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Geospatial Predictive Policing – Research Outlook & A Call For Legal Debate

Abstract

Time Magazine named predictive policing one of the 50 most important innovations in 2011. The software concept that is designed to give police departments the locations of future crimes before they occur has since spread around the world – including Germany – and is considered one of the most promising technology-led law enforcement tactics to date. This article gives an overview of the theoretical background of predictive policing, as well as maps the current state of scholarship, and provides a research outlook.
Keywords: Data-Driven Policing, Pre-Crime, Repeat Victimization Theory, Predictive Risk Assessment, Computational Criminology

Abstract

Bereits 2011 wurde Predictive Policing vom Time Magazin zu einer der 50 bedeutendsten Innovationen des Jahres gekürt. Das Softwarekonzept, das der Polizei die Orte zukünftiger Verbrechen nennt, bevor sie sich ereignen, hat seitdem seinen Siegeszug rund um die Welt – einschließlich Deutschlands – angetreten und gilt heute als eines der vielversprechendsten technologiebasierten Strafverfolgungstaktiken. Der vorliegende Beitrag möchte einen Überblick über den theoretischen Hintergrund dieses Ansatzes und den aktuellen Stand der Wissenschaft bieten sowie einen Forschungsausblick skizzieren.
***Schlagwörter**: Datengesteuertes Polizieren, Pre-Crime, Mehrfach-Viktimisierung, Risikoeinschätzung, Informatik-basierte Kriminologie*

A. INTRODUCTION

> *„The [...] choice is [...] whether collectively we will allow the coders to select our values for us."*[1]

1 *Lessig* Harvard Magazine 2000.

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Predictive algorithms are ubiquitous and have been subtly shaping our daily life for years. Anybody who has ever used a search engine, has ever bought a product online, or applied for a loan has very likely been exposed to predictive algorithms. They predict what we want to see at the top of our search results, what we want to buy next, and whether we will be able to pay our credit rates in the future. And now they also predict crime: So-called "predictive policing" programs are employed by more and more police departments around the world. To science fiction fans this is nothing new. Predictive policing has been prevalent in popular culture long before the technical capabilities to put such programs into action have now developed. Predictive policing has been in the public consciousness since Philipp K. Dick's 1956 short story "Minority Report" which was made into a feature film in 2002. More recently the topic has been picked up by dystopian Netflix series such as "Person of Interest", and the computer game "Watch Dogs 2": in each of which the protagonists are wanted for crimes they have not yet committed in an effort to create a crime-free society. The focus on the science fiction background of predictive policing which is regularly exploited by the media[2] as well as predictive policing manufacturers themselves[3], however, leads to unrealistic expectations and distorts the image of what current programs are able to accomplish. Still, it is true that parts of what was once purely science-fiction has now - at least to some degree - moved into the realm of the technical possible. Actuarial prediction trends have spread to various areas of the security sector enabling empirical risk analyses on an individual as well as a geospatial level. Examples include the Chicago "Strategic Subject List" – also termed the "Heat List" by the media – which since 2013 compiles the (by now at least) 1500 individuals who are at a high risk to be involved in gun violence in the near future. Based on social network analysis individuals are singled out and referred to local police commanders for preventive intervention. Not just individuals with a criminal record are targeted but also individuals that interact with convicts or those who live next to them.[4]

Furthermore, the commercially available computer system for sentencing decision support COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) is helping judges across the US in determining the length of a sentence and the possibility of parole, by predicting the likelihood of an individual to reoffend ba-

2 *Inter alia*: *Considine* The Long Eye of the Law – So Who's Ready for a "Minority Report"-Style Future?, Motherboard 03/20/2013; *Stroud* The minority report: Chicago's new police computer predicts crimes, but is it racist?, The Verge 02/19/2014; *Smith* "Minority Report" Is Real — And It's Really Reporting Minorities, Mic 11/09/2015; *Christiansen* Kriminalitäts-Vorhersagen à la Minority Report: Profi-Einbrechern auf der Spur, Heise Online 01/08/2015.

3 The name of German predictive policing program "Precobs" borrows deliberately from the term "Precogs" of Minority Report: genetically mutated humans that predict homicides before they occur; in one press release the manufacturer even refers to its predictive policing program explicitly as "Precogs": *IfmPt* Deutsche Prognosetechnik in Zürich und London, Press Release 06/2013.

4 *Stroud* The minority report: Chicago's new police computer predicts crimes, but is it racist?, The Verge 02/19/2014.

sed on a calculation of psychometric and empirical risk factors.[5] The lawfulness of this approach was confirmed by the Wisconsin Supreme Court in 2016.[6]

And finally, software such as AVATAR (Automated Virtual Agent for Truth Assessment in Real-time) that based on an *ad hoc* analysis of individuals' vital signs (including eye movement, breathing pattern and heartrate) automatically predicts if someone passing a boarder control has "mal intent" and poses a threat is being deployed at the US-Mexican border and has been tested in Europe by Frontex, the European boarder security agency.[7]

From this broader data driven preventive shift across the whole criminal justice system geospatial predictive policing, i.e. algorithms designed to give police departments the locations of future crimes has emerged as yet another example of actuarial predictions.

B. WHAT IS GEOSPATIAL PREDICTIVE POLICING?

As demonstrated above predictive algorithms are employed in different areas of the criminal justice system including in the various stages of criminal proceedings (cf. COMPAS), as well as in law enforcement operations. If integrated into the latter the approach is described by the umbrella term predictive policing. It encompasses two subcategories which must be carefully distinguished in any discussion:

1. individual-based predictive policing (predictive profiling or scoring) by which an individual's risk of committing a crime is assessed (cf. Chicago "Strategic Subject List"), and
2. location-based or geospatial predictive policing, a concept that is built on the premise that it is possible to predict the location and time of future crimes by using computer analysis of information about previously committed crimes.

For Germany, it is worth examining particularly the geospatial predictive policing phenomenon in detail since individual-based applications of predictive algorithms have not yet established themselves in German law enforcement tactics on a larger scale. Geospatial predictive policing, however, is spreading to cities all over Germany ever since the first test run in Munich in 2014.

5 See a critical analysis by *Angwin et al.* Machine Bias: There's Software Used Across the Country to Predict Future Criminals. And it's Biased Against Blacks, ProPublica 05/23/2016; the approach is not a new and has been written about already in the 1990 *inter alia* by *Schild* AI & L 6 (1998), 151.

6 State v. Loomis, 881 N.W.2d 749, (WI 2010). See also Malenchik v. State, 928 N.E.2d 564, (Ind. 2010); *Palazzolo* Court: Judges Can Consider Predictive Algorithms in Sentencing, Wall St. J. 07/13/2016.

7 *US Department of Homeland Security* Rapid Screening Tool: The AVATAR (2014).

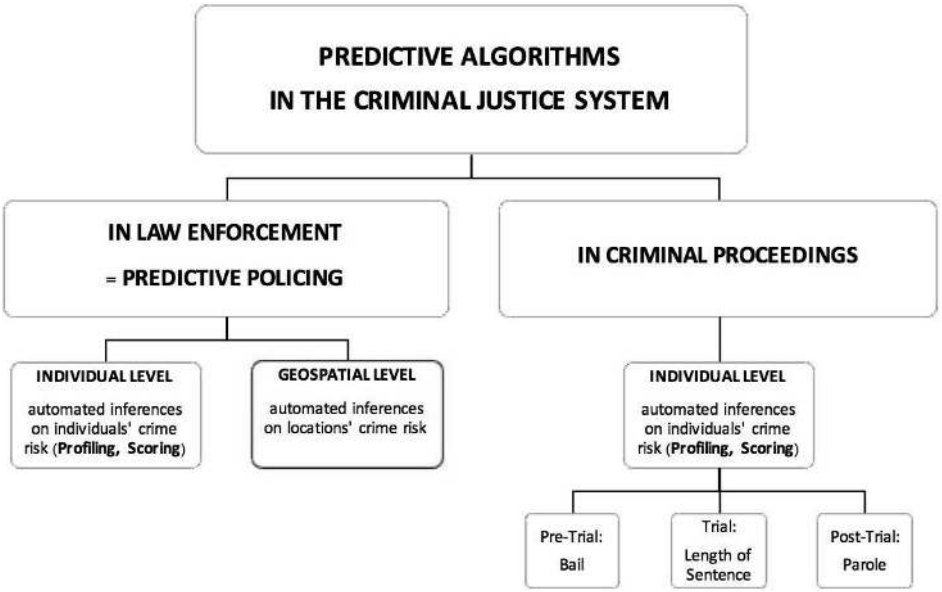

FIGURE 1: TYPOLOGY OF PREDICTIVE ALGORITHMS IN THE CRIMINAL JUSTICE SYSTEM

" […] humans are not nearly as random as we think. […] In a sense, crime is just a physical process, and if you can explain how offenders move and how they mix with their victims, you can understand an incredible amount",[8] says Jeffrey Brantingham cofounder of the American predictive policing company Predpol. *"Perpetrators are like a bad weather front"*,[9] claims Dieter Schürmann chief of the criminal division in the German Federal State of North Rhine-Westphalia who is overseeing the local predictive policing efforts.

Predictive policing uses mathematical algorithms to compile data points from past crimes, lie them out on a map and identify areas of increased likelihood of crime. On a weekly or daily basis, it provides police departments with a map on which highlighted circles and right-angles mark areas with increased crime risk as small as 150 m^2 (500 ft^2). Police departments can thereby focus their patrol resources on these areas for prevention or early detection of crime. Cities like Los Angeles have moreover started sending police helicopters over predicted crime hotspots claiming a deterrence effect.[10] Besides using the predictive software's information for internal police deployment de-

8 *Rubin* Stopping Crime Before It Starts, L.A. Times 08/21/2010.
9 *Borchers* Predictive Analytics bei der Polizei: Tätergruppen als Schlechtwetterfront entlang der Autobahn, Heise Online 02/26/2016.
10 *Mather/Winton* LAPD uses its helicopters to stop crimes before they start, L.A. Times 03/07/2015.

cision the Swiss canton of Aargau is also publishing selected burglary predictions to the public via a mobile phone app.[11]

The algorithms whose details are proprietary - they are a trade secrets of the private companies that created them - are based on the basic criminological finding that criminals follow habits, and that such habits make their future actions predictable. The (*Near-)Repeat Victimization Theory*[12] which states that places in the vicinity of a past crime location are at a higher risk to be targeted by criminals in the future is the core theoretical backbone of all predictive policing algorithms augmented by *Routine-Activity*, *Broken-Windows,* and *Rational Choice Theory*. The main source of input are statistical data from the police case-processing system but some algorithms go further as to include weather data, terrain data such as proximity to public transport and the dates of large-scale public events such as football games, as well as socio-cultural and -economic data reaching from nationality to migration background, education, religious affiliation, marital status, occupation and income level at a certain location.[13]

In Germany, the software concept is currently limited to predictions of the locations of professional burglaries,[14] but in other countries predictions have evolved to include a broad range of crimes such as rape, aggravated assault, robbery, auto theft, and arson, as well as piracy. In Germany and Switzerland steps have been taken to expand predictions to crimes of graffiti property damage.[15]

Police departments and software manufacturers claim that predictive policing reduces crime: e.g. a reduction of burglary by 29% in a six-month predictive policing test run in Munich, Germany from October 2014 to March 2015.[16] Even if accurate these numbers only constitute momentary descriptive snapshots of the crime situation, disregarding long-term crime displacement and adjustment effects, as well as the question of a truly causal relationship between a crime rate fluctuation and predictive policing deployment. Even though predictive policing has been around for ten years a clearly positive *long term* evaluation of the technology that would satisfy a rigorous independent scientific standard of proof[17] is yet to come.

The Catch-22 of predictive policing may well be that at the current level it is not effective enough to add value to police work, if the efficiency would be increased by using more advanced algorithms and diverse personalized data sources, the application

11 "KAPO-App" available for free in App Stores.

12 Cf. *inter alia Johnson* Journal of Experimental Criminology 4 (2008), 215; *Short, et al.* J Quant Criminol. 25 (2009), 325; *Farrell/Sousa* 2001, 225.

13 See e.g. the presentation on the German predictive policing program SKALA by *Schürmann* 2015, 13.

14 *Egger* Positionspapier zum Einsatz von PRECOBS bei der Bayerischen Polizei, 2015.

15 *IfmPt/futureLAB* IfmPt and futureLAB have decided to form a strategic partnership, Press Release 08/04/2016.

16 *Bavarian Ministry of the Interior* Herrmann berichtet über Erfahrungen des Precobs-Tests in München und Mittelfranken, Press Release 06/24/2015.

17 One study reaching a positive conclusion on predictive policing is co-authored by founders of the US predictive policing software company PredPol: *Mohler et al.* JASA 110 (2015), 1399.

might be desirable from an efficiency point of view but undesirable from a legal concerns point of view.

From a criminological perspective, a core task for geospatial predictive policing thus remains a comprehensive empirical evaluation of its efficiency, starting with a discussion of what is the most suitable indicator of success for predictive policing: a reduction in crime, an increase in crime detection or a different measurement.

C. DISTRIBUTION OF GEOSPATIAL PREDICTIVE POLICING

Geospatial predictive policing was first introduced into police practices in the US in 2005 by IBM's Blue CRUSH (Crime Reduction Using Statistical History) program in Memphis.[18] Geospatial predictive policing has since disseminated to various countries around the world including France, Great Britain, Italy, Switzerland and Germany.

Figure 2 shows a map of cities in Germany which are currently testing or permanently deploying geospatial predictive policing. There are three types of software in use in Germany today:

1. Precobs (Pre Crime Observation System) sold by the German private company Institute for pattern-based Prediction Technique (*Ger.:* Insitut für musterbasierte Prognosetechnologie - IfmPt),
2. programs based on IBM's statistical analysis software SPSS, conducted with assistance from IBM, as well as
3. various in-house developments by police departments that do not want to rely on commercially available solutions but want to develop their own software concept.

Internationally the selection of commercial predictive policing programs is much wider, including at least a dozen different programs.[19] In Germany the decision to use predictive policing is not centrally made but lies within the responsibility of each of the sixteen federal states. About half of them are permanently deploying predictive policing, actively testing it or conducting concrete research.

18 *Perry et al.* 2013, 69.

19 PredPol (US), Risk Terrain Modelling (US), HunchLab (US), Hitachi Visualization Suit, ArcGIS (internationally), ComandCentral Predictive, Accurint Crime Analysis, Map Revelation (France), KeyCrime (Italy) just to name a few.

FIGURE 2: DISTRIBUTION MAP OF GEOSPATIAL PREDICTIVE POLICING IN GERMANY

Bavaria started a trial run of Precobs in 2014 and has since permanently integrated it into its police operations.[20] Baden-Württemberg tested the same software for six month starting October 2015. A decision on the continuation of the project is expected in spring 2017.[21] North Rhine-Westphalia has been developing a predictive policing program under the acronym SKALA (*Ger.:* System zur Kriminalitätsanalyse und Lageantizipation) since November 2015.[22] The project is designed for a duration of three years and based on IBM's SPSS. Lower Saxony in cooperation with IBM and the Karlsruhe Research Service Institute, too, undertook a six-month research project on predictive policing based on IBM's SPSS in 2014.[23] Moreover, from February to October 2017 Lower Saxony is testing the in-house developed predictive program PreMAP which is deployed as an app accessible for police officers on mobile tablets.[24] An in-house program named KLB (*Ger.:* Kriminalitätslagebild)-operativ has been developed in Hesse since 2015.[25] The in-house development named KrimPro is being tested in Berlin since July 2016.[26]

Since January 2016 the police in Hamburg is conducting the two-year preliminary research project "Prediction Potential of Serious Burglary Crime" (*Ger.:* "Prädiktionspotenzial Schwere Einbruchskriminalität") on the capabilities of crime prediction. They are not including field trials of specific software.[27] Brandenburg is conducting a similar theoretical feasibility study.[28]

The fascination with predictive policing has obviously taken root among German law enforcement decision makers and is likely to spread to even more federal states in

20 In Munich and Middle Franconia: Bavarian Ministry of the *Bavarian Ministry of the Interior* Herrmann berichtet über Erfahrungen des Precobs-Tests in München und Mittelfranken, Press Release 06/24/2015.

21 In Stuttgart and Karlsruhe: *Ministry of the Interior of Baden-Württemberg* Polizei startet Einsatz der Prognose-Software „precobs", Press Release 10/30/2015.

22 In Cologne, Duisburg, Essen, Gelsenkirchen, Düsseldorf: *Landeskriminalamt Nordrhein-Westfalen* Schriftliche Stellungnahme zur öffentlichen Anhörung des Innenausschusses des Landtags Nordrhein-Westfalen am 27. Oktober 2016 zum Antrag der Fraktion der CDU, Stellungnahme 16/4351, 2016, 25.

23 In Hannover: *Ministry of the Interior of Lower Saxony* Beantwortung der Mündl. Anfrage der CDU zur „Vorausschauenden Polizeiarbeit", Session of the Parliament of Lower Saxony 18. Dec. 2014 - Fragestunde Nr. 48, (2014).

24 In Wolfsburg and Salzgitter-Peine-Wolfsbüttel: *Ministry of the Interior of Lower Saxony* Polizei Niedersachsen geht neue Wege - Mit PreMAP gegen Einbrecher, Press Release 12/05/2016.

25 In Wiesbaden, Main-Taunus, Darmstadt-Dieburg and Main-Kinzig: *Hessian Ministery of the Interior* Innenminister Peter Beuth stellt Prognose-Software „KLB-operativ" vor, Press Release 07/20/2016.

26 *Berlin Chief of Police* Kollege Computer hilft bei der Kriminalitätsprognose, Press Release 08/10/2016.

27 *Kriminologische Forschungsstelle Landeskriminalamt Hamburg* Projektbeschreibung Prädiktionspotenzial Schwere Einbruchskriminalität, 2016.

28 *German Government* Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Andrej Hunko, Jan Korte, Frank Tempel, weiterer Abgeordneter und der Fraktion DIE LINKE, Drs. 18/10785, 2016, 5.

the near future. This makes a look at the current state of scholarship even more pressing. Is legal scholarship keeping up with this rapid development?

D. SCHOLARSHIP REVIEW

Despite the fact that the first predictive policing attempts were made more than a decade ago, and predictive policing has been named one of the year's top 50 innovations by *Time Magazine* already in 2011,[29] legal scholarship on the issue remains scarce. The topic has been dealt with academically by economists, social scientists, and computer scientists but neglected by legal scholars.

The most elaborate overview of predictive policing can be found in a 2013 report by the global policy think tank *RAND Corporation*.[30] However, only one of its total of 200 pages is designated to "civil and privacy rights". The study was lead-authored by an information scientist with no apparent legal input as the report's objective was not a comprehensive evaluation of critical issues surrounding predictive policing but to provide a reference guide for police departments interested in purchasing predictive policing software.

A state office of criminal investigation (*Ger.:* Landeskriminalamt) in Germany commissioned a sociologist to review predictive policing practices in 2014, resulting in a twelve-page report touching shortly on data protection issues.[31]

The Max Planck Institute for Foreign and International Criminal Law in Freiburg is expected to present an evaluation of the six-month predictive policing pilot project in Baden-Württemberg in spring 2017. The evaluation is authored by two criminologists with a social science background, *Oberwittler & Gerstner,* and will focus on efficacy rather than legal implications of predictive policing.

The Association for Innovative Social Research and Social Planing (*Ger.:* Gesellschaft für innovative Sozialforschung und Sozialplanung e.V - GISS) is assisting in the evaluation of the SKALA predictive policing project in North Rhine-Westphalia (2015 – 2018), focusing on whether predictive policing offers added value to policing in terms of efficiency.[32]

The German Ministry of Education and Research is currently funding the multi-partner program Assessing Big Data (2015 – 2019). One aspect of this program is the use of big data by governments which will includes an analysis of predictive policing conducted by the Berlin Social Science Center (WZB), again, with no immediate legal input.

29 *Grossman et al.* The 50 Best Inventions, Time Magazine 11/28/2011.
30 *Perry et al.* 2013.
31 *Gluba* Kriminalistik (2014), 347.
32 *Landeskriminalamt Nordrhein-Westfalen* Schriftliche Stellungnahme zur öffentlichen Anhörung des Innenausschusses des Landtags Nordrhein-Westfalen am 27. Oktober 2016 zum Antrag der Fraktion der CDU, Stellungnahme 16/4351, 2016, 26.

The German geographer *Belina* recently considered predictive policing as an update to the 19th-century concept of social physics.[33] The geographer *Straube* is currently preparing his doctoral thesis on geospatial predictive policing.

German sociology professor *Krasmann* is conducting an ethnographic study of geospatial predictive policing (2017 – 2018).[34]

Mastrobuoni, an economist at the University of Essex, UK arrived at the conclusion of a positive cost-benefit analysis of predictive policing in Milan, Italy without touching on legal issues.[35]

The Norwegian Board of Technology an independent body for technology assessment issued an extensive 100-page report on predictive policing in 2015[36] authored by computer scientists which discusses discrimination issues from an ethics point of view.

Social scientists *Legnaro & Kretschmann* critically analyze the social costs of predictive policing with regard to enforced securitization of space and its role as architecture for reassurance of the public.[37] The article only shortly mentions legal issues.

Transnational approaches are rare, but from 2008 to 2011 INEX a research project funded by the European Union analyzed the ethical consequences of the proliferation of security technologies.[38] Some of INEX's findings are likely to resonate in a predictive policing context since both subject matters spawn from the same pre-crime aspiration.

At a G6-meeting in 2016 the interior ministers of major EU member states declared their intention to work towards an exchange on predictive policing.[39] In the same year Germany and France proposed a EU-research project on predictive policing to the Council of the European Union.[40]

The Council of Europe has launched the project MSI-NET on human rights and algorithms in March 2016,[41] first outputs of which are expected to arrive within the next two years.

The little decidedly legal writing that does exist is insulated and fragmented. A large part of publications is generally limited to explaining the criminological theory behind predictive policing along with speculations on its accuracy and effectiveness[42] rather

33 *Belina* MschrKrim (2016), 85.
34 See the project presentation at www.wiso.uni-hamburg.de/fachbereich-sowi/professuren/hentschel/forschung/predictive-policing.html.
35 *Mastrobuoni* 2016.
36 *Teknologirådet* 2015.
37 *Legnaro/Kretschmann* Krim. Journal (2015), 94.
38 Available at: http://www.inexproject.eu.
39 *German Ministry of the Interior* G6-Treffen auf Schloss Moritzburg, Press Release 06/02/2015.
40 *German and French Delegation* Draft European initiative to prevent and combat organised domestic burglary, Concil of the European Union, Doc. 6876/16, Press Release 03/082016.
41 Committee of Experts on Internet Intermediaries (MSI-NET), available at: https://www.coe.int/en/web/freedom-expression/committee-of-experts-on-internet-intermediaries-msi-net- .
42 Cf. *Nix* 2015.

than offering a detailed legal assessment. Concerns about privacy and equality are largely voiced in passing but not investigated further.

Zedner, criminal law professor at Oxford University, UK has written about the larger societal shift in crime control towards pre-crime and pre-punishment from a theoretical philosophical perspective without going into detail on predictive algorithms.[43]

American legal scholar *Joh* has analyzed the relationship of big data use in law enforcement and the Fourth Amendment.[44]

Ferguson as well as *Fabio* analyze the impact of predictive policing on the reasonable suspicion threshold for police action.[45]

Dutch criminal law professor *Hildebrandt* has argued for a regulation of predictive law enforcement technologies in her advice to the government.[46]

Singelnstein is the only German law professor to have publicly touched on the issue of predictive policing.[47]

It is apparent that a coherent legal perspective on predictive policing is missing. Consolidating the existing fragmented approaches into a single source and expanding them into a comprehensive analysis and governing concept will be the task of future legal research.

E. RESEARCH PROJECT: LEGAL EVALUATION OF PREDICTIVE POLICING IN GERMANY AND THE UNITED STATES

Addressing the above-illustrated need for further research is the objective of the author's doctoral thesis. Her research project first sets out with a legal impact assessment of predictive policing in Germany and the United States focusing on constitutional guarantees, and second, addresses the question if and how predictive policing may be governed in the future.

Even though all sociotechnical systems need to be understood as historical projections of power within their very specific national contexts, it is important in case of a global phenomenon such as predictive policing to take a supra-regional perspective to highlight commonalities in the legal challenges posed. The two countries Germany and the United States lend themselves to such perspective in a unique way. They are chosen representatively of both the world's largest legal systems - the common-law system and the continental European civil law system. The countries also complement each other because they constitute different stages of familiarity with predictive policing: the US being the birthplace of predictive policing, Germany being a recent adopter. A comparative view on predictive policing does, however, not just promise to be revea-

43 *Zedner* Criminal Justice Matters 81 (2010), 24. See also *Zedner* Theoretical Criminology 11 (2007), 261.
44 *Joh* Wash. L. Rev. 89 (2014), 35.
45 *Ferguson* U. Pa. L. Rev 163 (2015), 327.
46 *Hildebrandt* 2016.
47 See his website at www.jura.fu-berlin.de/fachbereich/einrichtungen/strafrecht/lehrende/singelnsteint/muendliches/index.html.

ling for Germany, but is of interest to American scholarship as well. In a post-9/11 world with the need to balance security and individual freedoms intricately US scholars such as *Bruce Ackerman*[48] have with great interest turned towards Germany and its wealth of historic experience with the struggle of honoring constitutional liberties while maintaining security in the face of facist and terrorist threats (regarding the National Socialists Movement in the first half of the last century, the Red Army Fraction in the second half).[49]

The author's legal impact assessment addresses both the status quo level as well as foreseeable advancements of geospatial predictive policing in the areas of artificial intelligence and the use of more diverse data input sources including social media data. Even though geospatial predictive policing is today still a far cry away from the science fiction references it conjures up, it is inevitable that once it becomes normalized into routine police practices there will be calls for increasing accuracy and scope of the present level of predictions. Such near-future developments need to be taken into account in an analysis which will stretch from implications for the reasonable suspicion threshold for police action to privacy, discrimination and transparency.

With regard to privacy questions that need to be addressed include: Are personal data, i.e. any information concerning the personal or material circumstances of an identified or identifiable individual used as input data of the algorithm? Where is the line between personal and anonymized data? Are the locations of past crimes personal data (of the victims) and need to be obfuscated (cf. the disagreement on this issue among the German Data Protection Commissioners of Bavaria[50] and Baden-Württemberg[51])? What standard for anonymization should be required in the light of far reaching deanonymization techniques?[52] To what degree may social media data be freely analyzed for predictions? Should certain kinds of data be *per se* excluded from predictions even if anonymized, e.g. the predominant religious affiliation or divorce rate at a certain location?

What level of data security is required? Whose server must the input data and the aggregated predictions be stored at: the servers of a possibly foreign private company located abroad or the local police's server? May predictive policing applications be cloud-based (using a remote data center that is accessible to police officers on any web-based device)?

Questions surrounding discrimination include whether geospatial predictive policing is creating and relying on stigmatizing behavior profiles for groups of people who

48 *Ackerman* 2006, 3, and *Id.* Harv. L. Rev. 113 (2000), 633-725.
49 See *Miller* J. Nat'l Sec. L. & Pol'y 4 (2010), 369, 370 f.
50 Cf. "*nothing to object*" (*Ger.:* "*nicht zu beanstanden*") *Data Protection Comissioner of Bavaria*, 27. Tätigkeitsbericht (2015/2016), 2017, 52 ff.
51 Requiring an obfuscation: *Data Protection Commissioner of Baden-Württenberg*, 32. Tätigkeitsbericht (2014/2015), 2016, 44.
52 Information scientist have repeatedly pointed out in various settings that allegedly anonymous or pseudonymized data can be connected back to an individual with little (computing) effort see e.g. *Narayanan/Shmatikov* 2008; *Hayes et al.* 2016 Proc. 23rd ACM Conf. on Computer and Comunications Security (2016), 177.

are represented at a certain location. A study of the earlier mentioned algorithm COMPAS that is assisting judges has recently found evidence of racial bias in the algorithms.[53] How much of the concerns of racial discrimination by predictive profiling algorithms can be transferred to a geospatial predictive policing context?

Details about the exact composition of the algorithms are classified. Does this secrecy contradict the rule of law if the algorithm is applied by governments in a fundamental rights sensitive context such as criminal law? This raises the issue of transparency at whose core lies the need for reviewability of executive decisions. It encompasses questions of both factual transparency (access to input data and source code of an algorithm) and epistemic transparency (prohibiting the use of uninterpretable artificial intelligence).

> "*Unprecedented computational power and sophistication make possible unexpected discoveries, innovations, and advancements in our quality of life. But these capabilities, most of which are not visible or available to the average consumer, also create an asymmetry of power between those who hold the data and those who intentionally or inadvertently supply it.*"

states the White House Report on Big Data in 2014[54] and already four centuries ago did Francis Bacon write "*nam et ipsa scientia potestas est*" (*Engl.:* "*for knowledge itself is power*").[55] Future research must thus take a detailed look at in how far an asymmetry of power is engraved into predictive policing and what standard of transparency may be required to rectify an imbalance. Technological evolution has increasingly led to the infiltration of the law enforcement sector with techniques once endemic to military and intelligence services.[56] It is, however, unacceptable for the intelligence community's secrecy to penetrate law enforcement in the same way.

The conclusion of the impact assessment will lead to the issue of whether predictive policing requires a regulatory framework. Predictive policing algorithms are being developed by mathematicians in conjunction with social scientists without professional legal input and are being deployed by police departments without in-depth legal counsel. Law enforcement tools have advanced beyond the laws that govern it. To this day, predictive policing practices remain entirely unregulated. Based on the findings to the impact assessment future research will develop a framework of principles by which predictive policing may be governed and conceptualize a control and regulating regime. Individual police departments should not have to solve the numerous questions raised in the paragraphs above themselves. Without defined parameters for the use of

53 *Angwin et al.* Machine Bias: There's Software Used Across the Country to Predict Future Criminals. And it's Biased Against Blacks, ProPublica 05/23/2016.

54 *Executive Office of the President* Big Data: Seizing Opportunities, Preserving Values, 2014, 3.

55 *Bacon* 1863, 79.

56 The US algorithm on which the Predictive Policing software PredPol is based on was initially developed to predict casualties Iraq: *Bond-Graham/Wednesday* All Tomorrow's Crimes – The Future of Policing looks a lot like good Branding, SF Weekly 10/30/2013.

geospatial predictive policing and without regulatory oversight there is the risk that police departments will develop varying, contradicting approaches and standards for predictive policing. This is already the case with regard to the obfuscation of the addresses of burglary victims which is required by Baden-Württemberg, but not by Bavaria which is using the same software.[57]

Any regulation must further contain a flexible method of response to technological evolutions in the area of predictive algorithms. The author's research will thus in detail look at what form of statutory regulation of geospatial predictive policing is necessary and feasible, as well as consider the institution of an independent standard setting and control body for predictive algorithms specifically in the criminal law system.

Horst Herold, the chief of the German police force in the 1970s once said[58]: "*The one who refuses modern methods, suppresses knowledge and is anti-enlightenment.*"

The goal of predictive policing regulation is not to suppress knowledge. To the contrary, it is to enable a public discussion and democratic review of the "modern methods" used in a sensitive, high stakes area such as criminal law. Every predictive policing program must thus have inbuilt pathways for continuously ensuring that fundamental rights are not infringed, especially as the software will evolve in the upcoming years. In order to do so, to ensure that the technical development will not overtake the legal one in the near future, a system of transparency has to be anchored in law today. For the realm of intelligence services Snowden's revelations on communication mass surveillance in 2013 have demonstrated drastically what can happen if the technical development is well ahead of the legal and societal one: What is technically possible is being implemented, and nearly impossible to reverse.

Still, predictive policing should not solely be viewed as a threat to the rule of law in Germany but taken as a chance for establishing a regulatory model of transparency exemplary for other areas of algorithmic decision making.

F. CONCLUSION

Predictive policing lies at the intersection of law and computer science. To achieve a wholesome debate input from both fields is required. To speak with *Kranzberg*, technology is neither good or bad, nor is it neutral.[59] As stated in the introductory quote it is up to us - the legal scholarship and society as a whole - to decide on the values we want embedded in technology and whether we will allow these values to be selected solely by coders.

Predictive policing and similar algorithmic applications in the criminal law system have taken root and will continue to evolve regardless of legal input. But they shouldn't have to. Legal scholars should not shy away from the technical intricacies of

57 See *supra* footnotes 50, 51.
58 *Cobler* Transatlantik (1980), 29.
59 *Kranzberg* Technology and Culture 27 (1986), 544.

algorithmic decision making and join the debate with social and computer scientist today.

I am thus leaving the reader with the following provocations:

1. Privacy is not enough as a yard stick for predictive policing.
2. Predictive development will not halt at a legal threshold. What is technically possible will be developed.

This this why we should even more so:

3. interrogate the architecture of algorithms as we interrogate the code of parliament. Unless we do, or unless we learn how, the relevance of our constitutional tradition will fade.[60]

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60 Adapted from *Lessig* Harvard Magazine (2000): "*We should interrogate the architecture of cyberspace as we interrogate the code of Congress. Unless we do, or unless we learn how, the relevance of our constitutional tradition will fade.*"

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