate that human tip will inform how they might consider the predictive computer tip.

1. Anonymous Tip Cases

The Fourth Amendment requires reasonable suspicion to stop a specific individual based on a tip. The Supreme Court has stated that "an informant's 'veracity,' 'reliability,' and 'basis of knowledge'—remain 'highly relevant in determining the value'" of the tip.[173] This legal standard derives from *Illinois v. Gates*, the Supreme Court's seminal case on probable cause involving an anonymous informant.[174]

Gates, like many predictive cases, involved a prediction that certain contraband would be in the possession of two specific, named individuals who had been identified through an anonymous letter.[175] In *Gates*, police had no information about the informer or the basis of knowledge about the tip,[176] however, many of the details in the tip accurately predicted future events.[177] This corroboration of predicted actions observed by police officers created probable cause to justify the search.[178] *Gates* relied on *Draper v. United States*,[179] a case that also rested a finding of probable cause on the level of

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[173] *White*, 496 U.S. at 328–29 ("*Gates* made clear, however, that those factors that had been considered critical under *Aguilar* and *Spinelli*—an informant's 'veracity,' 'reliability,' and 'basis of knowledge'—remain 'highly relevant in determining the value of his report.' These factors are also relevant in the reasonable-suspicion context, although allowance must be made in applying them for the lesser showing required to meet that standard." (quoting Illinois v. Gates, 462 U.S. 213, 230 (1983))).

[174] *Gates*, 462 U.S. at 231–32 ("'The process does not deal with hard certainties, but with probabilities. Long before the law of probabilities was articulated as such, practical people formulated certain common-sense conclusions about human behavior; jurors as factfinders are permitted to do the same—and so are law enforcement officers. Finally, the evidence thus collected must be seen and weighed not in terms of library analysis by scholars, but as understood by those versed in the field of law enforcement.'" (quoting United States v. Cortez, 449 U.S. 411, 418 (1981))).

[175] *Id.* at 225.

[176] *Id.*

[177] *Id.* at 226–27.

[178] *Id.* at 246; *see also id.* at 241 ("Our decisions applying the totality-of-the-circumstances analysis outlined above have consistently recognized the value of corroboration of details of an informant's tip by independent police work.").

[179] *Id.* at 242–43.

corroborated detail in a predictive tip.[180] In *Draper*, the anonymous informant accurately predicted the city, train, and physical and clothing description of the suspect who was thought to be carrying narcotics.[181] The Supreme Court reasoned that such detailed predictive information demonstrated that the informant had inside information about the suspect and the crime and, thus, the tip was reliable.[182] Both *Gates* and *Draper* stand for the proposition that detailed, individualized prediction corroborated by police observation can support a finding of probable cause.[183] The predictive judgment of probable cause is to be considered in a non-technical manner usable by officers on the street.[184] This analysis also has been adopted to govern the reasonable suspicion calculus for informant tips.[185]

The Supreme Court has explicitly addressed informant tips and reasonable suspicion in two major cases, providing both support and establishing limits for the use of informant tips. First, in *Alabama v. White*, an anonymous tip that was corroborated by some predictive details was found to be just enough to establish reasonable suspicion.[186] In *White*, police received an anonymous call stating that the suspect would be leaving a particular apartment at a particular time in a particular "brown Plymouth station wagon with the right taillight lens broken, [and] that she would be going to Dobey's Motel, and that she would be in possession of about an ounce of cocaine inside a brown attaché case."[187] Following up on the tip, police observed the brown Plymouth station wagon with a broken taillight at the correct address and "[t]hey followed the vehicle as it drove the most direct route to Dobey's Motel. When the vehicle reached

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180 Draper v. United States, 358 U.S. 307, 313–14 (1959).

181 *Id.*

182 *Id.* It is important to note the details involved. The tip in *Draper* was not that there would be a man carrying drugs, but rather the following:

> Draper would arrive in Denver on a train from Chicago on one of two days, and that he would be carrying a quantity of heroin. The informant also supplied a fairly detailed physical description of Draper, and predicted that he would be wearing a light colored raincoat, brown slacks, and black shoes, and would be walking "real fast."

Gates, 462 U.S. at 242 (quoting *Draper*, 358 U.S. at 309).

183 *Gates*, 462 U.S. at 245–46; *Draper*, 358 U.S. at 313–14.

184 *Gates*, 462 U.S. at 231 ("Perhaps the central teaching of our decisions bearing on the probable-cause standard is that it is a 'practical, nontechnical conception.'" (quoting Brinegar v. United States, 338 U.S. 160, 176 (1949))).

185 *See infra* notes 187–97 and accompanying text.

186 Alabama v. White, 496 U.S. 325, 332 (1990) ("Although it is a close case, we conclude that under the totality of the circumstances the anonymous tip, as corroborated, exhibited sufficient indicia of reliability to justify the investigatory stop of respondent's car.").

187 *Id.* at 327.

the Mobile Highway, on which Dobey's Motel is located, Corporal Reynolds requested a patrol unit to stop the vehicle."[188] Police stopped the car and searched it with Ms. White's consent.[189]

Following the reasoning of *Gates*, the Supreme Court found the prediction detailed enough, timely enough, and individualized enough to justify reasonable suspicion.[190] The Court focused on the substantial corroboration of the tip:

> What was important was the caller's ability to predict respondent's *future behavior*, because it demonstrated inside information—a special familiarity with respondent's affairs. The general public would have had no way of knowing that respondent would shortly leave the building, get in the described car, and drive the most direct route to Dobey's Motel. Because only a small number of people are generally privy to an individual's itinerary, it is reasonable for police to believe that a person with access to such information is likely to also have access to reliable information about that individual's illegal activities.[191]

The Court emphasized that because there was a low degree of reliability and no information about the basis of knowledge, such a tip requires more corroboration to establish reasonable suspicion.[192] In other words, the weak reliability of the tip has to be compensated for with greater direct corroboration of predicted details.

In contrast, the Supreme Court later held an anonymous tip that did not involve predictive detail or inside information to be insufficient to justify reasonable suspicion for a stop.[193] In *Florida v. J.L.*, "an anonymous caller reported to the Miami-Dade Police that a young black male standing at a particular bus stop and wearing a plaid shirt was carrying a gun."[194] In response to this tip, "[o]ne of the officers approached J.L., told him to put his

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188 *Id.*

189 *Id.*

190 *Id.* at 331 ("Given the fact that the officers proceeded to the indicated address immediately after the call and that respondent emerged not too long thereafter, it appears from the record before us that respondent's departure from the building was within the timeframe predicted by the caller.").

191 *Id.* at 332.

192 *Id.* at 330 ("Thus, if a tip has a relatively low degree of reliability, more information will be required to establish the requisite quantum of suspicion than would be required if the tip were more reliable.").

193 Florida v. J.L., 529 U.S. 266, 268, 271 (2000) ("The anonymous call concerning J.L. provided no predictive information and therefore left the police without means to test the informant's knowledge or credibility.").

194 *Id.* at 268.

hands up on the bus stop, frisked him, and seized a gun from J.L.'s pocket."[195] As the Court acknowledged, while the general description of the suspect was predicted, "[a]part from the tip, the officers had no reason to suspect [J.L.] of illegal conduct. The officers did not see a firearm, and J.L. made no threatening or otherwise unusual movements."[196] The Court distinguished *White* because in *White*, the "tipster had inside knowledge about the suspect and therefore [it was reasonable for the police officer] to credit his assertion about the cocaine."[197] In *J.L.*, the prediction did not mention criminal action that was corroborated by police observation, and thus the prediction alone could not justify reasonable suspicion.[198]

Four important principles can be distilled from the Court's reliance on prediction in the context of anonymous informant tips. First, the prediction must be individualized not only to a specific person, but also to ongoing criminal activity of that specific person. Second, the predictive tip must be corroborated by police observation, which means corroboration of both the specific individual and the ongoing crime.[199] Third, the predictive value of the tip turns on the level of particularized detail involved in the prediction. Fourth, the timing of the prediction matters, as tips must be fresh to be useful.[200] These themes of individualization, corroboration, particularized detail, and timing are central to the Fourth Amendment analysis for reasonable suspicion.

2. Known Informant Tips

While focused on anonymous tips, the Court in *Gates* also recognized that known informant tips or police informant tips can sometimes be relied upon if there is a demonstrated history of reliability.[201] As the Court stated:

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195 *Id.*

196 *Id.*

197 *Id.* at 270.

198 *Id.* at 270–71.

199 Taslitz, *supra* note 165, at 203–04 ("But the Court has never entirely abandoned the individualized suspicion mandate for traditional criminal searches for evidence concerning currently non-existent crimes, and the Court has always required a relatively brief period of time between when suspicion arises and when the search or seizure must be executed.").

200 In *J.L.*, the timing of the tip to observation was quick, although there was no firm record established. *J.L.*, 529 U.S. at 268 ("Sometime after the police received the tip—the record does not say how long—two officers were instructed to respond. They arrived at the bus stop about six minutes later and saw three black males 'just hanging out [there].'" (alteration in original) (quoting Petition for Writ of Certiorari to the Supreme Court of Fla. at A-42, *J.L.*, 529 U.S. 266 (No. 98-1993))).

201 *See* Illinois v. Gates, 462 U.S. 213, 233 (1983); *see also* Adams v. Williams, 407 U.S. 143, 146 (1972) ("Applying these principles to the present case, we believe that Sgt. Connolly acted justifiably in responding to his informant's tip. The informant was known to him personally and had provided him with information in the

> If, for example, a particular informant is known for the unusual reliability of his predictions of certain types of criminal activities in a locality, his failure, in a particular case, to thoroughly set forth the basis of his knowledge surely should not serve as an absolute bar to a finding of probable cause based on his tip.[202]

In other words, established reliability can make up for a lack in basis of knowledge. Thus, the analysis of veracity, reliability, and basis of knowledge can be more easily evaluated in known informant cases because the reliability of the informant can be more easily judged.[203] In so holding, the Supreme Court, in *Gates* and later cases, recognized that the strength or weakness of a tip could be balanced by different levels of direct corroboration through observation. A weak, unreliable tip could be bolstered by more corroboration.[204] A strong, reliable tip needed less corroboration.[205] This balancing along a continuum of suspicion could be considered in the totality analysis.

As will be discussed, predictive policing may be more analogous to a known informant case. Assuming the predictive policing model is reliable, it may matter less that the basis of knowledge is difficult to prove.

B. Profiles: Predicting Criminal Activities Based on Shared Characteristics

Another predictive Fourth Amendment situation involves a suspicion that a person sharing certain common characteristics will be committing a crime. Most easily observed in "profiling" cases, certain shared characteristics or actions are thought to predict criminal activity in certain areas. Drug courier profiling, illegal immigration profiling, and group profiling have been addressed by courts, and they have generally been acknowledged as a relevant factor to be considered in determining reasonable suspicion.[206] For purposes of

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past. This is a stronger case than obtains in the case of an anonymous telephone tip. The informant here came forward personally to give information that was immediately verifiable at the scene.").

202 *Gates*, 462 U.S. at 233.

203 Where informants are known, however, a lesser degree of corroboration is required. *Compare Williams*, 407 U.S. at 146–47 (upholding a *Terry* stop based on an uncorroborated tip from a known and previously reliable informant), *with* Alabama v. White, 496 U.S. 325, 331–32 (1990) (holding that an anonymous tip justified a *Terry* stop because both innocent details and predictive information were corroborated). A known informant's reputation may be assessed, and he may be held accountable if his allegations turn out to be fabricated. *J.L.*, 529 U.S. at 270.

204 *See Williams*, 407 U.S. at 147.

205 *See id.*

206 *See, e.g.*, Florida v. Royer, 460 U.S. 491, 493 n.2 (1983) (plurality opinion) ("The 'drug courier profile' is an abstract of characteristics found to be typical of persons transporting illegal drugs.").

this section, the focus is on how courts have analyzed the predictive weight of this generalized suspicion in certain areas.[207] In addition, this section analyzes the use of pure probabilistic analysis for reasonable suspicion. While courts are reluctant to consider pure probabilities in evaluating the predictive value of generalized suspicion, there has been significant academic debate on the issue. Since predictive policing technology actually establishes a numerical probability that a particular area will be a place of potential crime, this line of reasoning will be addressed as well.

1. Profiling as Prediction

Courts regularly allow generalized suspicion in the form of group-based identifiers to justify a stop. In a robbery case, individuals who fit the witness's description of the suspect can be stopped.[208] On a known drug corner, individuals suspected of participating in a drug buy can be stopped.[209] At airports, train stations, and buses, people fitting general profiles for a drug courier can be stopped and questioned.[210] Along the border, individuals who are suspected of being illegal immigrants can be stopped.[211] Even the questionable practice of racial profiling can be considered a series of predictive suppositions that lead to suspicion.[212] As Bernard Harcourt has observed, "The

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[207] This section does not address the racial or class-based critiques of this form of identification. *See generally* R. Richard Banks, *Race-Based Suspect Selection and Colorblind Equal Protection Doctrine and Discourse*, 48 UCLA L. REV. 1075, 1083–88 (2001); Samuel R. Gross & Katherine Y. Barnes, *Road Work: Racial Profiling and Drug Interdiction on the Highway*, 101 MICH. L. REV. 651, 655 (2002); David A. Harris, *The Stories, the Statistics, and the Law: Why "Driving While Black" Matters*, 84 MINN. L. REV. 265, 273 & n.48, 274 (1999); Kevin R. Johnson, Essay, *How Racial Profiling in America Became the Law of the Land:* United States v. Brignoni-Ponce *and* Whren v. United States *and the Need for Truly Rebellious Lawyering*, 98 GEO. L.J. 1005, 1006–08 (2010); Sheri Lynn Johnson, *Race and the Decision to Detain a Suspect*, 93 YALE L.J. 214 (1983) [hereinafter Johnson, *Race and the Decision*]; Anthony E. Mucchetti, *Driving While Brown: A Proposal for Ending Racial Profiling in Emerging Latino Communities*, 8 HARV. LATINO L. REV. 1, 18 (2005).

[208] *See* Bernard E. Harcourt & Tracey L. Meares, *Randomization and the Fourth Amendment*, 78 U. CHI. L. REV. 809, 813 (2011). Courts naturally think of suspicion based on "group-based identifiers." *Id.*

[209] *Id.* ("[S]uspicion attaches to group-based traits, conditions, and behaviors; the police identify sets of individuals with motives, individuals who match a drug-courier profile, individuals who fit an eye-witness description, individuals who are in a specific location, or individuals who have the same blood type.").

[210] Tracey Maclin, *The Decline of the Right of Locomotion: The Fourth Amendment on the Streets*, 75 CORNELL L. REV. 1258 (1990); *see also* David Rudovsky, *The Impact of the War on Drugs on Procedural Fairness and Racial Equality*, 1994 U. CHI. LEGAL F. 237, 240.

[211] *See* United States v. Arvizu, 534 U.S. 266, 268–69, 277 (2002).

[212] *See* Tracey Maclin, *Race and the Fourth Amendment*, 51 VAND. L. REV. 333, 344–46 (1998). In other contexts, the Supreme Court has obliquely acknowledged the unconstitutionality of strict racial profiles, yet at the same time it has allowed racially based profiles to remain factors in the reasonable suspicion analysis. *Id.* at 344. This can most easily be seen in the border patrol stop cases in which race or perceived national origin can be a contextual factor in determining reasonable suspicion. Again, the underlying logic of these profiles is

fact is that the police do not profile on race alone. They also profile on car models, vehicle attributes, rental cars, stickers, location, direction, motorist appearance, age, etc. The police use these various attributes—as well as, possibly, race—to narrow down the pool of likely suspects."[213] Each of these Fourth Amendment police–citizen stops is based on a predictive judgment that the individual will be engaging in criminal activity. As will be discussed, courts have upheld the use of these profiles against repeated Fourth Amendment challenges.[214]

Most clearly, the Supreme Court has referenced the drug courier profile in several cases, without directly addressing the constitutionality of the predictive profile.[215] *United States v. Sokolow* recognized that a drug courier profile is not an irrelevant or inappropriate consideration that, taken in the totality of circumstances, can be considered in a reasonable suspicion determination.[216] *Sokolow* involved a young man traveling from Hawaii to Florida in the summer, with a two-day stay over. He purchased his tickets in cash and with what appeared to be a fake name.[217] While none of these factors alone were criminal or suspicious, together they fit a drug courier profile as established by the Drug Enforcement Agency.[218]

The Court in *Sokolow* acknowledged the probabilistic basis of the profile, but it avoided any sustained analysis of what level of probability was required.[219] As some critics have pointed out, "[T]he government fail[ed] to

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that at certain locations (the border), with certain crimes (smuggling), a predictive profile of a typical suspect is appropriate in determining reasonable suspicion for a particular suspect.

213 Bernard E. Harcourt, *Rethinking Racial Profiling: A Critique of the Economics, Civil Liberties, and Constitutional Literature, and of Criminal Profiling More Generally*, 71 U. CHI. L. REV. 1275, 1307 (2004) (emphasis omitted) (footnote omitted).

214 Steinbock, *supra* note 164, at 29–30 ("[A]lthough predictive profiling is not inconsistent with the Fourth Amendment, the factors used must indicate to the investigating officers (and, later, the reviewing court) the requisite degree of suspicion. Nothing suggests that these actors should defer to a computer algorithm for projecting that level of suspicion, but nothing rules out that possibility either." (footnote omitted)).

215 Ornelas v. United States, 517 U.S. 690, 692 (1996); United States v. Sokolow, 490 U.S. 1, 10 n.6 (1989); *id.* at 13 (Marshall, J., dissenting); INS v. Delgado, 466 U.S. 210, 215–17 (1984); Florida v. Royer, 460 U.S. 491, 493, 497–501 (1983) (plurality opinion); Reid v. Georgia, 448 U.S. 438, 440 (1980) (per curiam); United States v. Mendenhall, 446 U.S. 544, 547 n.1 (1980); *id.* at 551–57 (Stewart, J., concurring).

216 *Sokolow*, 490 U.S. at 10 (recognizing that drug courier profiles are not inappropriate to consider in determining reasonable suspicion).

217 *Id.* at 3–4.

218 *Id.* at 10 n.6 ("Agent Kempshall testified that respondent's behavior 'had all the classic aspects of a drug courier.' Since 1974, the DEA has trained narcotics officers to identify drug smugglers on the basis of the sort of circumstantial evidence at issue here." (citation omitted)).

219 *See id.* at 8 (recognizing that profiling based on probabilistic evidence can factor into the reasonable suspicion analysis); *see also id.* at 13 (Marshall, J., dissenting) ("Reflexive reliance on a profile of drug courier

provide empirical proof for its claim that the drug courier profile has reliable predictive value."[220] Further, others, including Justice Marshall in dissent, pointed out that even if predictive in the short run, the profiles have questionable utility since drug couriers will just change their behavior to avoid suspicion.[221] In other contexts, scholars have challenged the empirical basis of the predictive value of profiling and found it lacking.[222] Nevertheless, the current law from the Supreme Court and other courts recognizes that a predictive profile can be a relevant, if not controlling, factor for reasonable suspicion.[223]

The drug courier profile (and other profiles) exists as an example of predictive evidence, predicated on the belief that the "probability that a person who engages in the conduct highlighted by the profile is a drug courier is higher than the probability for the population at large."[224] As Judge Charles Becton has acknowledged in his article on drug courier profiling, the predictive value of profiles combines subjective "clinical predictions" that are individualized to a particular person with "statistical predictions" that are based on general formulas with "predetermined characteristics" of generic individuals.[225] This hybrid model gives significant power to the officers to

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characteristics runs a far greater risk than does ordinary, case-by-case police work of subjecting innocent individuals to unwarranted police harassment and detention.").

220 Maclin, *supra* note 212, at 359.

221 *Sokolow*, 490 U.S. at 14 n.1 (Marshall, J., dissenting) ("Even if such profiles had reliable predictive value, their utility would be short lived, for drug couriers will adapt their behavior to sidestep detection from profile-focused officers."); *cf.* Michael O. Finkelstein & Bruce Levin, *On the Probative Value of Evidence from a Screening Search*, 43 JURIMETRICS J. 265, 272 (2003) (concluding "profiles are somewhat predictive but not accurate enough to show a reasonable probability of crime, given the rarity of drug couriers").

222 Tracey L. Meares & Bernard E. Harcourt, *Foreword: Transparent Adjudication and Social Science Research in Constitutional Criminal Procedure*, 90 J. CRIM. L. & CRIMINOLOGY 733, 789–90 (2000) (analyzing New York City report on stop and frisks that found one arrest for every 7.3 *Terry* stops). *See generally* Charles L. Becton, *The Drug Courier Profile: "All Seems Infected That th' Infected Spy, As All Looks Yellow to the Jaundic'd Eye"*, 65 N.C. L. REV. 417 (1987).

223 Reid v. Georgia, 448 U.S. 438, 441 (1980) (per curiam) (holding, pre-*Gates*, that profile evidence alone is insufficient for reasonable suspicion because the "circumstances describe a very large category of presumably innocent travelers, who would be subject to virtually random seizures were the Court to conclude that as little foundation as there was in this case could justify a seizure"); Finkelstein & Levin, *supra* note 221, at 271 ("The justices generally agree that a profile, standing alone, does not constitute probable cause for an arrest. There is less agreement on whether the DEA profiles can provide a basis for reasonable suspicion. Those who uphold stops based primarily on profiles appear to accept the DEA assertion that the profiled characteristics, considered collectively, are common for drug couriers but rare for normal travelers. Those who oppose stops based on profiles argue that many normal travelers would fit the profile description.").

224 Tung Yin, *The Probative Values and Pitfalls of Drug Courier Profiles as Probabilistic Evidence*, 5 TEX. F. ON C.L. & C.R. 141, 152 (2000).

225 Becton, *supra* note 222, at 429.

make not only legitimate individualized judgments, but also illegitimate arbitrary judgments that can be retrospectively justified by the profile.[226] Because the profile exists and is generalized enough to be manipulated,[227] it is hard for courts to decide whether the stop is legitimate or not.[228] Further, because the agents control the profile, they can create a self-fulfilling prophesy by only stopping those who fit the profile, thus strengthening the seeming validity of the profile even if it does not match the reality of who is engaged in drug couriering.[229]

2. Predictive Actions

A less defined category of cases involves profiling certain actions as predictors of criminal wrongdoing. Flight, evasive action, furtive movements, hand-to-hand exchanges, and aggressive driving can all warrant suspicion based on predictive judgments that such actions correspond with ongoing criminal activity.[230] For situations in which there is an expected criminal activity in a particular location not because of a profile, but because of generalizations from past activities, the group trait can help to establish individualized suspicion.[231] For example, in an area known for weapons offenses, a bulge in a waistband might be considered a sign of carrying a gun.[232] On a known drug corner, a hand-to-hand exchange of money for small objects might be indicative of a drug deal. While this may stretch the concept of prediction a bit far, the reality is that underlying the suspicion is the prediction of criminal activity.

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226 *See id.*; *see also* Yin, *supra* note 224, at 148 (recognizing the "chameleon-like way" the profile adapts and criticism that the profile allows for an "ad hoc rationalization[]" to justify the stop).

227 Yin, *supra* note 224, at 152; *see also* United States v. Zapata-Ibarra, 223 F.3d 281, 282–83 (5th Cir. 2000) (Weiner, J., dissenting).

228 *See Zapata-Ibarra*, 223 F.3d at 282–83 (Weiner, J., dissenting); Yin, *supra* note 224, at 152.

229 Yin, *supra* note 224, at 151.

230 *See* Craig S. Lerner, *Reasonable Suspicion and Mere Hunches*, 59 VAND. L. REV. 407, 437–39 (2006); Andrew E. Taslitz, *Police Are People Too: Cognitive Obstacles to, and Opportunities for, Police Getting the Individualized Suspicion Judgment Right*, 8 OHIO ST. J. CRIM. L. 7, 37 (2010).

231 Harcourt & Meares, *supra* note 208, at 813.

232 *See id.* ("[S]uspicion attaches to a group trait that an individual displays, such as having a bulge in one's pants pocket, fitting a description in the vicinity of a recently committed offense, throwing away a plastic vial at the sight of a police patrol car, or driving a car with Florida license plates on the New Jersey Turnpike. These are group-based determinations often made irrespective of the officer's knowledge of whether a specific offense has been committed, and suspicion potentially attaches to *all* individuals *within* these categories. Suspicion in these cases is 'individualized' only in the sense that it attaches to an individual because he or she is a member of the suspect group. In other words, in most cases of policing, suspicion does not originate at the individual level.").

In each of the cases involving profiling group traits or generalized activities, several principles can be distilled in evaluating reasonable suspicion.[233] First, the profile must be particularized enough to distinguish the profiled individual from the rest of the public.[234] Second, the suspicion based on a group trait must still be corroborated by direct observation of the officer. A report that a suspect matched a drug courier profile would not be useful if the officers did not corroborate that, in fact, the person did match the profile upon observation. Third, suspicion based on general characteristics is limited by location. A drug courier profile would not be useful in an area with no known drug problem, such that the presence of an established drug problem should be part of the profile. Fourth, the suspicion must be connected to an identifiable, on-going specific type of crime. It would not be sufficient to have a general "criminal" profile that covered all types of crimes (even if some criminals engage in multiple criminal acts).[235] Finally, the profile has an implicit temporal element in that as criminals adapt to the profile, the existing profiles must be modified or abandoned.[236]

3. Probabilities as Prediction

A final related concern may be pure probabilities as predictive judgments. While the Supreme Court has recognized that the question of reasonable suspicion deals "with probabilities," it has never relied on a purely probabilistic analysis for reasonable suspicion.[237] Lower courts have upheld arrest warrants on DNA matches and other forensic science matches based on pure probabilities, but there has never been a Supreme Court case in which the probability of crime explicitly has been used as the sole justification for a stop.[238]

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233 Again, the legal standard remains unchanged: "The officer [making a *Terry* stop] . . . must be able to articulate something more than an 'inchoate and unparticularized suspicion or hunch.'" United States v. Sokolow, 490 U.S. 1, 7 (1989) (quoting Terry v. Ohio, 392 U.S. 1, 27 (1968)).

234 Reasonable suspicion "must be based on specific, objective facts," *see* Brown v. Texas, 443 U.S. 47, 51 (1979), and requires that "the detaining officers . . . have a particularized and objective basis for suspecting the particular person stopped of criminal activity." United States v. Cortez, 449 U.S. 411, 417–18 (1981); *see also* Reid v. Georgia, 448 U.S. 438, 441 (1980) (per curiam).

235 *See generally* City of Indianapolis v. Edmond, 531 U.S. 32, 46–47 (2000) (declaring that general crime suppression techniques violate the Fourth Amendment).

236 *Cf. Sokolow*, 490 U.S. at 14 n.1 (Marshall, J., dissenting).

237 *Cortez*, 449 U.S. at 418.

238 David H. Kaye, *Probability, Individualization, and Uniqueness in Forensic Science Evidence: Listening to the Academies*, 75 BROOK. L. REV. 1163, 1178–79 (2010); Laurence H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329, 1330 n.2 (1971) ("*[A]ll*

This does not mean that the question has not been raised and addressed in the abstract. As Professor Arnold Loewy posed in an article on the Fourth Amendment:

> Suppose that in a particular city block of Main Street, between Fourth and Main and Fifth and Main, it could be established demographically that nine out of every ten men on the street between 6 p.m. and 10 p.m. are carrying drugs. Would that create probable cause (or reasonable suspicion) to arrest any man found on that block of Main Street at the requisite hours?
>
> The answer, I believe, is "no." Probable cause and reasonable suspicion require more than demographic probabilities. There must be something specific to the defendant to create the probability as to him (perhaps a furtive gesture, an informant's tip, excessive nervousness, etc.).[239]

Other scholars might disagree and would hold such a probability is sufficient to create reasonable suspicion.[240] Real world hypotheticals can easily be imagined. For example, what if predictive policing technology could be improved such that on a notorious drug corner the likelihood of a drug sale on a particular day was 90% or higher? Would the conclusion that police need more than just the probability hold?[241]

Similarly, what if the probabilities exist but are statistically quite low? For example, in one reported situation the predictive policing information provided to the Santa Cruz police officer was that there was a 2.06% probability of a

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factual evidence is ultimately 'statistical,' and all legal proof ultimately 'probabilistic,' in the . . . sense that no conclusion can ever be drawn from empirical data without some step of inductive inference . . . .").

[239] Arnold H. Loewy, *Rethinking Search and Seizure in a Post-9/11 World*, 80 MISS. L.J. 1507, 1518 (2011).

[240] The scholarly commentary on the role of probabilities is vast and nuanced. *See generally* Max Minzner, *Putting Probability Back into Probable Cause*, 87 TEX. L. REV. 913 (2009); Margaret Raymond, *Down on the Corner, Out in the Street: Considering the Character of the Neighborhood in Evaluating Reasonable Suspicion*, 60 OHIO ST. L.J. 99, 105 (1999) ("Something more than a purely probabilistic inference of suspicion based on statistical likelihoods must be present to justify a stop."); Lawrence Rosenthal, *Probability, Probable Cause, and the Law of Unintended Consequences*, 87 TEX. L. REV. SEE ALSO 63 (2009); Yin, *supra* note 224, at 158 (recognizing that businesses use forms of yield management to predict future behavior from past activity).

[241] Professor Christopher Slobogin has written insightfully about this issue. *See* CHRISTOPHER SLOBOGIN, PRIVACY AT RISK: THE NEW GOVERNMENT SURVEILLANCE AND THE FOURTH AMENDMENT 37–44 (2007); Christopher Slobogin, *The World Without a Fourth Amendment*, 39 UCLA L. REV. 1, 39–41 (1991).

crime happening that day at a particular location.[242] How should a court evaluate the predictive impact of this criminal forecast; does a 2.06% likelihood create reasonable suspicion? Must there be a determined numerical probability? Such low probabilities may well weigh against a finding of reasonable suspicion based on the forecast data.

Finally, there exists the problem of relative probability. As I have argued elsewhere, in the high crime area context there exists a denominator problem.[243] Just as "high" is a relative term that requires an understanding of lower crime areas, drawing lines for predictive probabilities presents similar problems. If one block is forecast to have a 9% likelihood of burglary, and another block a 19% likelihood, is the 9% area less persuasive because there are other higher percentage areas? So far courts have been quite uncomfortable drawing such lines, but the questions remain.

C. High Crime Areas: Predicting Criminal Activities in Places

Considerations of prediction can also be observed in courts' evaluations of the high crime area factor in reasonable suspicion cases.[244] After *Illinois v. Wardlow*, the high crime nature of an area can be considered in evaluating the officer's objective suspicion.[245] As predictive policing technology seeks to predict certain areas of higher potential criminal activity, this line of cases has clear relevance.

After about thirty years of acknowledged, but imprecise usage, the high crime area term of art reached its peak in *Wardlow*, in which it became one of only two factors considered in a totality of circumstances analysis for reasonable suspicion.[246] In *Wardlow*, "high crime area" plus "unprovoked

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[242] Thompson, *supra* note 50, at 40 ("Linden Street, where, the statistics reveal, there is a 2.06 percent chance of a crime happening today, and 3:1 odds that a crime, should it occur, will be a home break-in versus an auto theft.").

[243] Ferguson, *supra* note 71, at 218–19.

[244] *See, e.g.*, Illinois v. Wardlow, 528 U.S. 119, 124 (2000); United States v. Wright, 582 F.3d 199, 222–23 (1st Cir. 2009) (Lipez, J., dissenting); United States v. Wright, 485 F.3d 45, 53 (1st Cir. 2007); United States v. Baskin, 401 F.3d 788, 793 (7th Cir. 2005); United States v. Vargas, 369 F.3d 98, 101 (2d Cir. 2004); Bolton v. Taylor, 367 F.3d 5, 8–9 (1st Cir. 2004); United States v. Bonner, 363 F.3d 213, 216 (3d Cir. 2004); United States v. Moore, 235 F.3d 700, 703–04 (1st Cir. 2000); United States v. Jordan, 232 F.3d 447, 448–49 (5th Cir. 2000); United States v. Montero-Camargo, 208 F.3d 1122, 1143 (9th Cir. 2000) (en banc) (Kozinski, J., concurring).

[245] *Wardlow*, 528 U.S. at 124.

[246] *Id.* ("Accordingly, we have previously noted the fact that the stop occurred in a 'high crime area' among the relevant contextual considerations in a *Terry* analysis." (citing Adams v. Williams, 407 U.S. 143, 144, 147–48 (1972))); *Williams*, 407 U.S. at 147–48 ("While properly investigating the activity of a person

flight upon noticing the police" resulted in reasonable suspicion to stop Mr. Wardlow.[247]

The facts in *Wardlow* point out the questionable use that prediction plays in many high crime area cases. In *Wardlow*, a narcotics unit driving in a caravan observed Mr. Wardlow holding a white opaque bag.[248] Wardlow was standing on a downtown Chicago street corner at about noon.[249] Upon sight of the police, Wardlow ran, and when he was stopped a gun was recovered from the bag.[250] The justification for the stop included the flight in a high crime area.[251] Yet, as was revealed in the lower court proceedings, the observing officers had no information about that particular block, or Wardlow, and happened simply to be riding past the block to another location.[252] In addition, the proof that the area was, in fact, a high narcotics area was belied by the crime statistics presented to the courts, including the Supreme Court, which did not include any narcotics arrest data.[253] While the area in question—Chicago's District 11—was a low-income area known for violent crimes, how that information factored into a predictive judgment about a man holding a bag in the afternoon is not immediately clear.[254]

More relevantly, even if it could be assumed that the area was objectively a high crime area, it is not clear how that information would help predict that Mr. Wardlow, as opposed to any one of the 98,000 people who lived in the district, was committing a crime (or more specifically a narcotics crime).[255] The prediction of a higher level of criminal activity, or even a higher level of

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who was reported to be carrying narcotics and a concealed weapon and who was sitting alone in a car in a high-crime area at 2:15 in the morning, Sgt. Connolly had ample reason to fear for his safety."); Debra Meek Nelson, Illinois v. Wardlow*: A Single Factor Totality*, 2001 UTAH L. REV. 509, 510.

247 *Wardlow*, 528 U.S. at 124–25.

248 *Id.* at 121–22.

249 *Id.* at 137 (Stevens, J., concurring in part and dissenting in part).

250 *Id.* at 122 (majority opinion).

251 *Id.* at 124–25.

252 People v. Wardlow, 678 N.E.2d 65, 67 (Ill. App. Ct. 1997) ("[Officer Nolan's] testimony indicates only that the officers were headed somewhere in the general area. There was no evidence that the officers were investigating the specific area where defendant had been standing or that any of the police cars had stopped at that location or that defendant had any basis for believing that police were interested in his activity. Officer Nolan testified that he was 'caravaning' down West Van Buren when he noticed defendant. He did not testify that the officers were targeting 4035 West Van Buren because it was known to be a location where drugs were sold."), *aff'd*, 701 N.E.2d 484 (Ill. 1998), *rev'd*, 528 U.S. 119 (2000).

253 *Wardlow*, 528 U.S. 119; *see also id.* at 139 (Stevens, J., concurring in part and dissenting in part) ("The State, along with the majority of the Court, relies . . . on the assumption that this flight occurred in a high crime area.").

254 *Id.* at 137 (Stevens, J., concurring in part and dissenting in part).

255 *Id.* at 137 n.15.

narcotics activity, simply was not corroborated by the actual observation. In this situation, the high crime area label is more of a retrospective justification for a stop than a predictive factor.[256]

The Court's flawed reasoning in *Wardlow* might be unremarkable, except that there have been thousands of post-*Wardlow* cases that have relied on the high crime area designation to determine reasonable suspicion.[257] While a handful of cases have explicitly wrestled with the predictive value of this label, most have simply applied it without considering whether it offers any predictive weight.[258]

Numerous judges and scholars have critiqued the use of the high crime area designation, almost since its creation.[259] Critics point to its discriminatory effect on low-income areas and communities of color.[260] Its use has raised questions of infringements on civil liberties, as well as the stigmatizing effect on economic development and community–police relations.[261] Some scholars, myself included, have suggested retiring the high crime area term as an inexact, overly general term of art that is inconsistent with the existing crime mapping technology and the Supreme Court's emphasis on particularized suspicion.[262] While courts routinely use the term high crime area in considering the totality of circumstances to support reasonable suspicion, there is less emphasis on why that information is relevant to help predict a particular crime. As stated, the high crime area in *Wardlow*—Chicago's District 11—had

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[256] Or, in the alternative, it reveals that, contrary to its stated reasoning, the Court accepts that unprovoked flight alone may give rise to reasonable suspicion. *See id.* at 124 (majority opinion). As can be seen in the dissent in *Pennsylvania v. Dunlap*, two members of the Court clearly believe that particularized prediction may rise to the level of reasonable suspicion, if not probable cause. *See* 129 S. Ct. 448, 448 (2008) (Roberts, C.J., dissenting), *denying cert. to* 941 A.2d. 671 (Pa. 2007).

[257] A Westlaw search of the terms "high crime area" and "reasonable suspicion" after 2000 returns over two thousand results.

[258] Ferguson & Bernache, *supra* note 70, at 1607–18 (collecting cases).

[259] David A. Harris, *Factors for Reasonable Suspicion: When Black and Poor Means Stopped and Frisked*, 69 IND. L.J. 659, 677–78 (1994); Lenese C. Herbert, *Can't You See What I'm Saying? Making Expressive Conduct a Crime in High-Crime Areas*, 9 GEO. J. ON POVERTY L. & POL'Y 135, 135–38 (2002); Johnson, *Race and the Decision*, *supra* note 207, at 255–56; Raymond, *supra* note 240, at 116–24; Amy D. Ronner, *Fleeing While Black: The Fourth Amendment Apartheid*, 32 COLUM. HUM. RTS. L. REV. 383, 384–85 (2001); Christopher Slobogin, *The Poverty Exception to the Fourth Amendment*, 55 FLA. L. REV. 391, 405 (2003); Mia Carpiniello, Note, *Striking a Sincere Balance: A Reasonable Black Person Standard for "Location Plus Evasion"* Terry *Stops*, 6 MICH. J. RACE & L. 355, 358 (2001).

[260] *See, e.g.*, Harris, *supra* note 259, at 677–78.

[261] *See, e.g.*, *id.*

[262] *E.g.*, Ferguson, *supra* note 71, at 223–25.

a population of 98,000.[263] The predictive value for an individual among that number of people is negligible. Similarly, the lack of particularized focus on the type of crime weakens the predictive value of the information. Had the high crime area been localized to a particular block, or a particular type of crime, the value of the predictive information would be more relevant. Some federal and state courts have required this nexus between a particularized area, crime, time, and the observations of the police officer.[264] In addition, most of the current predictive policing forecasting programs seem to embrace the importance of a narrowly tailored area, with a focus on particular crime-type, and a close temporal proximity.[265] As will be discussed later, the advent of predictive policing may in fact signal the end of a generalized high crime area analysis, by replacing it with more precise technology and terminology.

D. Principles of Prediction and Reasonable Suspicion

From the above summary of Fourth Amendment cases, the same themes emerge to analyze reasonable suspicion. First, no matter the type of predictive information (tip, profile, or high crime area), the information alone is never enough to control the reasonable suspicion analysis. In every case, this information is considered relevant to the totality of circumstances, but must be corroborated by direct police observation. Second, the predictive information must be particularized to a person, a profile, or a place, in a way that directly connects the suspected crime to the suspected person, profile, or place.[266] Third, the predictive information must provide sufficient detail to identify or separate the targeted person, profile, or place from others not so targeted.[267] Finally, the predictive value of the information declines over time, such that predictive information must be acted on quickly or be lost.

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[263] Illinois v. Wardlow, 528 U.S. 119, 137 n.15 (2000) (Stevens, J., concurring in part and dissenting in part).

[264] United States v. Black, 525 F.3d 359, 367 (4th Cir. 2008) (Gregory, J., dissenting); United States v. Wright, 485 F.3d 45, 53 (1st Cir. 2007); United States v. Bonner, 363 F.3d 213, 216–18 (3d Cir. 2004); *id.* at 218–19 (Smith, J., concurring); United States v. Montero-Camargo, 208 F.3d 1122, 1143 (9th Cir. 2000) (en banc) (Kozinski, J., concurring).

[265] See *supra* text accompanying notes 40–44 for a discussion of the LAPD model of predictive policing.

[266] The *Wardlow* case does cut against this need for particularity, as there was little particularized information about Mr. Wardlow before officers arrived on the scene. *See supra* text accompanying note 253.

[267] William J. Mertens, *The Fourth Amendment and the Control of Police Discretion*, 17 U. MICH. J. L. REFORM 551, 594–95 (1984) ("[T]he police must be able to justify singling out from the rest of humanity (or at least from the rest of the people in the general area) the particular individual whom they have stopped as somehow meriting this special attention."); Taslitz, *supra* note 230, at 14–15.

Each of these principles informs the discussion of predictive policing and reasonable suspicion: the subject of Part III.

III. PREDICTIVE POLICING AND REASONABLE SUSPICION

If crime locations can be predicted, and the current Fourth Amendment doctrine embraces predictive judgments, then what to make of predictive policing? Certainly an accurate prediction of a particular crime, in a specific location, should have some effect on police officers and courts. Whether it be a computer algorithm or criminological theory, the identification of environmental vulnerabilities that could be exploited by criminals is a reasonable factor to consider in evaluating suspicious activity in that area. The question analyzed in this Part is how to apply current Fourth Amendment concepts to this new technological innovation.

Two basic questions exist for any court addressing the effect of predictive policing on the reasonable suspicion analysis. First, assuming an accurate and reliable system, is this predictive forecast appropriate to consider in the totality of circumstances? Second, if so, how does a court analyze the issues under the Fourth Amendment?

The short answer to the first question is that it is too soon to evaluate. The near repeat theories and the risk terrain models, among other variations, are only now being developed and refined.[268] The underlying theories of environmental vulnerabilities make logical sense, but whether that logic translates into accurate crime forecasts will take several years to determine. Further, how courts interpret these predictive forecasts within the current Fourth Amendment structure may, in fact, shape the technologies. Judicial demands for standards of precision, probabilities, and procedures will likely require the predictive technologies to evolve and improve.[269] Lines will have to be drawn about probabilities and the predictive reliability of the models tested. Before this issue of legitimacy is resolved, however, a predictive policing case may reach a trial court, and that court will have to address the issue using the existing reasonable suspicion doctrine.

As to the second question, the existing Fourth Amendment analogies are imperfect, but informative, in determining how courts might address the effect

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[268] It is important to emphasize the newness of the technologies. Many of the tests are in their initial phases, and no claim of success has yet to have been made. *See supra* text accompanying notes 103–04.

[269] This has happened in other areas in which new technologies challenge Fourth Amendment principles.

of predictive policing technologies in a reasonable suspicion determination. As detailed below, a careful evaluation of the available analogies cautions against adopting any of them as models for examining predictive policing. At the same time, revealingly, each of the analogies leads to the same ultimate conclusion. Predictive policing technologies—if accurate and reliable—can add to the totality of circumstances for reasonable suspicion and will have a direct effect on Fourth Amendment liberties. While these predictions cannot, alone, establish reasonable suspicion (or probable cause) they may change the balance of suspicion in the forecasted areas.

A. Predictive Policing as a Data-Driven "Tip"

As examined earlier, one possible Fourth Amendment analogy for predictive policing is the tip cases. In this model, predictive policing technologies provide a non-specific tip about a type of crime in a particular area.

1. Predictive Policing as an Anonymous or Informant Tip

The parallels in considering predictive policing as an anonymous or informant tip are obvious and yet imprecise.[270] Unlike a tip, predictive policing includes no personal knowledge in its forecast of potential criminal activity. This is an important distinction that removes predictive policing from the reasoning of *Draper*, *White*, and even *Gates*, in that there is no "inside" information that can help evaluate the reliability of the tip.[271]

Further, a predictive policing "tip" is not particularized to an individual. While a particular block might be identified as being the location of a particular type of crime, the algorithms, as currently used, are no help in identifying particular persons suspected. Thus, the core logic of the tip cases falls away. Because predictive policing does not provide personal knowledge

[270] The analysis in this section focuses on a particular type of informant tip. Some informants report past facts that a police officer can interpret to predict future crime. But some informants, like those in *Gates*, *White*, and *Draper*, focus on future actions of suspects. Alabama v. White, 496 U.S. 325, 327 (1990); Illinois v. Gates, 462 U.S. 213, 225 (1983); Draper v. United States, 358 U.S. 307, 309 (1959). The facts presented are genuine predictions that a certain action will happen at a certain time. It is this subset of informant tips that is the focus of this analysis.

[271] *See supra* Part II.

about an ongoing crime, or particularized identification of the suspect involved, it cannot support the weight of reasonable suspicion.[272]

As such, if considered simply like a tip, a predictive policing forecast should not support reasonable suspicion to stop anyone on the block just because there might be a heightened level of potential criminal activity in the area.[273] First, such a tip is too generalized, lacking the detail required in *White* to identify a suspect.[274] Second, it does not identify an actual ongoing crime, as required by *J.L.*[275] Third, there is no corroboration as required by almost all the tip cases.[276] For reasonable suspicion, police would need more than just the generalized tip, including substantial direct corroborative observation linking the tip to the individual observed.

2. Predictive Policing as a Tip About an Area

The more difficult, and more relevant, example for predictive policing focuses on when a known informant provides a tip about *an area* or location. For example, known informant tips about drug houses, drug corners, or general areas of criminal activity are commonplace in law enforcement.[277] In these cases, officers responding to those identified areas have been allowed to rely on the non-specific predictive tip about an area in their reasonable suspicion

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[272] Florida v. J.L., 529 U.S. 266, 272 (2000) (recognizing that informant tips must not only relate to a particular individual, but also an "assertion of illegality" in the conduct of that individual).

[273] Reasonable suspicion "requires that a tip be reliable in its assertion of illegality, not just in its tendency to identify a determinate person." *Id.*

[274] *See White*, 496 U.S. at 327–32 (emphasizing that the tip not only contained a number of details at the time, but detailed predictions of future activity as well).

[275] *See J.L.*, 529 U.S. at 272 (emphasizing that to support reasonable suspicion the tip should not merely identify a person but a crime as well).

[276] United States v. Reaves, 512 F.3d 123, 126 (4th Cir. 2008) ("When the police rely on an anonymous tip to support reasonable suspicion, the tip 'must be accompanied by some corroborative elements that establish [its] reliability.'" (alteration in original) (quoting United States v. Perkins, 363 F.3d 317, 323 (4th Cir. 2004))).

[277] *See, e.g.*, United States v. Griffin, 589 F.3d 148, 150 (4th Cir. 2009) ("[T]he Value–Lodge Motel in Charlotte, North Carolina, was well known to officers of the Charlotte–Mecklenburg Police Department as a location for violent crime and drug trafficking."); United States v. DeJear, 552 F.3d 1196, 1198 (10th Cir. 2009) ("According to the officers, that house was at an intersection that had a history of criminal activity."); United States v. Clarkson, 551 F.3d 1196, 1201–02 (10th Cir. 2009) (including characteristics of an area, such as being known for high crime, as factors for reasonable suspicion); United States v. Pearce, 531 F.3d 374, 377 (6th Cir. 2008) (holding that police officers who were patrolling the streets around the Mount Carmel Deli, an area known for narcotics trafficking, had reasonable suspicion to justify an investigatory search).

calculus.[278] Predictive policing then can be considered like a reliable tip of generalized information about an area.[279]

Two points need to be emphasized about this second type of generalized tip. First, traditional application of the totality of circumstances test does not quite fit.[280] The reason why police might trust a known informant's prediction of criminal activity is not the same as the reason one might trust a computer program's prediction of criminal activity. While reliability is key to both, it is a different reliability. On one hand an objective, well-functioning computer program seems more reliable than your typical police informant. The computer has no biases, no past bad acts, and no agendas. On the other hand, the information in the computer is generalized, and that fact makes it less reliable. By analogy, if the human informant stated that based on past experience with car thefts, the informant has a general feeling that a car theft would occur at a location, most courts would not think this "feeling" would be sufficient for reasonable suspicion.[281] Even if the informant explained that the past experiences were regular, recorded, and accurate, the inference that one could generalize from that experience to future crimes is weak. Most courts would want more than past experiences, requiring something particular and detailed about this area now. Again, the reliability turns on the particularized insight about a specific area at a specific time. A generalized sense, standing alone, would not be enough.

While insufficient on its own, this type of reliable, known informant tip, if corroborated, might result in reasonable suspicion. The key remains the observations that corroborate the tip. Similar to a police informant who provides reliable, if generalized, suspicion about a drug house or street corner,

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[278] *See* Pennsylvania v. Dunlap, 129 S. Ct. 448, 448 (2008) (Roberts, C.J., dissenting) (arguing that an experienced police officer's generalized knowledge that drug activity was likely in an area should have been enough for probable cause), *denying cert. to* 941 A.2d. 671 (Pa. 2007).

[279] This is analytically distinct from a high crime area (discussed in the next section) because the information is about a particular crime that may or may not be located in an established high crime area. *See supra* Part II.C.

[280] Going back to reasonable suspicion first principles, assuming a well-functioning predictive system that accurately collects, records, and analyzes crime data, the question is how to evaluate this computer informant's "veracity," "reliability," and "basis of knowledge." Alabama v. White, 496 U.S. 325, 328–30 (1990). Veracity can be quickly disposed of as the computer algorithm presents none of the truth-related concerns that arise with a human informant. The computer computes what it computes, neither being true nor false. The basis of knowledge element of the analysis is important, but turns on more foundational concerns of where the data comes from and how it is collected and sorted. These concerns will be addressed in the next Part. Generally speaking, however, veracity and basis of knowledge are not serious concerns with computer programs.

[281] *See, e.g.*, *White*, 496 U.S. at 330 (emphasizing how the totality of circumstances should be factored in when making a determination of reasonable suspicion).

the information can color what a reasonable officer observes, even if it cannot be reasonable suspicion in itself. In addition, because courts have recognized that a reliable tip may require less corroboration than an anonymous tip,[282] if considered more like a reliable informant tip about an area, then police may actually need less corroboration in their observations.

This conclusion presents a significant change in how courts could apply the reasonable suspicion standard. It means that a computer algorithm could alter Fourth Amendment protections in certain forecast locations. Returning to the parking garage scenario at the beginning of this Article, the two women could not have been stopped on reasonable suspicion but for the predictive element of the analysis. Merely looking into car windows is not sufficient activity to warrant the reasonable belief that criminal activity is afoot. However, with a predicted computer "tip" of car theft, it might be. Analyzed carefully, this conclusion means that the potential for crime in an area can alter the reasonable suspicion analysis.

For courts, assuming the reliability and accuracy of the prediction, a data-driven "tip" may be appropriate to factor into the reasonable suspicion analysis. While corroboration is still required, predictive policing "tips" may require less corroboration than other tips and may affect the Fourth Amendment analysis.

B. Predictive Policing as Profiling in an Area of Forecast Crime

A second Fourth Amendment analogy to consider is predictive policing as a form of profiling. In this analogy, predictive policing technologies would forecast a "profiled" crime in a certain geographic area, such that anyone in the area who acted in conformity with certain recognizable characteristics could be stopped based on reasonable suspicion. Whether considered "profiling" or probabilistic suspicion of activities in an area, the Supreme Court's acceptance of profiling helps frame the analysis.[283]

Under current law, profiles of suspected criminal activity in particular locations for specific crimes appear to be constitutional.[284] The focus here is on the actions or activities of individuals that match actions or activities generally

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[282] *Id.*

[283] Florida v. Royer, 460 U.S. 491 (1983) (plurality opinion) (allowing police to rely on a drug courier profile).

[284] *See supra* notes 209–13.

considered to be indicative of criminal activity. The profile includes considerations of activity, place, and general characteristics. For example, in a residential neighborhood with a burglary problem, a burglar profile could be created so that otherwise innocent actions—like loitering with bags large enough to carry contraband, tools, ropes, and gloves (in warm weather)—could be considered suspicious. Someone acting "like a burglar" on a particular block within a particular time frame would then be considered the same as someone acting like a drug courier arriving from a known source city for drugs. The result would be that profiles of generalized criminal activities would be used to justify stops of individual suspects if they happen to be in a predicted area of crime.[285]

Profiling suspicious activities is not new, and it mirrors the daily practice of police officers who informally have an idea of stereotypical criminal activity.[286] Labeling it a profile, or merely good police work, may not be significant. What is significant is that the predictive policing forecast, in combination with this traditional police observation, will change the Fourth Amendment calculus for reasonable suspicion.

For example, in one hypothetical case, a police officer sees a man loitering on a corner with a large duffle bag looking at a house. Under these limited facts, a stop based on reasonable suspicion would be difficult to justify. There is nothing objectively criminal about waiting with a bag. Even if the officer could say that burglars carry bags and burglars steal from houses, there is not a fit with anything criminal this man has done. Yet, imagine in a second hypothetical case a police officer is informed that a specific city block has had a rash of home burglaries. The predictive policing algorithm predicts that there is a statistical likelihood of another burglary on that block at this time. Police are told to be on the lookout for burglars (and are given an appropriate profile). In this second case, a stop based on reasonable suspicion would likely be upheld.

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[285] Johnson, *Race and the Decision*, *supra* note 207, at 217–18 ("Although the aim in selecting facts to justify probable cause or reasonable suspicion must be objective prediction, practicality tempers the precision of the prediction required. . . . The variety of 'suspicious' facts or circumstances police may witness is nearly infinite, but most fall into one of four general categories. The simplest factor is *conduct resembling a crime* or necessary preparation for that crime. A more subtle factor that attracts police attention is *conduct that appears to reflect consciousness of guilt*. In addition, *characteristics of the actor* may either legitimate observed conduct or render it more suspect. Finally, *the environment in which the actor is observed* may aid in the interpretation of his conduct."); Slobogin, *supra* note 241, at 39–41.

[286] *See* Lerner, *supra* note 230, at 437–39; Taslitz, *supra* note 230, at 37, 58.

Notice that the actions of the man have not changed at all. Objectively, what the suspect has done is no more or less suspicious or criminal. Yet the prediction, in combination with a profile of generalized criminal activity, can change the constitutional analysis.

Of the two changed elements in the analysis—the prediction and the profile—arguably the profile is more important. From a purely probabilistic model, even if the computer model said that there was a very significant likelihood of a burglary in a particular block, if all the police officer saw was a man on the street (no bag, no looking at the house), then even a very high probability of crime would not be enough to justify a stop. The profile, because it serves the corroborating function of linking the prediction to the individual suspect, matters more.

This insight again reveals a common theme in the Fourth Amendment analogies. Corroboration of individual actions is required for reasonable suspicion.[287] A profile of a burglar is insufficient standing alone. A prediction of a burglary is insufficient standing alone. But, together a court might find that under a totality of circumstances this combination could be sufficient for reasonable suspicion.

C. Predictive Policing as a Micro-High Crime Area

The final Fourth Amendment analogy is to consider predictive policing as creating a micro-high crime area. As discussed earlier, location in a high crime area is an accepted factor in the reasonable suspicion analysis.[288] Under *Wardlow* and its progeny, the ability to predict a specific area of heightened potential criminal activity appears to directly impact the reasonable suspicion analysis.[289]

For example, as practiced in Los Angeles and Santa Cruz, the predictive policing model has targeted three specific types of property crime and then focused police attention on 500-by-500 foot areas.[290] Assuming that the

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[287] Illinois v. Gates, 462 U.S. 213, 241 (1983).

[288] *See supra* Part II.C.

[289] Illinois v. Wardlow, 528 U.S. 119, 124 (2000) (citing Adams v. Williams, 407 U.S. 143, 144, 147–48 (1972)); *e.g.*, United States v. DeJear, 552 F.3d 1196, 1200–01 (10th Cir. 2009); United States v. Clarkson, 551 F.3d 1196, 1201–02 (10th Cir. 2009); United States v. Pearce, 531 F.3d 374, 383 (6th Cir. 2008); *cf.* Shelton v. United States, 929 A.2d 420, 424–26 (D.C. 2007) (distinguishing a long line of cases justifying Fourth Amendment seizures based on hand-to-hand transactions because the observed activity *did not* take place in a high crime area).

[290] Thompson, *supra* note 50, at 38, 40 (describing the 500-by-500 foot target).

predictive analysis is based on past crimes and established crime patterns, those micro-areas would easily fall within the Supreme Court's understanding of a high crime area.[291] In fact, those areas—small in size, responsive to immediate crime patterns, and particularized to a type of crime—are superior to the rather amorphous definition of a "high crime area" previously accepted by the courts.

In analyzing reasonable suspicion, there seems to be little reason why an officer should not consider the predictive information he or she has been given before patrolling the streets.[292] The information is objective, verifiable, and particularized to a certain area about a certain crime, and even temporally relevant. A court analyzing the reasonableness of the officer's suspicion based on objective standards should take this information into account. To return to our burglar example, an officer who stops the man standing with the bag outside the house, in part, because it was a predicted "high burglary" block is making a reasonable decision based on the available information.

Notice, however, again the critical fact in the argument is that there is a corroborative observation that matches the predicted forecast.[293] If the predictive policing forecast suggested an area with a heightened pattern of residential burglary, and the police officer went to the area and observed a hand-to-hand transaction suggestive (but not conclusive) of a drug deal, the predictive information would be irrelevant. For the predictive technology to add any value to the totality of circumstances test, there must be a nexus between prediction, crime, and observed activity. A disconnect in any of those factors removes the value of the prediction for reasonable suspicion.

Finally, the predicted area must be limited in size. For example, if the predicted area covered an entire neighborhood or police district, then the predictive relevance of a man holding a bag outside a house is weakened. The chosen metric of a 500-by-500 foot area appears workable and appropriate.

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[291] The Supreme Court has never defined a high crime area, but in *Wardlow* an area large in size without any particularized crime data was allowed to constitute a high crime area. 528 U.S. at 121, 124.

[292] *But see* United States v. Montero-Camargo, 208 F.3d 1122, 1143 (9th Cir. 2000) (en banc) (Kozinski, J., concurring) ("Just as a man with a hammer sees every problem as a nail, so a man with a badge may see every corner of his beat as a high crime area. Police are trained to detect criminal activity and they look at the world with suspicious eyes. This is a good thing, because we rely on this suspicion to keep us safe from those who would harm us. But to rely on every cop's repertoire of war stories to determine what is a 'high crime area'—and on that basis to treat otherwise innocuous behavior as grounds for reasonable suspicion—strikes me as an invitation to trouble." (citation omitted)).

[293] United States v. Wright, 485 F.3d 45, 53–54 (1st Cir. 2007) (examining "the nexus between the type of crime most prevalent or common in the area and the type of crime suspected in the instant case").

Time is also relevant. If, for example, there had not been a burglary in six months, the predictive value of the prediction is minimal.[294] Particularized place and time remains critical to a useful high crime area analogy.

In many ways predictive policing has the potential to add some discipline to the rather protean "high crime area" term. Predicted areas may no longer be generic high crime areas, encompassing tens of thousands of residents (as in *Wardlow*), but single blocks with information about particular crimes. With this available technology, courts may no longer need to rely on the generalized high crime area terminology when more particularized and more relevant information is available. As will be discussed in the next section, the precision of the technology may in fact provide more protection for citizens in broadly defined high crime areas, while at the same time presenting difficulties for law enforcement that has gotten used to the generic and easily adaptable term.

D. The Future of Predictive Policing and Reasonable Suspicion

A police stop based on a predictive policing forecast soon will be in front of a trial court in a motion to suppress evidence. The court will need to consider the effect of predictive policing on the Fourth Amendment. The court will also have to graft existing Fourth Amendment caselaw on this new technology.

While courts may take different approaches to the question, no matter the doctrinal analogy chosen the result is the same. Predictive policing will impact the reasonable suspicion calculus by becoming a factor within the totality of circumstances test. While never enough alone, with some relevant corroboration, a predictive tip will serve as the basis of a constitutional stop. Timing will matter, as the predictive value of the information decays with time. The particularized nexus will also matter, as the predicted forecast must match the observed actions. Yet, as demonstrated, the weight of predictive policing in the totality has the potential to be significant.

The fact that predictive policing forecasts can affect constitutional rights may be more of a symptom of the malleability of the reasonable suspicion doctrine, rather than signifying any great change that prediction offers.[295] As

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[294] Again, as discussed earlier, the near repeat theories have a quick decay that makes the timeliness of the information very important. *See supra* notes 129–30 and accompanying text.

[295] *See, e.g.*, Harris, *supra* note 259, at 660; Raymond, *supra* note 240, at 100; Slobogin, *supra* note 259, at 405.

has been discussed in other contexts, the reasonable suspicion standard offers less protection than perhaps originally designed, and it has been further eroded with an ever-evolving totality of circumstances test.[296]

Yet, the fact that a law-enforcement-designed technology can alter liberty protections in certain areas raises the question of whether the Supreme Court's reasonable suspicion test is being exploited. If police can define away certain areas using computer algorithms, or define generalized activities as immediately suspicious in certain areas, it becomes quite easy to escape what had been a limiting restriction on police officers.[297] This speaks less to the police and prosecutors that are fighting crime within the existing legal doctrine than to the doctrine itself, which may need a counterweight to protect liberty interests in all areas, including areas of predicted criminal activity.

IV. FUTURE CONCERNS WITH PREDICTIVE POLICING

Predictive policing is new and evolving. Definitions, validation studies, and its effectiveness will be evaluated as the technology matures. Its effect on the Fourth Amendment may evolve as well, as courts and litigants must pick among the existing reasonable suspicion precedents for suitable analogies for analysis. Its impact may, in fact, cause courts to rethink the current overly flexible approach to reasonable suspicion, based on a concern that this technology could be manipulated or used in a discriminatory manner.

This Part addresses some of the main concerns that courts, litigants, and predictive policing supporters should consider in analyzing the constitutional impact of predictive policing. The focus here, again, is on the Fourth Amendment concerns, not the effectiveness of the technology from a law enforcement perspective. The focus is also on predictive technologies centered on the property-based near-repeat phenomenon, and not the risk terrain model, because the former has actually been implemented in law enforcement practice.

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296 *See, e.g.*, David A. Harris, *Particularized Suspicion, Categorical Judgments: Supreme Court Rhetoric Versus Lower Court Reality Under* Terry v. Ohio, 72 ST. JOHN'S L. REV. 975, 1022 (1998); Lewis R. Katz, Terry v. Ohio *at Thirty-Five: A Revisionist View*, 74 MISS. L.J. 423, 493 (2004).

297 *See* Johnson v. United States, 333 U.S. 10, 13–14 (1948) ("The point of the Fourth Amendment, which often is not grasped by zealous officers, is not that it denies law enforcement the support of the usual inferences which reasonable men draw from evidence. Its protection consists in requiring that those inferences be drawn by a neutral and detached magistrate instead of being judged by the officer engaged in the often competitive enterprise of ferreting out crime.").

A. Understanding the Logic of Why Prediction Works and Its Limits

Central to the use of predictive policing technologies in Fourth Amendment cases must be an understanding of why prediction works. Predictive algorithms are not magic boxes that divine future crime, but instead probability models of future events based on current environmental vulnerabilities. Creators of those algorithms understand that the limitations of the predictions rest in the limitations of the data and the conclusions drawn from the data.[298]

Early adopters of predictive policing technologies have focused primarily on property crimes for a good reason. The accumulated research data supports the near-repeat effect for some property-based crimes, and not for other crimes.[299] If burglaries are contagious then it makes sense to focus police efforts near the original burglary. If a particular parking lot generates a high volume of car thefts, it makes sense to focus resources at that location. However, the reason there will be a future crime is not that there was a past crime. Instead, the reason there will be a future crime is that the environmental vulnerability that encouraged the first crime is still unaddressed. This insight is critical to incorporate into the reasonable suspicion analysis. Prediction should be irrelevant if the underlying vulnerability has been remediated.

Litigants and courts must understand these limitations. For example, if a particular block suffers a statistically high number of car thefts over a month period, a predictive model might forecast that the same block will be the locus of a subsequent theft. Blind adherence to the predictive forecast might mean that an individual observed with a screwdriver on that block, in combination with the forecast, might result in reasonable suspicion for a stop. However, if prior to the stop police had arrested the gang responsible for all the prior car thefts, improved the lighting in the area, and posted police on the street, reliance on the prediction should be irrelevant.[300] The reason why the future crime is predicted to happen no longer holds. Incorporating predictive policing into the reasonable suspicion analysis of the court then would not be appropriate.

This insight will require litigants challenging a predictive policing stop to understand the logic of predictive policing technologies. Legal motions may

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298 *See, e.g.*, Mohler et al., *supra* note 48, at 104; Short et al., *supra* note 100, at 3965.

299 *See supra* Part I.

300 These types of law enforcement responses would address crime increases under both a flag theory and boost theory. See *supra* notes 93–98.

have to be filed to open up the data or to challenge the underlying computer models. It requires courts to see the prediction as a comment on the environmental vulnerabilities that generate crime. It also means that the environment must remain unchanged (or uncorrected) such that the same vulnerability exists during the time of prediction.

As can be observed, timing is important. The near repeat theory incorporates a natural decay such that the prediction is only valid for a short time span (one or two weeks).[301] This finding reveals the importance of understanding the environmental factors. Over time, those factors change and, thus, cannot be the unthinking basis for a valid prediction.

The crime type is also important. Programs like risk terrain modeling that model violent crimes present different challenges than the near-repeat phenomenon for property crimes. Violent crimes such as robbery might correlate with environmental factors (isolation, darkness, escape routes, reasons for being on the street), while violent crimes such as shooting correlate with very different factors (revenge, gangs, turf borders). Computer algorithms that predict these latter types of crimes must be based on very different theories of crime and place, and courts that rely on these predictions must understand the differences.

The early adopters of predictive policing have taken a careful approach to considering the effects of their experiments. Admirably, the coordinators of the study at the LAPD have looked to conduct-validated studies, with blind testing and very precise areas, as their model.[302] Researchers developing RTM have also been intentional in recording, analyzing, and limiting their studies in a scientific manner.[303] The initial tests, while successful, have been tempered with an understanding that the methods are experimental and the conclusions restrained. While there is tremendous interest in expanding the technology, the

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301 *See supra* notes 129–30 and accompanying text.

302 Thompson, *supra* note 50, at 97 ("Unlike Santa Cruz, the L.A. experiment will be run like a clinical trial, with control areas where crime is predicted and tracked but predictive policing methods are not introduced.").

303 Baxter, *supra* note 25 ("George Mohler, a Santa Clara University assistant math professor, produced the algorithm for Santa Cruz police after analyzing years worth of data. He said the 4 percent decline in burglaries in the first six months is not conclusive evidence that it works. 'You kind of have to take those numbers with a grain of salt because there are other factors,' Mohler said Friday. Variables such as the economy, the weather, new criminals in town and even long-term demographic changes factor into crime figures, Mohler said. In a more scientific experiment, Mohler has been working with Los Angeles police and an anthropology professor at UCLA. That experiment has split the city into districts. Predictive policing patrols are used in some areas and others remain with traditional patrols.").

current predictive policing systems are being conducted in a careful, reflective, and scientific manner.[304]

Whether this caution will remain as other police departments adopt the technology is unclear. Further, whether new adopters or courts recognize the limitations and logic of the technologies is uncertain. A real concern is that the allure of a magic black box that can predict crime will become divorced from the underlying logic of why the predictions work in the first place.

In fact, as can be seen in a review of Part III of this Article, there is little room in the Fourth Amendment legal analysis to argue the underlying principles of why prediction works. By the time courts are addressing the issue, a police officer will have acted on predictive information and arrested an individual. Blind reliance on the forecast, divorced from the reason for the forecast, may lead to inappropriate reliance on the technology. In addition to finding the proper Fourth Amendment analogy, or articulating the reasonable suspicion factors, courts will have to focus on why certain environmental factors might contribute to future crime or why the absence of those environmental vulnerabilities could undermine the logic of the algorithm. Further, courts will need to remember that predictive policing predicts the potentiality of a crime and not the crime itself, and, thus, the true test will be the observation of actual, corroborative criminal activity.[305] Keeping these issues in the forefront of any reasonable suspicion determination is an important responsibility for litigants and courts.

B. Ensuring Reliability, Accuracy, and Transparency

Underlying the question of legitimacy rests the foundational question of whether predictive policing technologies are reliable and accurate. Any data-driven policing system is only as good as the data involved.[306] If the data collection, recording, analysis, or retention is flawed, then the entire system is

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[304] Rubin, *supra* note 2, at A17 ("Much of the work at UCLA and other universities focuses on burglaries, because there are a lot of them and their times and locations are easy to pin down. Building predictive tools capable of addressing rarer and more complex crimes, such as homicides and rapes, will be far more complex.").

[305] United States v. Roch, 5 F.3d 894, 897–98 (5th Cir. 1993) ("In fact, the surveillance failed to provide reasonable suspicion of any crime. The agents did not see Roch commit a criminal offense, engage in any questionable behavior, or break any traffic laws. The only activity the agents observed was a man and woman leaving the motel parking lot in a[] white and orange pickup truck, and driving to a filling station." (footnotes omitted)).

[306] *See* Cope, *supra* note 65, at 193.

called into question.[307] Prior experience with data-driven crime mapping systems presents several cautionary lessons for the future of predictive policing.[308]

1. Reliability and Accuracy

The first concern rests on the data itself. Predictive policing is based in large measure on extrapolations from past crime data. However, as has been well-studied, not all crime is reported, not all crime is recorded, and thus, not all crime is included in crime databases to be used for predictions.[309] While most murders are reported, not all automobile thefts, petty thefts, or domestic violence assaults are reported.[310] Further, in areas of high crime among groups of violent criminals, not all retaliatory acts are reported. Thus, the precision assumed in a statistical probability may not reflect the accurate crime numbers. Current predictive policing has focused on burglary and car theft, two crimes that tend to be reported more regularly (perhaps due to the fixed nature of the property, or the insurance incentives to report). Predictive numbers for those types of crimes might be more accurate. However, as predictions move toward more violent crimes or gang crime, the underlying reporting percentages need to be reexamined.

Reporting of crimes must also result in recording of crimes. A police report does not get entered into the system unless the police officer records it accurately in terms of date, location, crime type, and time.[311] This means police paperwork must be accurate, and processes must be in place to make sure that all reported crimes are entered into the system. This emphasis on accuracy is not a speculative concern. For example, one of the early adopters

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[307] This, in turn, affects the quality of the reasonable suspicion analysis. *See* Murray v. United States, 419 U.S. 942, 944 (1974) (Douglas, J., dissenting) ("But the transmission of the information in the form of a Los Angeles 'police report' is of no immediate analytical significance; the Los Angeles Department merely served as a conduit between the searching officer and a still undisclosed source. The fact that the searching officer received his information from another police officer does not alter the usual Fourth Amendment inquiry."), *denying cert. to* 492 F.2d 178 (9th Cir. 1973).

[308] *See* Ferguson, *supra* note 71, at 225–27.

[309] CHAINEY & RATCLIFFE, *supra* note 26, at 65 ("Crime data recorded in police information systems offer only a partial view of crime in society, and not all crime reported to the police ends up being recorded as crime.").

[310] *See* JOHN MARKOVIC & CHRISTOPHER STONE, VERA INST. OF JUSTICE, CRIME MAPPING AND THE POLICING OF DEMOCRATIC SOCIETIES 2 (2002) ("Even some jurisdictions with sophisticated crime mapping programs choose not to map some forms of domestic violence, crimes among juveniles, threats, defacing public property, and other criminal offenses.").

[311] *Cf.* HARRIES, *supra* note 26, at 98.

of predictive policing was the Memphis Police Department, which saw immediate success with its Blue C.R.U.S.H. (Crime Reduction Using Statistical History) program.[312] Like many predictive policing tactics, the Blue C.R.U.S.H. system was heralded as a revolutionary breakthrough that reduced the crime rate in the City of Memphis.[313] However, in 2011, an internal governmental audit discovered the existence of 79,000 police memos in which potential crimes were recorded, but not counted in the crime statistics. This trove of documents called into question the scope of the crime reduction, as many potential crimes were simply not inputted into the computer system.[314] While the city audit is ongoing, it may mean an upward revision in the crime statistics and questions for a much-heralded crime prevention program.[315]

The imprecision of crime reporting and recording does not simply affect the accuracy of the data, but the underlying focus of resources for law enforcement.[316] If financial fraud or high-end drug dealing is underreported compared to car thefts, then a system based on predictive policing and data will focus on the latter at the expense of the former. One might even be able to predict that certain areas would be the site of these crimes (such as Wall Street or certain university campuses), but if not reported, the predictive analysis will never incorporate this data.

In addition to accurate reporting, there also must be timely analysis. One of the lessons of the crime and place studies is that the near-repeat effect decays quite rapidly.[317] Crime reports must be inputted into the systems in a timely enough fashion to be useful to officers on the street. This means a move to more real-time reporting, such that the predictive numbers will change at least weekly, if not daily, or hourly.

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312 Ashby, *supra* note 52.

313 Rachael King, *IBM Analytics Help Memphis Cops Get 'Smart'*, BLOOMBERG BUSINESSWEEK (Dec. 5, 2011), http://www.businessweek.com/technology/ibm-analytics-help-memphis-cops-get-smart-12052011.html.

314 Amos Maki, *Crimes Lurk in Police Memos*, COM. APPEAL (Memphis), Jan. 25, 2012, at A1; Mike Matthews, *MPD Memos Predicted to Drastically Increase Crime Stats*, ABC24 (Jan. 25, 2012, 5:08 PM), http://www.abc24.com/news/local/story/MPD-Memos-Expected-to-Drastically-Increase-Crime/KkIIl2jHK0yaUtilCB4fzg.cspx ("Memphis Police Director Toney Armstrong confirmed the discovery of 79,000 memos dating back to 2006. MPD's top cop said many of those memos could be crimes that should have been reported. . . . Now, with a full review of those 79,000 memos, those crime stats will probably go way up.").

315 Maki, *supra* note 314, at A1 ("The department picked a sampling of 20,000 memos from 2010 and found what Armstrong described as a high error rate. 'We found that one out of every 15 memos should have been upgraded to a report,' he said. The discovery could cast doubt on the crime-reduction numbers the department claimed under former police director Larry Godwin.").

316 Credit goes to Professor Steven Morrison for reminding me of this important point.

317 See *supra* Part I.

Finally, the algorithms chosen to forecast crimes must be validated, tested, and submitted for outside study. In general, academic scholars have developed these algorithms from experiments independent of the world of law enforcement.[318] As academics are versed in the scientific method, scholars expect testing and peer validation. This tradition, however, may run into tension with traditional law enforcement practices of maintaining control and secrecy over tactical operations. Further, some of the predictive policing programs are proprietary and opening them for study would decrease the competitive advantage of those institutions or companies that own the programs.[319] Adopters of predictive policing technologies will have to balance the utility of tactical secrecy with the reality that courts and litigants will be seeking to evaluate the reliability of the programs. Only in this way will the legitimacy of the technology be accepted for use in courts.

2. Transparency

Related to the internal data collection and analysis is the concern of how that information gets translated to courts and litigants in a court proceeding. Predictive policing programs will need to be explained to courts in a way that accurately addresses concerns with data collection, analysis, and the creation of the probabilities. After all, it will be a judge that agrees or disagrees with the reliability of the information before it can be included in the totality of circumstances calculus.

One can easily imagine the situation described earlier from Santa Cruz, in which a police officer explains to the court that at roll call he was informed that a particular block had a 10.6% probability of a car theft for a particular time, and that is why he stopped a suspect near a car.[320] The questions may include, "Where did that 10.6% probability number come from?" "How accurate is it?" "How timely?" "How reliable?" Adopters of the new technologies will need to have answers that will satisfy the courts in a contested hearing. Metrics for evaluation will need to be created, and then it will be up to courts to address the line drawing on a case-by-case basis.

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[318] For example, Professor George Mohler, a math professor, modeled his predictive policing software on studies done on earthquakes with seismic aftershocks and Professor P. Jeffrey Brantingham is an anthropologist. *See* Rubin, *supra* note 2, at A1.

[319] *See, e.g.*, King, *supra* note 313. Several other companies have designed and are selling predictive computer systems to law enforcement.

[320] See *supra* Part I.

This type of questioning could probably be addressed outside the courtroom if mechanisms of accountability and transparency were built into the predictive policing systems. Independent oversight boards, audits, and other methods to test and retest the data collection and analysis may be needed.[321] Regulations, standards, and best practices will have to be developed and disseminated. Litigants will need to know about internal processes and be able to compare them to other systems in other jurisdictions. This will mean allowing access into the systems, as well as limiting some of the proprietary or secrecy arguments mentioned above. All of these improvements in transparency will be needed for public oversight of these new public safety initiatives.

These issues have been recognized by some of the early adopters of predictive policing. The LAPD pilot program has, for example, developed a blind control test to see the effect of its program, and this pilot project is being overseen by academics trained in the scientific method.[322] In addition, the LAPD model has been designed to avoid the "self-fulfilling prophecy" concern that predictions will lead to arrests, which will lead to additional predictions in the same area.[323] To remedy this problem, the LAPD model looks at a three-year period of crimes, and does not over-value recent arrests into the model.[324] This pilot program was designed with accountability and transparency in mind, and should likely be a model not just for effectiveness, but also for a process of openness in developing these programs. As the programs expand across the country, adopting these control mechanisms may be equally as important as adopting the technology.

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321 As of yet, these oversight structures have not been developed.

322 See *supra* text accompanying notes 40–57.

323 *See* Ferguson, *supra* note 71, at 196 n.107.

324 *See* Malinowski E-mail, *supra* note 42 ("We . . . stress that this is a place-based strategy that develops and plots forecasts based on a three year look at crime patterns and that arrests are not part of the equation. We felt this was important because we heard from some community members that they were concerned about the program creating a kind of self-fulfilling prophe[c]y from under which a community could not recover. For instance if the police deploy to an area due to a forecast based on crime AND arrests and do, in fact, make additional arrests that go back into the model, it could skew further forecasting. In our model, we would hope to deploy the officers based on crime only and then hopefully deny the criminal the opportunity to commit the crime in the first place. We don't want to necessarily be tied up taking a report or making an arrest if we could just as easily be in the right place at the right time and deter the criminal from carrying out their plans to commit a property crime.").

C. Hard Cases

Predictive policing may well become an effective tool for law enforcement. Yet, the technology will also create tension for police in defending Fourth Amendment challenges by defendants. Most notably, by defining particular areas of high crime down to the block, police are also implicitly demarcating other areas as not predicted areas of heightened criminal activity.[325] This move changes how police and prosecutors will be able to rely on the generic high crime area designation. As there have been thousands of reported cases involving a high crime area, the number of potential cases implicated by this change is significant.[326]

For example, assume police are dispatched to a predicted block of heightened car theft. Following the map in front of them, the police set up surveillance for the forecast crime. Nothing happens, and after a while, the police drive off. Two blocks away, the police see a young man with a screwdriver standing near a parked car. At that moment, the police are no longer in the predicted area. While subjectively the police are no doubt influenced by the concern of car thefts in the general area, and objectively such a concern might be reasonable, the forecast does not cover that block. It is not a micro-area of heightened crime. The man does not fit the "profile plus activity" model. The "tip" is for the wrong area. So, assuming the officers go ahead and stop and search the young man, the predictive profiling model works against the officers for Fourth Amendment purposes. The officers cannot rely on the forecast. While the officers' common sense response is probably, "Come on, we were just two blocks away," the move from a predicted area of particular crime to a generic and undefined high crime area might actually weaken the justification to stop.

A similar problem may arise when the predictive model suggests that one type of crime will occur, and an observing officer sees suspicious activity of another type of crime. As discussed, the logic of the prediction is based on certain types of crimes.[327] Further, the logic of the relevance of the stop is based on the nexus between prediction and observation. Yet, one can easily imagine that the stakeout for a residential burglary will result in the

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325 *See* United States v. Wright, 485 F.3d 45, 49 (1st Cir. 2007). In *United States v. Wright*, a defendant introduced city crime statistics against the prosecution in an attempt to prove that the area was not in fact a high crime area as defined by the city's own standards. *Id.*

326 Ferguson & Bernache, *supra* note 70, at 1608–18 (demonstrating uncertainty in both federal and state courts regarding the standard for what constitutes a "high crime area").

327 *See supra* Part I.

observation of a suspicious activity unrelated to burglary. Whereas in the past, an officer could finesse the difference by alluding to the high crime nature of the neighborhood, now the precision of predictive policing might undercut that argument.

A final example might involve the problems with statistical probabilities. One of the consequences of developing a sophisticated crime prediction model is that the predictive percentages will be available for all to see. A police officer who used to be able to state in a suppression hearing, "I was patrolling a high theft area, one of the top areas for car thefts in the city," now might be faced with justifying whether a 10.6% likely prediction as directed by an algorithm is sufficient to change the reasonable suspicion calculus. Or, as described earlier, an officer may be faced with arguing that a 2.06% increase is statistically significant.[328] In the traditional situation, most trial judges would take on good faith the officer's generalized professional judgment. With the statistics, however, now the court can evaluate the probabilities on its own, and it may reach a contrary conclusion.

In each of these cases, the court may well limit the often-malleable reasonable suspicion doctrine. Hard data has a way of hardening previously fuzzy judgment calls. To be clear, in the above examples courts may still choose to keep both the high crime area designation and the predictive forecast as separate and independent bases for reasonable suspicion. But, a new reliance on precise, real-time crime statistics is going to undercut the utility of the old overbroad designation. While this may be a positive development, it is a consideration that adopting jurisdictions may want to consider.

D. Discriminatory Use or Discriminatory Effect

A concern with all law enforcement technology is that it could be used in a discriminatory fashion. On its face, objective data-driven police tactics should reduce, not increase, the discriminatory effect of certain police tactics. However, as can be seen in a few real-world examples, data-driven law enforcement can have a disproportionate effect on certain communities that perceive it as discriminatory.

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328 *See* Thompson, *supra* note 50, at 40.

The New York City Police Department has led the nation in its implementation of a data-driven law enforcement model.[329] The adoption of the COMPSTAT program led to a dramatic drop in crime in New York City.[330] At the same time, numerous complaints arose both about the pressures to collect data (make arrests), as well as its impact on certain communities.[331] Currently, New York City is being sued by citizens over the use of "stop and frisk" policies that are largely focused on certain communities.[332] The numbers are striking as over half a million citizens were stopped and frisked every year for the last few years.[333] Most of those citizens were people of color.[334]

Whether data-driven or not, the focus on particular communities—usually poor and usually communities of color—has created concerns about constitutional equities. While all citizens would like reduced crime, for citizens in higher crime areas the costs of that reduction in terms of police–citizen tension, liberty infringements, and occasional physical violence have not always been squarely balanced.[335] In addition, constitutional freedoms to assemble, travel, and participate are at stake. In theory, predictive policing should improve these tensions because the focus is on single blocks, not neighborhoods, and particular crimes, not general neighborhood reputation. In addition, if the strategy is merely to direct police to higher areas of crime in

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329 Eli B. Silverman, *With a Hunch and a Punch*, 4 J.L. ECON. & POL'Y 133, 144–45 (2007); *see also* John Douglass, *Tactical Deployment: The Next Great Paradigm Shift in Law Enforcement?*, GEOGRAPHY & PUB. SAFETY, Jan. 2009, at 6, 7 n.1. *See generally* JAMES J. WILLIS ET AL., POLICE FOUND., COMPSTAT IN PRACTICE: AN IN-DEPTH ANALYSIS OF THREE CITIES 2 n.1 (2003) (describing the origins of the name COMPSTAT).

330 WILLIS ET AL., *supra* note 329, at 12, 15.

331 *See* Graham Rayman, *The NYPD Police Tapes: Inside Bed-Stuy's 81st Precinct*, VILLAGE VOICE, May 5, 2010, at 12, 14, 15 (describing the pressure on police departments to report certain numbers).

332 *See* Editorial, *The Truth Behind Stop-and-Frisk*, N.Y. TIMES, Sept. 3, 2011, at A26.

333 I. Bennett Capers, *Rethinking the Fourth Amendment: Race, Citizenship, and the Equality Principle*, 46 HARV. C.R.-C.L. L. REV. 1, 16, 17 & n.120 (2011) ("Between January 1, 2006, and September 30, 2007, the New York City Police Department completed stop-and-frisk forms for 867,617 individuals. Of that number, 453,042 were black, and another 30% were Hispanic, numbers grossly disproportionate to their representation in the general public. Only one in every 21.5 blacks stopped was found to be engaged in activity warranting arrest. Put another way, of the 453,042 stop-and-frisk forms police officers completed for black suspects, approximately 402,943 were for stopping and frisking blacks *not* engaged in unlawful activity warranting arrest."); Editorial, *supra* note 332, at A26.

334 Capers, *supra* note 333, at 17 n.120; Editorial, *supra* note 332, at A26.

335 John D. Castiglione, *Human Dignity Under the Fourth Amendment*, 2008 WIS. L. REV. 655, 659–61 (describing how courts balance the government's interests against the invasion of privacy); Harris, *supra* note 207, at 290–91 (describing the irony that the victims of crimes and those who need the most protection are most likely to be stopped during illegal searches); Andrew E. Taslitz, *Respect and the Fourth Amendment*, 94 J. CRIM. L. & CRIMINOLOGY 15, 23–24 (2003) (detailing illegal seizure of property and home invasions and the psychological effect on victims); *see* Tracey Maclin, *"Black and Blue Encounters"—Some Preliminary Thoughts About Fourth Amendment Seizures: Should Race Matter?*, 26 VAL. U. L. REV. 243, 255 (1991).

order to disrupt the environmental vulnerability (and not arrest anyone), then this innovation may decrease rather than increase police–citizen tension.

On the other hand, one could imagine potential discrimination if certain groups were targeted using predictive technologies. While gangs are an obvious and oft-stated target of future use, one could see how predictive forecasts of gang criminal activities, coupled with corroboration of gang presence in an area, could result in an automatic finding of reasonable suspicion to stop gang members on the street. While perhaps not the most sympathetic figures for protecting Fourth Amendment freedoms, such police-made manufacturing of reasonable suspicion also runs counter to existing constitutional law.[336]

E. Courtroom Effect

As a final matter, courts should consider the practical effect of allowing predictive policing programs to influence the reasonable suspicion analysis in court. Independent of concerns with reliability, accuracy, or potential manipulation, there is a separate issue with allowing law enforcement to control the factors that make up reasonable suspicion. As seen in the creation of profiles, or the claim of suspicion based on presence in a high crime area, a malleable reasonable suspicion test offers little protection from a police stop.

The concern with adding a prediction model to an already weakened reasonable suspicion standard is that one factor can control the totality of circumstances in finding reasonable suspicion. The prediction, because it comes from an objective source, will color the subjective suspicion of the officer and the ultimate objective decision of the court. In practical application, it will be difficult for a court to discount the weight of some objective support for the officer's suspicion. To allow predictive policing such influence without mechanisms of accountability for the data and analysis, and without full transparency, may result in a troubling lack of protection for individuals who end up in the forecasted areas.[337]

This concern should inspire courts to take a more active role in ensuring that the predictive policing models work and can be evaluated. This will result

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[336] Harris, *supra* note 207, at 290–91 ("The right to be free from illegal searches and seizures belongs not just to the guilty, but to everyone.").

[337] Of course, some might argue that this weight is given to officers anyway without the additional weight of a computer algorithm.

in new battles over discovery, expert reports, and line drawing about the predictive validity of the claims. This development is to be expected and welcomed as a natural course of new technologies being introduced into courtrooms.

CONCLUSION

In the future, predictive policing will affect the Fourth Amendment reasonable suspicion analysis. How it affects it and whether these changes weaken or strengthen Fourth Amendment protections remains unclear. This Article has attempted to provide a framework for analysis for developers of the technology as well as courts struggling to interpret the consequences of the technology. Only by understanding the criminological traditions of crime and place and predictive themes in the Fourth Amendment doctrine can courts adequately assess the technology and its impact.