AN OVERVIEW OF POLICE TECHNOLOGY: ADOPTION AND EFFICACY

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Abstract: Technology continues to evolve at a rapid pace and touches all facets of modern life including law enforcement's role in public safety. Police agencies have adopted many law enforcement technologies to improve response times, aid in investigating and solving crime, and enhance transparency. This literature review describes common types of technologies in use by police departments, how and why police technologies are selected, and their overall effects. Overall, police agencies' policies and practices regarding technology should involve planning, consideration, and caution considering potential limitations and harms, as well as cost to tax payers.

Introduction

New technology drives changes in all aspects of society, including crime and the criminal justice system.[1] Law enforcement agencies today employ a wide variety of technology to deal with crime and enforce the law in a more effective, efficient, and safe manner. Consequences of law enforcement use of technology are not empirically well understood, however. Scholars are just beginning to explore technology policy decisions,[2] how police uses of technology evolve over time,[3] and how and to what extent technology affects police outcomes.[4]

The rapid growth of technological innovation in policing has outpaced efforts to measure its impacts. This lack of knowledge and rapid evolution of form and function has been seen in body-worn cameras, as well as predictive algorithms, acoustic gunshot detection systems, license plate readers, and drones. For-profit companies tout technology as a solution to a multitude of problems in public safety, yet the adoption of these tools and their uses in practice remain mostly unexamined. The array of motivations for adopting technology, the lack of rigorous research on its effectiveness, and the sheer number of technological products that currently exist suggests what is true for one type of technology is probably not generalizable. Thus, drawing conclusions about the consequences of technology in policing is challenging.

This article reviews the research literature on current police technology, factors that play a role in technology adoption, and how technology impacts the work of law enforcement. Key operational technology adopted by law enforcement in Illinois will be noted and areas for future research suggested.

An Overview of Police Technology

Technology Types

Technologies that support public safety can generally be divided into hard and soft types.[5]

- *Hard technologies* are tangible resources to prevent crime and are distinguished by innovations in materials, devices, and equipment, such as less-than-lethal weaponry, mobile computers, drones, surveillance cameras, and body armor equipment.
- *Soft technologies* strategically use information to prevent crime and are distinguished by new computer programs, analysis techniques, and methods of data sharing or system integration, such as predictive software, mapping, and facial recognition software.

Law Enforcement Technology

There are many hard and soft technologies available to law enforcement. Below are descriptions of some of the most common used today. *Figure 1* depicts a timeline of select major police technologies. In addition, the text box highlights algorithmic prediction in policing, which has potential benefits and drawbacks.[6]

  Body-worn cameras. Wearable cameras can be attached to the body of an on-duty officer and record, from a first-person perspective, events that take place while the officer is on patrol or completing other job assignments. The videos can be reviewed by the officer, a civilian they interacted with, law enforcement command staff, and the public as evidence or training

material, depending on the circumstances and policies on video use.[7] Body-worn cameras are utilized in practice as tools to promote transparency, document evidence, record behavior, and deter undesirable behavior.[8] In a 2013 survey of police agencies, about 32 percent of agencies reported at least some distribution of these cameras to officers.[9] Some research has indicated body-worn cameras can reduce use of force and complaints against officers.[10]

ALGORITHMIC PREDICTION IN POLICING

Predictive policing can help forecast where crime will occur in the future. Software uses algorithms to analyze data and make predictions. The Los Angeles Police Department was the first to use data to predict crime. Universities and private technology companies developed software to sell to police agencies and most algorithms originated from models that forecast consumer behavior. The benefits of predictive policing include enhanced intelligence and the uncovering of crime trends to improve police response and increase public safety. However, the public has raised concerns that predictive policing may not be transparent, accurate, or respectful of citizens' privacy. In addition, this strategy has not been evaluated to assess benefits and drawbacks; therefore, more rigorous research is warranted.

Meijer, A. (2019). Predictive policing: Review of benefits and drawbacks. International *Journal of Public Administration, 42*(12), 1031-1039.; Moses, L. B., & Chan, J. (2016). Algorithmic prediction in policing: Assumptions, evaluation, and accountability. *Policing and Society, 28*.; Richardson, R., Schultz, J., & Crawford, K. (2019). Dirty data, bad predictions: How civil rights violations impact police data, predictive policing systems, and justice. New York University Law Review Online.; Schlehahn, E. , Aichrothe, P., Mann, S., Schriener, R., Lang, U., Shepherd, I.D., & Wong, B. L. (2015). Benefits and pitfalls of predictive policing. *2015 European Intelligence and Security Informatics Conference.*

Acoustic gunshot detection systems. Acoustic gunshot detection systems use outdoor sensors to alert law enforcement to geographic locations of shots fired. These systems help police locate and respond to gunfire more quickly, help those who are injured, and offer additional information, such as presence of multiple shooters and types of firearms used. [11] ShotSpotter is the most well-known brand offering this technology. Research indicates acoustic gunshot detection systems are accurate,[12] but the impact on community gun violence is unknown.[13]

License plate recognition technology. License plate recognition technology scans license plates of moving or parked vehicles from a police car or a fixed location. The scanner reads the license plate's alphanumeric pattern and attempts to match the pattern to a database of plates of interest, i.e., belonging to an owner with an arrest warrant or stolen car. Plate recognition technology quickly scans hundreds of license plates at a time, much faster than what one officer can scan manually at their discretion.[14] In 2014, 59 percent of police agencies with 100 or more officers utilized this technology.[15] In two studies, researchers employed randomized control trials to examine the effectiveness of the technology on crime reduction. Neither study

found reductions in crime, but one found the technology heightened productivity (more "hits") leading to arrests and recoveries) to combat auto theft.[16]

Figure 1
Timeline of Select Major Police Technologies, 1960-present[17]
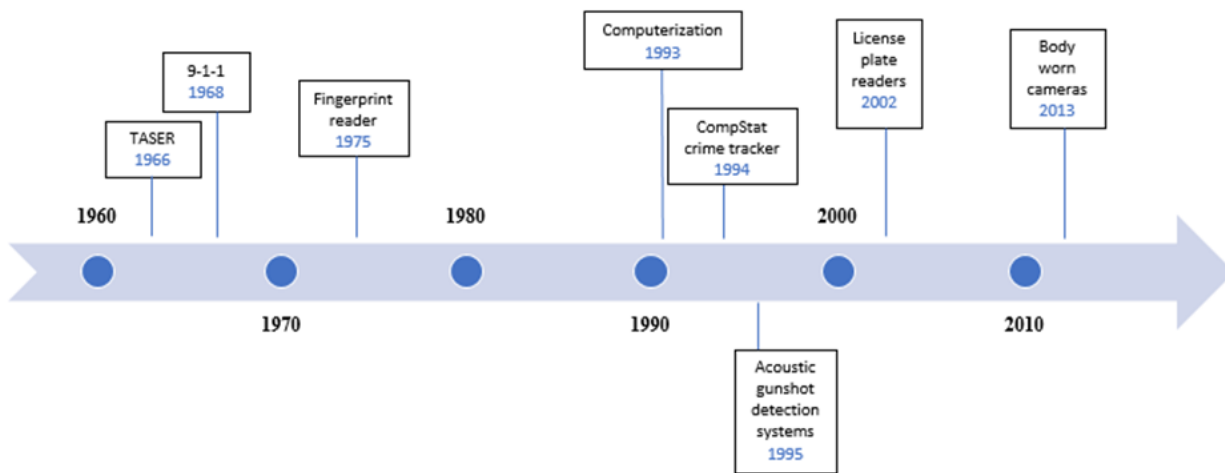
Police Adoption of Technology

Grabosky and Ayling (2006) theorize that when "police go shopping" their purchasing choices are guided by ideology, economics, and pragmatism.[18] In practical terms, these would encompass policing philosophy, politics, available budget, and utility. Thus, factors like perceptions of risk and liability, cost-benefit ratio, personal beliefs and values, and popular claims about technology are considered. Police act as consumers in much the same way as those looking to purchase a new phone, car, or fitness program.[19] Police can even receive trials of new products at no cost, such as temporarily installed license plate readers on squad cars. Many police agencies have received government grants to support the acquisition and testing of new technology.[20]

Just like other consumers, police may not always understand fully what they are getting when they shop.

Grabosky, P., & Ayling, J. (2006). When police go shopping. *Policing: An International Journal*, *29*(4), 665–690.

Companies who sell technology to police have long recognized the opportunity to profit from law enforcement and invest their resources into the rapid deployment of new products that might attract them. In this sense, demand for public safety inherently produces a market of potential consumers of related technology. However, the consequences of acquiring technology in the public safety sector may be more serious than in the typical consumer market, especially if public safety and order hinges on the function of the product, the freedom and/or privacy of members of the public are affected by its use, and/or taxpayer money is used.

For those reasons, it is critical that police and civilians alike understand new technology, how it functions, why it is acquired, and how it is used in policing practices.

Theoretical Frameworks

Several factors may influence the search for technological solutions to policing problems. The diffusion of innovations model and organization choice framework help explain how technology is adopted by law enforcement.

       Diffusion of innovations model. The diffusion of innovations model posits that the adoption of ideas, objects, or practices across a social system, such as law enforcement, is a function of the characteristics of an innovation and how those in the system communicate about it over time.[21] The model suggests adoption of technology flows in this order:

1. Slow at first with just a few *innovators*.
2. Ramp up via *early adopters*.
3. Rapid increase via a mass of *early and late majority* followers.
4. Finally, a few *laggards* adopt the innovation.

This diffusion of innovation model may be useful in explaining the spread of new policing strategies, but the model has limits. Whereas the model may help explain the pace and trajectory of innovation adoption, it is less helpful in explaining why innovations are appealing at the very start, differences in rates of adoption among similar innovations, and cases where an adopter might fit into multiple categories.[22]

       Organizational choice framework. Considering limitations of the diffusion of innovations model, Hendrix and colleagues (2017) employed a survey approach to answer a fundamental question about police technology adoption – Are decisions to adopt technology linked to strategic policing goals?[23] Their study sought to examine associations between policing strategies and the adoption of technologies via the organizational choice framework. The framework outlines the following four pathways by which a law enforcement agency might be motivated to acquire a new technology:

1. *Rational* – Technology is adopted primarily as a functional part of a strategy designed to achieve goals an organization has previously identified.
2. *Contingency* – Technology is adopted primarily due to decisions and/or events outside of the organization (e.g. a mandate to report crime).
3. *Institutional* – Technology is adopted primarily to facilitate an agency's survival through expanded resources, status and prestige, and protection from threats.
4. *Entropic* – Technology is mostly adopted haphazardly, without a clear connection to an intentional purpose.

From a rational perspective, specific policing strategies might call for certain types of technology due to the activities needed to carry out that strategy, but the study conducted by Hendrix and colleagues (2017) found few significant relationships between self-reported policing strategies and the six technologies studied. Results did suggest that predictive policing was associated with automated license plate readers and community policing was associated with social media use.[24] However, factors such as region and jurisdiction type (e.g., city, county, state, highway) also played important roles, and agencies with more officers were more likely to have adopted the use

of geographic information systems, data mining software, social media, and license plate readers. Considering the influence of other factors (e.g., agency size), the study's authors ultimately concluded that there was not a significant correlation between strategic police goals and most of the technology that agencies acquired, evidence of a potentially entropic approach to the adoption of technology.[25] Absent a clear understanding of how technology is meant to achieve overarching police agency goals, any technology is likely to have limited impact.[26]

Need for More Study on Police Technology

Public safety technology companies and media covering their products often make claims about effectiveness despite a lack of existing empirical evidence, which can be misleading.[27] Existing published studies suggest that police use of technology can be, at best ,beneficial and, at worst, harmful, but this depends greatly on the type of technology.[28] In addition, decades of overlapping shifts in other areas of policing make it difficult to separate out the independent influence of individual technologies on policing.

Current research indicates the effect of technology in policing is best characterized as mixed. Lum, Koper and Willis (2017) explain that in theory, new technology fundamentally holds the potential to increase an organization's technical efficiency.[29] Research evidence suggests this potential is realized for some technologies currently in the field.[30] However, Lum and colleagues (2017) point out important distinctions between the goals for a police organization's efficiency and its effectiveness, meaning improvements in speed and convenience may not always result in reductions in crime or improvements in community relationships.[31] This disconnect can result from a combination of contributing factors. One salient issue is the way that technology is integrated into traditional police practices. In the field, promising new technology might be unceremoniously forced to support reactive policing activities instead of proactive ones[32] and if front-line officers are not trained to use the technology, or are not sold on the practical benefits, technology might simply go unused.[33] Indeed, officer attitudes and perceptions can interfere with the implementation of any innovation.[34]

Conclusion

Law enforcement decisions to adopt new technologies are complex. Police technology is ubiquitous, constantly evolving, and not frequently evaluated in a way that can offer objective conclusions about its effectiveness and long-term consequences. As a result, police agencies typically lack reliable guidance about new innovations, and when deciding to adopt a technology may not always acquire one that best aligns with strategic goals. This risks wasted resources, the perpetuation of discrimination and bias, and/or the degradation of relationships with the community and suggests that adopting a new police technology has the potential to work against police efficiency, effectiveness, transparency, and/or legitimacy. Police agencies' decisions regarding technology should always involve strategic planning, the consideration of potential limitations and harms, and a comprehensive assessment of the cost to tax payers and the organization.

[1] McGuire, M. R., & Holt, T. J. (2017). *The Routledge handbook of technology, crime and justice*. London: Taylor & Francis.

[2] Hendrix, J. A., Taniguchi, T., Strom, K. J., Aagaard, B., & Johnson, N. (2017). Strategic policing philosophy and the acquisition of technology: Findings from a nationally representative survey of law enforcement. *Policing and Society*, 1–17. https://doi.org/10.1080/10439463.2017.1322966

[3] Sanders, C. B., & Hannem, S. (2012). Policing "the risky": Technology and surveillance in everyday patrol work. *Canadian Review of Sociology*, *49*(4), 389–410. https://doi.org/10.1111/j.1755-618X.2012.01300.x

[4] Lum, C., Koper, C. S., & Willis, J. (2017). Understanding the limits of technology's impact on police effectiveness. *Police Quarterly*, *20*(2), 135–163. https://doi.org/10.1177/1098611116667279

[5] Byrne, J. M., & Rebovich, D. J. (2007). *The new technology of crime, law and social control*. Monsey, N.Y: Criminal Justice Press.

[6] Meijer, A. (2019). Predictive policing: Review of benefits and drawbacks. International *Journal of Public Administration, 42*(12), 1031-1039

[7] Bureau of Justice Assistance. (2015). *Body-worn camera frequently asked questions*. Bureau of Justice Assistance. Retrieved from https://www.bja.gov/bwc/pdfs/BWC_FAQs.pdf

[8] Bureau of Justice Assistance. (2015). *Body-worn camera frequently asked questions*. Bureau of Justice Assistance. Retrieved from https://www.bja.gov/bwc/pdfs/BWC_FAQs.pdf

[9] Reaves, B. A. (2015). *Local police departments, 2013: Equipment and technology*. Bureau of Justice Statistics. Retrieved from https://www.bjs.gov/content/pub/pdf/lpd13et.pdf

[10] Ariel, B., Farrar, W. A., & Sutherland, A. (2014). The effect of police body-worn cameras on use of force and citizens' complaints against the police: A randomized controlled trial. *Journal of Quantitative Criminology*, *31*(3), 509–535. https://doi.org/10.1007/s10940-014-9236-3; Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., … Henderson, R. (2016). Report: increases in police use of force in the presence of body-worn cameras are driven by officer discretion: a protocol-based subgroup analysis of ten randomized experiments. *Journal of Experimental Criminology*, *12*(3), 453–463. https://doi.org/10.1007/s11292-016-9261-3; Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., … Henderson, R. (2017). "Contagious accountability": a global multisite randomized controlled trial on the effect of police body-worn cameras on citizens' complaints against the police. *Criminal Justice and Behavior*, *44*(2), 293–316. https://doi.org/10.1177/0093854816668218

[11] Holliday Smith, R. (2016, May 18). Here's how the NYPD's expanding ShotSpotter system works. *DnaInfo.* Retrieved from https://www.dnainfo.com/new-york/20160518/crown-heights/heres-how-nypds-expanding-shotspotter-system-hears-gunfire/

[12] Mazerolle, L. G. (1998). *Using gunshot detection technology in high-crime areas*. Research in Progress Preview. Washington, D.C.: US Department of Justice, Office of Justice Programs, National Institute of Justice.

[13] Drange, M. (2016, April 23). *Is ShotSpotter worth the expense?* [Audio Podcast]. Retrieved from https://soundcloud.com/thisisreveal/216-reveal-b-block-web-master

[14] Lum, C., Merola, L., Willis, J., & Cave, B. (2010). *License plate recognition technology (LPR): Impact evaluation and community assessment*. Fairfax, VA: George Mason University, Center for Evidence-Based Crime Policy

[15] Lum, C., Koper, C.S., Willis, J.J., Happeny, S., Vovak, H., & Nichols, J. (2016). *The rapid diffusion of license plate readers in U.S. law enforcement agencies: A national survey*. Fairfax, VA: Center for Evidence-Based Crime Policy, George Mason University.

[16] Lum, C., Merola, L., Willis, J., & Cave, B. (2010). *License plate recognition technology (LPR): Impact evaluation and community assessment*. Arlington, VA: George Mason University, Center for Evidence-Based Crime Policy.: Taylor, B., Koper, C., and Woods, D. (2011). *Combating auto theft in Arizona: A randomized experiment with license plate recognition technology*. Washington, DC: Police Executive Research Forum.

[17] Johnson, T. S. A. (n.d.) *Law enforcement technology timeline, 1950-now.* Retrieved from https://www.timetoast.com/timelines/law-enforcement-technology-timeline-1950-now Miller, B. (2019). Data pinpoints the moment when police body cameras took off. Government Technology. Retrieved from https://www.govtech.com/data/Data-Pinpoints-the-Moment-When-Police-Body-Cameras-Took-Off.html; PoliceOne (2011). *Illustrated timeline: Policing in the U.S*. Retrieved from https://www.policeone.com/misc-law-enforcement-topics/articles/4506020-Illustrated-timeline-Policing-in-the-US/

[18] Grabosky, P., & Ayling, J. (2006). When police go shopping. *Policing: An International Journal*, *29*(4), 665–690. https://doi.org/10.1108/13639510610711592

[19] Loader, I. (1999). Consumer culture and the commodification of policing and security. *Sociology*, *33*(2), 373–392. https://doi.org/10.1177/S003803859900022X

[20] Department of Justice, Office of Public Affairs. (2015, September 21). *Justice department awards over $23 million in funding for body worn camera pilot program to support law enforcement agencies in 32 states.* Retrieved from https://www.justice.gov/opa/pr/justice-department-awards-over-23-million-funding-body-worn-camera-pilot-program-support-law

[21] Rogers, E. M. (1995). *Diffusion of innovations* (4th ed). New York: Free Press.

[22] Hendrix, J. A., Taniguchi, T., Strom, K. J., Aagaard, B., & Johnson, N. (2017). Strategic policing philosophy and the acquisition of technology: Findings from a nationally representative survey of law enforcement. *Policing and Society*, 1–17. https://doi.org/10.1080/10439463.2017.1322966

[23] Hendrix, J. A., Taniguchi, T., Strom, K. J., Aagaard, B., & Johnson, N. (2017). Strategic policing philosophy and the acquisition of technology: Findings from a nationally representative survey of law enforcement. *Policing and Society*, 1–17. https://doi.org/10.1080/10439463.2017.1322966

[24] Hendrix, J. A., Taniguchi, T., Strom, K. J., Aagaard, B., & Johnson, N. (2017). Strategic policing philosophy and the acquisition of technology: Findings from a nationally representative survey of law enforcement. *Policing and Society*, 1–17. https://doi.org/10.1080/10439463.2017.1322966

[25] Hendrix, J. A., Taniguchi, T., Strom, K. J., Aagaard, B., & Johnson, N. (2017). Strategic policing philosophy and the acquisition of technology: Findings from a nationally representative survey of law enforcement. *Policing and Society*, 1–17. https://doi.org/10.1080/10439463.2017.1322966

[26] Lum, C. (2010). Gadgets for gathering evidence are not evidence of better policing: Technology and the mythology of progress in American law enforcement. *Science Progress*.

[27] Moses, L. B., & Chan, J. (2016). Algorithmic prediction in policing: Assumptions, evaluation, and accountability. *Policing and Society, 28*. https://doi.org/10.1080/10439463.2016.1253695

[28] Koper, C. S., Lum, C., Willis, J. J., Woods, D. J., & Hibdon, J. (2015). *Realizing the potential of technology in policing*. Retrieved from https://cebcp.org/wp-content/technology/ImpactTechnologyFinalReport.pdf

[29] Koper, C. S., Lum, C., Willis, J. J., Woods, D. J., & Hibdon, J. (2015). *Realizing the potential of technology in policing*. Retrieved from https://cebcp.org/wp-content/technology/ImpactTechnologyFinalReport.pdf

[30] Choi, K.-S., Librett, M., & Collins, T. J. (2014). An empirical evaluation: Gunshot detection system and its effectiveness on police practices. *Police Practice & Research*, *15*(1), 48–61. https://doi.org/10.1080/15614263.2013.800671

[31] Lum, C., Koper, C. S., & Willis, J. (2017). Understanding the limits of technology's impact on police effectiveness. *Police Quarterly*, *20*(2), 135–163. https://doi.org/10.1177/1098611116667279

[32] Lum, C., Koper, C. S., & Willis, J. (2017). Understanding the limits of technology's impact on police effectiveness. *Police Quarterly*, *20*(2), 135–163. https://doi.org/10.1177/1098611116667279

[33] Sausdal, D. (2018). Everyday deficiencies of police surveillance: A quotidian approach to surveillance studies. *Policing and Society*, *0*(0), 1–17. https://doi.org/10.1080/10439463.2018.1557659

[34] Darroch, S., & Mazerolle, L. (2013). Intelligence-led policing: A comparative analysis of organizational factors influencing innovation uptake. *Police Quarterly*, *16*(1), 3–37. https://doi.org/10.1177/1098611112467411

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