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Assessment of Data-Driven Deployment by the Shelby County Sheriff's Office

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LITERATURE REVIEW

The Evolution of Data-Driven Policing: Computers in Law Enforcement

Throughout the history of policing, electronic data use has increased as use of technology has become more common. Computer use by police departments was first implemented in the St. Louis Police Department in the mid-1960s (Colton, 1979). The beginnings of wide-spread technology use by law enforcement can be traced to the Omnibus Crime Control and Safe Streets Act of 1968 (Northrop, Kraemer, & King, 1995). This led to the creation of the Law Enforcement Assistance Administration (LEAA), which contributed approximately \$50 million to law enforcement agencies to enable them to access police technology (Northrop et al., 1995). Surveys conducted in the early and mid-1970s showed that implementation of police technology was slower than anticipated (Colton, 1979).

Police use of technology became more common during a crime spike in the 1960s and 1970s when a "demand gap" emerged and it was evident that traditional policing techniques were not getting the job done (Ratcliffe, 2016). In the 1970s, technology use within law enforcement agencies markedly improved, most notably in data entry and management (Ratcliffe, 2016). Managing crime data more effectively allowed for the creation of a "strategic picture of crime" (Ratcliffe, 2016, p. 2). The demand gap led to "greater calls on the police for effectiveness and efficiency" (Ratcliffe, 2016, p. 2). The public wanted more professionalism from the police, with increased access to information. While the factors listed above helped increase data management technology within departments, rising levels of organized crime that ignored jurisdiction and state lines meant that police departments needed a better way to collaborate with each other.

Crime Mapping

Early crime maps were noted as early as 1829 in France and were known as choropleth maps. Chamard (2016, p. 1) defined these as "maps that display quantities of things in areas. More specifically, in choropleth maps geographical areas are divided into multisided figures called polygons, which are then shaded depending on the value of the variable being displayed." Election maps are a modern example of choropleth maps. During the 1900s, sociologists at the University of Chicago mapped the homes of delinquent children using another type of map called a point map. These maps used dots or points to mark geographical points of interest and were completed without the aid of computers, which took hours of work. Crime mapping in a true sense did not appear until the ability to run crime mapping programs on desktop computers.

Before mapping programs became widely available, police departments used a basic pushpins and paper technique. These maps allowed for elementary detection of clustered activity but lacked the ability for more advanced analyses that incorporated other factors, such as time of offense. Even with the availability of computers, digitizing crime maps was still a significant undertaking. Due to the labor involved, many police departments couldn't afford to computerize their maps. A study conducted in the late 1990s showed that larger departments were much more likely to have a computerized crime mapping system than their smaller counterparts (Charmard, 2016).

Crime mapping has advanced with the development of Geographical Information System technology (GIS), which began in planning for the 1970 census and improved from there. As satellite images of Earth became available and the military was able to create a platform for these images to be viewed, GIS technology quickly came to be useful for gathering intelligence. The ease of attaining computer hardware that came with a reduction in price in the 1980s combined with improved computer systems and more advanced software has had a positive impact on the widespread use of GIS technology. However, early use of GIS crime mapping was met with several setbacks, such as organizational problems, information sharing issues, technical problems, and geocoding problems. These problems have not entirely disappeared, and new problems have emerged over time (Chainey & Ratcliffe, 2013).

CompStat, short for "Compare Statistics," is a program introduced in New York City in 1994. The idea for CompStat stemmed from failures in traditional policing (Weisburd, Mastrofski, McNally, Greenspan, & Willis, 2002). To counter these failures, data-driven decision making was emphasized. CompStat was intended to be an organizational device that used crime information to target crime reduction. This organizational tool allowed agencies to more effectively use their data, and its emergence was followed by an impressive decrease in crime.

Current Technology

Police use of technology has grown and changed over the years. Crime mapping has moved from merely describing where crimes have happened to be a predictive tool for preventive measures. Current technologies can gather data on police activity, indicate where crime reduction projects are in place, detail crime incidents, and more (Chainey & Ratcliffe, 2013). Data are used in police briefings as indicators of where future crimes may occur and in targeting crime hotspots. Data gathered on crimes can also be applied to analysis of crime reduction projects in areas where those have been deployed (Chainey & Ratcliffe, 2013). Many other policing technologies employed today have not always been readily available, including "wiretapping, fingerprints, DNA research, database coupling, data mining and profiling, camera surveillance and network analyses" (Custers, 2012, p. 62). Other less well-known methods of computerized data collection are also in use now, such as 3D crime scene imaging and through-the-wall radar technology (Solar, 2015). Technology is integrated into police officers' everyday lives via use of body-cameras. This video footage can be used in court as evidence (Solar, 2015).

According to Willis, Koper, & Lum (2018), 60% of all large police departments currently use license plate readers (LPRs), high-speed cameras that can read and instantly analyze license plates. The LPR stores pictures of the plates and compares them to a database of plates of interest to law enforcement. These could be the plates of stolen vehicles or plates connected to known criminals. Along with the plate information itself, data such as the date, time, description of the vehicle, and the location of the vehicle are available to officers to aid in investigations.

Another technology currently being used by law enforcement is gunshot detection technology (GSD). GSD was developed in the mid-1990s and works by triangulating multiple sensors that can detect sound waves produced by a gunshot. Systems generally require three or more sensors to detect the sound wave for optimal accuracy. Data gathered from these sensors is then sent to law enforcement with the location, and an identification of the noise (whether it was an actual gunshot or another sound, like vehicle backfire). Previously, gunshots were reported mainly through citizen reports, which can be inaccurate. With the innovation of GSD, law enforcement is hoping to "increase the perceived risk of firing a weapon," mainly through more rapid dispatch and response times, and to reduce gun crime overall (Choi, Librett, & Collins, 2014, p. 51).

The Use of Data in Policing

According to Lum, Koper, and Willis (2016, p. 135), "technology has become a major source of expenditure and innovation in law enforcement and is assumed to hold great potential for enhancing police work." Police departments use data from this technology in many ways. For example, crime mapping data is used to "locate crime and traffic crash hotspots, thus enabling law enforcement officials to target these areas with highly visible traffic enforcement" (Hardy, 2010, p. 1). Data not only are collected but are also analyzed. Analyses are used to inform decisions on "local partnerships; strategic operations; information sharing and outreach; monitoring, evaluating, and adjusting operations; and measuring outcomes" (Hardy, 2010, p. 2). All the data gathered by police can then be used to increase proactive measures. In Chicago, for example, the police department currently focuses on a "heat list" of offenders that risk analysis programs have shown to be possible future risks (Joh, 2014). Even Homeland Security is employing computer systems into their preventive measures, with their systems filtering out potentially threatening words (Joh, 2014).

In New York, the NYPD has developed a "Domain Awareness System" that links data gathered from several computerized systems such as CCTV footage and LPR technology (Joh, 2014). New York has been active in data-driven policing beginning with CompStat in the 1990s, the system that allowed them to use pinpointed crime maps to target specific areas and more efficiently allocate resources based on the maps. This system led to significant decreases in crime rates (Hyunseok, Hoover, & Joo, 2010).

Research with the Mesa Police Department in Arizona showed how data-gathering technology like LPRs can influence police efficiency and resource allocation and illustrated the effectiveness of those technologies on reducing hotspot crimes. Specifically, Mesa police were interested in whether these technologies could reduce auto theft and increase the recovery of stolen vehicles and the apprehension of thieves. The department deployed an auto theft unit of four patrolmen in various types of cars all outfitted with LPRs. Each camera was linked to state-level data on stolen vehicles and other vehicles of interest, with a small amount of warrant information being linked as well. After methodically sweeping hotspots for 30 weeks, results of the study showed that the LPR patrol unit was more likely than other patrol units to recover stolen vehicles and to apprehend auto thieves. However, the LPR unit was only nominally more likely to make arrests for auto theft. Only four auto theft or stolen plates arrests were made, with the remainder being for unrelated crimes, either observed or based on warrants. The patrols saw a two-week time frame during which auto thefts and reports of drug activity were reduced. However, a sustained reduction in actual auto theft was not realized. Based on these results, Mesa concluded that, while LPR cameras may not be cost effective for hotspot crime patrols, a specialized unit may be able to impact a targeted offense, at least in the short-term. In addition, while increasing scanned license plates may lead to more matches with the database of auto theft information, it is best to deploy a manual patrol unit as well (Koper, Taylor, & Woods, 2013).

Conclusion

Technology use by police departments began in the 1960s with computers cautiously being integrated into stations that could afford them, with many tasks still being done by hand. Crime maps did not consist of the advanced information we have access to today, but pushpins on a map on the wall. As computer technology became more advanced and more affordable, many cities saw the positives of becoming more computerized, starting with their data management systems. This eventually led to data analysis being done to meet growing demands for police professionalism and accountability. New York City set the standard in the 1990s by implementing CompStat and using its data to more efficiently and effectively allocate its resources to higher crime areas and focus on high-risk offenders. This standard led to other cities implementing similar programs that helped bring their crime statistics down. In time, law enforcement has implemented increasingly advanced systems that allows it to analyze even more detailed aspects of crime, such as the Shelby County Sheriff's Office (SCSO) data that can focus on the time of day and day of the week crimes are occurring. These data often are used in law enforcement units that monitor these hotspot areas to inform management decisions on more effective and efficient allocation of resources.

METHODS

The SCSO provided the Public Safety Institute (PSI) with data of Data Smart Policing (DSP) Reports that cover the number of certain offenses within all eight districts for the 2021 calendar year. This data was then separated into each district for a more thorough examination of each district. These reports give the number of certain categories of Group A and Part One crimes (listed after the references) that are being tracked department wide and show the number of tracked crimes for each district. The SCSO has devised a list of tracked crimes which are crimes that it believes it can directly impact through proactive policing and deterrence, rather than crimes that call for law enforcement to primarily be reactive.

Tracked Crimes List

- Aggravated Assault (not domestic violence)
- Burglary/Business
- Burglary/Construction
- Burglary/Residential (not domestic violence)
- Motor Vehicle Theft
- Other Larceny
- Robbery/Individual
- Theft from Building
- Theft from Motor Vehicle
- Vandalism

Data Smart Policing Weekly Meetings

Every week the SCSO hosts its DSP meetings which are modeled after the CompStat program in New York. The meetings are started by the SCSO Homeland Security Bureau giving a detailed report for each district. This report includes the crime trends and hotspots that have been noted from the crimes the week before. They are made aware of target days and times, which crimes have increased, and geographical areas they should focus on. The report also includes any special events that are coming up that require officers to be present.

The next section involves sergeants and lieutenants giving individual reports based on shifts, crime trends, and the tools they are using in order to combat crime numbers. Some of these tools may include tasks such as an increase in routine checks or patrols or shifting the focus to particular activities (such as traffic enforcement) when not responding to calls. This is followed by the leadership of the other units being able to give individual reports based on their accomplishments the past week, what they will be focusing on in the upcoming week, or their ability to reallocate resources to other units.

Data Collection & Dissemination

The SCSO uses the help of Watson, a software designed to help streamline the process of completing field reports, enhancing communications and providing immediate access to information provided by the database software. Through this software, the Sheriff's Office is able to create the DSP reports. These reports are sent out to the district leaders on Monday, and a DSP PowerPoint is sent out Tuesday morning. This not only gives the leadership time to prepare a plan before a Wednesday meeting but allows them to evaluate their plan and make any adjustments they see necessary.

Even though leadership team members are given the DSP report on Monday, they have full access on demand to data at any time they want. Through the online portal they have the ability to change districts, identify the types of crimes, and pull a report or map that shows the data they have chosen. They also have the ability to pull a detailed report that provides all the information for those crimes on the list/map. The sergeants and lieutenants who analyze the data and push out plans for each district often arrive to work an hour before their officers' shifts start in order to examine the daily data and to evaluate if they should move resources based on crimes and location while being proactive in stopping crimes. They often take this time to also review the reports from the previous shift to know if there are any daily trends occurring. After reviewing the reports these officers will turn their focus to

splitting up larger geographical areas into smaller, easier to manage areas to deploy officers to. They may also put officers in areas if there are clusters of crimes being caused by the same type of offenders (e.g., students vandalizing property on their way home from school).

Alongside these reports and on demand data, the SCSO also uses an outside program for its license plate readers which has access to over 3,300 cameras across the United States. Within the Shelby County area, they oversee 228 cameras consisting of homeowner associations, school districts, towns such as Arlington, etc. Through their extensive use of these cameras, they are not only able to have multiple hits on the same vehicle but capable of using their system to help identify individual hits of certain license plates.

ANALYSIS AND RESULTS

Tracked Crimes List Evaluation

To determine whether the SCSO is being data driven when using its resources, the PSI examined changes in crime within each district, in particular the tracked crimes. An analysis was conducted for calendar year 2021 to determine whether identifying a tracked crimes list appeared to have any short-term impact on the number of reported crimes the week after a big increase in offenses. Figures 1-9 show the increase or decrease within each district's tracked crimes offenses for each week. Figure 10, titled 'SCSO All Districts,' represents the total number of these crimes across the entire district. On each of these charts, the numbers from 2 to 52 on the bottom axis represent the weeks of the year. For example, Week 1 is December 28, 2020 through January 3, 2021. Each bar represents the number of reported tracked crimes that changed from the previous week. For example, in Figure 1 there were five more tracked crimes in week two for the district as compared to week one. In week three there were five less crimes than there were in week two.



*District map showing the outlines of the SCSO Districts in white.

Every week the leadership of the SCSO meets to discuss what each district/unit is doing for the upcoming week regarding any programs that are being run and what they are doing in order to combat crime. Prior to the meeting, the heads of these groups are given a 'Data Smart Policing 4 Week Trending Crime Analysis Report.' In this report not only does it give four weeks' worth of the number of tracked crimes in their district, but it provides three additional tables: Time of Day/Day of Week, Offense by Day of Week, and Offense by Time of Day. This allows both the command staff of the SCSO's Homeland Security Bureau and the command staff of the district to examine any trends within days of these offenses and time of day.

While examining Figures 1-10, for the most part of 2021, each district quickly responded to upticks of these offenses in their boundaries. Each district leader not only had the ability to control the resources within his or her own area, but also had access to additional units that could be placed within their districts from other bureaus in the SCSO. Fairly regularly, when reported crime went up (reflected by the orange bars), the next week reported crimes went down (reflected by the green bars). The reports that are drawn from Watson and handed out start with District 2. District 1 (as shown in the above map) is an area of land that the City of Memphis de-annexed

around 2019, also known as Ensley Bottoms. Due to the low number of reports that are taken there a year they are not included on the DSP report.





















Figure 11 shows the total number of tracked reported crimes for all districts for the year 2021. Of the 3,140 reported tracked crimes, 29.71% were for 'Theft from a Vehicle,' 15.54% were for 'Other Larceny,' and 14.20% were for 'Vandalism Mis/Felony.' Except for 'District Other' (which includes crimes reported in Bartlett, Collierville, Germantown, Memphis, Millington, 201 Poplar, Jail East, Shelby County Correction Center [SCCC], and Unified School District 1 & 2 [1USD & 2USD]) 'Theft from a Vehicle' was the top reported crime under the tracked crimes list. In 'District Other' the top crime was 'Other Larceny.'



Table 1 shows the top three tracked crimes for each district for the calendar year 2021. The percentage next to each one demonstrates the percentage of how often those crimes occurred in relation to the total amount of tracked crimes for that district. As mentioned before 'Theft from Vehicle' was the most common crime in all districts except one. Each of those districts dealt with 'Theft from Vehicle' anywhere between 18.42% to 34.23% of the time when responding to a tracked crime call. Other crimes that were often seen through the districts were 'Other Larceny,' 'Vandalism Mis/Felony,' and 'Aggravated Assault.'

District 2	*		District 7		
	Theft from Veh.	32.68%		Theft from Veh.	21.51%
	MVT All	12.73%		Vandalism Mis/Fel	19.71%
	Other Larceny	12.41%		Agg. Assault	19.35%
District 3	y		District ARL		
	Theft from Veh.	34.23%		Theft from Veh.	29.53%
	Other Larceny	20.72%		Vandalism Mis/Fel	23.49%
	Vandalism Mis/Fel	13.96%		Other Larceny	22.15%
District 4			District LAK		
	Theft from Veh.	34.18%		Theft from Veh.	30.68%
	Other Larceny	15.40%		Other Larceny	23.86%
	Vandalism Mis/Fel	14.55%		Vandalism Mis/Fel	10.80%
District 5			District Other		
	Theft from Veh.	22.22%		Other Larceny	39.24%
	Other Larceny	16.67%		Theft from Bldg.	21.52%
	Agg. Assault	16.67%		Vandalism Mis/Fel	15.82%
District 6					
	Theft from Veh.	18.42%			
	Vandalism Mis/Fel	17.84%			
	Agg. Assault	17.54%			

Table 1: Top Three Tracked Crimes for Each SCSO District in 2021

Table 2 gives the percentage change for Group A, Part One, and tracked crimes for all districts under the SCSO. Examining the difference between 2020 and 2021 shows a decrease of crimes in some areas while others increased. Group A crimes increased by 8.17% in 2021 while Part One and tracked crimes decreased by 3.53% and 5.62% respectively. It should be noted that, for the most part, Group A crimes are reactive by nature. While there are steps that local leadership and law enforcement can do to possibly deter these crimes, law enforcement will be required to be reactive to them; for example, embezzlement or extortion crimes are harder to aim programs and

prevention towards than crimes such as theft of motor vehicle parts or burglary of a construction site.

Year to Date	Group A	Part One	Tracked
YTD (Thru December 26, 2020)	6645	2947	3275
YTD (Thru December 26, 2021)	7188	2843	3091
Yearly Percent Change	+8.17%	-3.53%	-5.62%

Table 2: Year to Date Percentage Change for Group A, Part One, and Tracked Crimes

CONCLUSIONS

- 1. After attending the SCSO DSP meetings, there are several aspects of the meetings that seem to not only enhance the effectiveness of these meetings but promote strengthening interdepartmental bonds.
 - a. The interaction between the command staff (captain and higher) present and the sergeants/lieutenants giving their reports is more relaxed. Command staff instead advocate for their officers to handle issues within the districts and also expect them to be able to come to these meetings with an actual plan and not just a generalized solution.
 - b. Command will also voice any changes or adoptions they want to see done with districts plan to battle crime. Command staff will also include reasoning as to why they believe the change should be made or include rationalization if they view the plan is insufficient (i.e., we have tried this before and it did not have an effect).
 - c. It was noted multiple times during these meetings that both the command staff and other units regularly acknowledge the good that other units had done during the prior week. Not only does this acknowledgement help the leaders of each unit know the good work that their officers are doing but pushes for better interdepartmental interactions.

- 2. Through the use of reports made available by Watson, providing not only the types of crimes that are happening during the week, but the days and times, gives the district leaders more information to use towards their weekly plan. They're not only driven in collecting and analyzing data but are actively using that information to better enhance their safety plans.
- 3. While attending their Data Smart Policing meetings, each member of different districts and units mentions the use of data within his or her plan for the week. These leadership officers seem to trust the data and believe that using the data will help them get a better grasp on crime.
- 4. Most law enforcement agencies put their time in tracking primarily the Group A and Part One crimes. Focusing on crimes they can proactively impact instead of reactive only crimes is a smart use of resources – especially when dealing with limits on these resources. While all violent crime numbers remain an important focus to the SCSO, the leadership wants to make sure that they're using the resources they have to best of their abilities.
- 5. After viewing weekly crime numbers for each district, there appears to be an immediate effect on crime within each district. However, there seems to be only a mild long-term impact on these numbers. While districts often saw a decrease the next week, it was often followed by an increase within a few weeks. This may be the result of having to move limited resources from one geographic area to another.

RECOMMENDATIONS

- The SCSO does use hotspots to help identify areas within each district where crime is happening most often. Its current format for these hotspot maps is the use of a grid like system overlaying the entire district. It could be more beneficial to the districts if hotspots were more precise within the area, which could determine more precisely whether commitment of additional resources impacts the amount of crime in those hotspots.
- 2. Linking data to how that collected data helps solve crimes would be helpful (for example, having data that shows how many LPR hits lead directly to an arrest or at least knowing who the suspect is).

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Group A Crime

Divided into 24 categories of crime

- 1) Animal Cruelty
- 2) Arson
- 3) Assault Offenses
- 4) Bribery
- 5) Burglary/Breaking & Entering
- 6) Counterfeiting/Forgery
- 7) Destruction/Damage/Vandalism
- 8) Drug/Narcotic Offenses
- 9) Embezzlement
- 10) Extortion/Blackmail
- 11) Fraud Offenses
- 12) Gambling Offenses
- 13) Homicide Offenses
- 14) Human Tracking Offenses
- 15) Kidnapping/Abduction
- 16) Larceny/Theft Offenses
- 17) Motor Vehicle Theft
- 18) Pornography/Obscene Material
- 19) Prostitution Offenses
- 20) Robbery
- 21) Sex Offenses, Forcible
- 22) Sex Offenses, Non-Forcible
- 23) Stolen Property Offenses
- 24) Weapon Law Violations

*There are over 55 specific crime offenses related to these 24 categories.

Part One Crimes

- 1) Aggravated assault (All)
- 2) Arson
- 3) Burglary (All)
- Larceny (Includes 23A through 23H)
- 5) Motor Vehicle Theft (All)
- 6) Murder
- 7) Rape (Includes forcible rape, forcible sodomy, sexual assault with an object, and forcible fondling.)
- 8) Robbery (Includes individual, business, and carjacking.)



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