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Hardware, Heartware, or Nightmare: Smart-City Technology and the Concomitant Erosion of Privacy

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HARDWARE, HEARTWARE, OR NIGHTMARE: SMART-CITY TECHNOLOGY AND THE CONCOMITANT EROSION OF PRIVACY

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I. INEVITABLE, POSITIVE CHANGE THROUGH TECHNOLOGY

Multiple factors are aligning in synchrony to enable smart-city technology to revolutionize the way city-dwellers will live in the near future. It is indisputable that 5G network capability is a key driver in the modernization of our cities. Another thing enabling the adoption of smart-city technology is that sensors and batteries necessary for smart-city technology have become much less expensive and much more effective and efficient.[2] An additional factor enabling the adoption of smart-city technology is the sheer number of connected devices. By the year 2020, it is predicted that there will likely be 75 billion devices connected to the Internet of Things.[3]

By necessity, smart-city technology must be incorporated into five aspects of city-dwellers' lives – public safety, transportation, healthcare, education, and energy usage. The need for smart technology is imperative: By 2050, it is expected that two-thirds of the world's population will live in cities, up from about one-third in 1950 and one-half today.[4] There were thirty-one so-called megacities with populations greater than 10 million in 2018, and the number of megacities is expected to increase dramatically to forty-three by 2030.[5] Urban travel is expected

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[2] *See, e.g.*, Qing Guo et al, *Towards Low-Cost Yet High-Performance Sensor Networks by Deploying a Few Ultra-fast Charging Battery Powered Sensors*, 18 SENSORS (2018), https://www.mdpi.com/1424-8220/18/9.

[3] See Tony Danova, *Morgan Stanley: 75 Billion Devices Will Be Connected to the Internet of Things by 2020*, BUSINESS INSIDER (Oct. 2, 2013), https://www.businessinsider.com/75-billion-devices-will-be-connected-to-the-internet-by-2020-2013-10#ixzz2jIo3UCkd (citing Morgan Stanley).

[4] Ash Amin and Nigel Thrift, *Citizens of the World: Seeing the City as a Site of International Influence*, 27 HARVARD INT'L REV. 14, 14 (2005).

[5] Around 2.5 Billion More People Will Be Living in Cities by 2050, Projects New UN Report, UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS, https://www.un.org/development/desa/en/news/population/2018-world-urbanization-prospects.html.

to triple by 2050.[6] Also by 2050, the number of people sixty or older is expected to triple.[7] By 2035, the world's energy needs are expected to increase by a worrisome thirty-seven percent.[8] All of these factors combine to create a need for better and more efficient technology to support these changes.

Smart-city technology is intended to improve quality of life for all impacted city-dwellers. Many reports indicate that adoption of smart-city technology has the potential to profoundly and positively affect quality of life in the future.[9] Some advocates for incorporating smart-city technology have dubbed the technology as "heartware" because of its humanitarian potential and the underlying need for residents to accept and embrace the positive changes that this technology can bring.[10] A study of time savings, for example, indicated that smart-city technology has "the potential to 'give back' each city dweller 3 working weeks' worth of time every year."[11] The study indicated that city residents could save sixty hours by utilizing smart traffic systems: thirty-five hours could be saved by using machine learning and intelligent transportation systems for public safety purposes; nine hours could be saved by using healthcare preventative apps and telecommunication with healthcare providers; and twenty-one hours could be saved by using digital communication services with government agencies.[12] Positive effects on residents' emotional and physical wellbeing could be significant. An additional

[6] Wilhelm Lerner, *The Future of Urban Mobility*, ARTHUR D. LITTLE GLOBAL (2011), https://www.adlittle.com/en/insights/viewpoints/future-urban-mobility-0.

[7] Michelle Nichols, *U.N. Report Predicts Older People to Triple by 2050*, REUTERS (Mar. 13, 2007) (citing 2006 revision of *World Population Prospects* by the U.N. Department of Economic and Social Affairs Population Division), https://www.reuters.com/article/us-population-un/u-n-report-predicts-older-people-to-triple-by-2050-idUSN1238922420070313.

[8] This percentage was calculated as an expected increase between the years 2013 and 2035, so some of the expected increase has already occurred. *BP Energy Outlook 2035*, BP (2014), https://www.bp.com/content/dam/bp-country/de_at/pdfs/2014_2035_energy_outlook_booklet.pdf.

[9] See, e.g., *Smart Cities – What's in It for Citizens*? JUNIPER RESEARCH (2018), https://newsroom.intel.com/wp-content/uploads/sites/11/2018/03/smart-cities-whats-in-it-for-citizens.pdf (This study was conducted for Intel by Juniper Research.).

[10] The term "heartware" was coined by advocates of smart-city technology in Singapore. See, e.g., Lim Swee Cheang and Guo Lei, *The Heartware of a Smart Nation*, 32 J. OF ASIA-PACIFIC STUD. (2018); Jenson Goh, *Developing the 'Heartware' for a Smart Nation*, TODAY ONLINE (Aug. 27, 2014), https://www.todayonline.com/commentary/developing-heartware-smart-nation.

[11] *Smart Cities – What's in It for Citizens?* at 3.

[12] *Id.*

and equally significant advantage, of course, is that less congestion and accompanying air pollution would benefit the environment.[13]

II. IMPROVEMENTS IN PUBLIC SAFETY, AT WHAT PRICE?

Smart-city technology can vastly improve public safety. By use of smart traffic systems, first-responders can arrive more quickly in an emergency. Technology can also greatly improve the ability of law enforcement to investigate crimes, both with increased speed and increased accuracy.[14] One study found that a ten percent reduction in violent crime and a fifteen percent reduction in emergency response times was generally achievable. The benefits to city-dwellers could be immense; in addition to lowered crime rates, tax dollars spent on investigations can be used with increased efficiency.

The most critical moments after a life-threatening emergency are those moments immediately following the violent crime or accident. If first responders can shave moments off their response times, survival rates and life expectancy rates can conversely increase.[15] When a 5G network is adopted, smart traffic sensors and video analytics can minimize first responder travel time by mapping the most expedient route and triggering traffic signals to change, creating a free path of travel for emergency vehicles.[16] Medical personnel in hospitals will be able to view and prepare for incoming patients during the critical moments of ambulance travel.[17] Machine learning can be employed to predict where crimes will occur and correspondingly increase law enforcement patrol in these areas; one study indicates that utilizing this form of a predictive model could prevent 3 million violent crimes.[18]

A. EXAMPLES OF SUCCESS

Combining the best of detection technology with state-of-the-art surveillance techniques has the potential to achieve remarkable results. In Cape Town, South Africa, for example, law enforcement is now combining use of several

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[13] *Id.* at 4.

[14] *Id.* at 15.

[15] *Id.*

[16] Interview by Jason Hiner, Editorial Director of CNET, with Michael Zeto, AT&T's Gen. Manager of Smart Cities Bus., at the 2019 Consumer Electronics Show in Las Vegas, Nev. (Jan. 9, 2019), https://www.cnet.com/videos/how-smart-cities-and-5g-will-improve-health-public-safety-and-transportation/.

[17] *Id.*

[18] *Smart Cities – What's in It for Citizens?* at 15.

devices to fight a horrific crime problem.[19] Specifically, Cape Town police are combining technology that detects gunfire with closed-circuit television and drone surveillance cameras.[20]

This utilization of new technology is particularly important for low-income residents of Cape Town, a city where wealthier residents commonly hire private security companies to patrol and surveil their neighborhoods.[21] The Cape Flats, slum areas outside the city center, suffer from notoriously high rates of crime but have low rates of police patrol. Activist Zackie Achmat, whom the New Yorker has called the "most important dissident in the country since Nelson Mandela,"[22] put the problem succinctly: "There are 200 times more murders in poor communities, but three times less police. . . . Twenty years into our democracy and we still have apartheid-style policing, not just in militarism but also in allocation of resources."[23] There is hope for decreasing crime in these areas now, thanks to smart-city technology. Since combining the use of robotic eyes (closed circuit television and drone cameras) with robotic ears (gunshot detection devices), Cape Town law enforcement reports an increase in the conviction rate for violent crimes from two percent to fifteen percent.[24] Cape Town's minister of law enforcement reported that during "the month of September [2017, after adoption of the audio detection technology in 2016], a total of 31 incidents were recorded, down from

[19] Cape Town is one of the world's 20 worst cities for violent crime, with a murder rate of 62 per 100,000 in 2015-2016. *Gunshot Detection System Helping Police Crack Down on Crime in Cape Town,* CBS NEWS (July 11, 2018), https://www.cbsnews.com/news/africawatch-gunshot-detection-system-helping-police-crack-down-on-crime-in-cape-town/ (citing South African Cities Network 2015-2016).

[20] Nereesha Patel, How *New Camera Technology Is Bringing Down Cape Gang Members,* 2 OCEANS VIBE NEWS (July 10, 2018), https://www.2oceansvibe.com/2018/07/10/how-new-camera-technology-is-bringing-down-cape-gang-members-video/.

[21] Victoria Eastwood, *Bigger than the Army: South Africa's Private Security Forces*, CNN NEWS (Feb. 8, 2013), http://www.cnn.com/2013/02/08/business/south-africa-private-scurity/.

[22] Samantha Power, *The Aids Rebel*, THE NEW YORKER (May 19, 2003), http://www.newyorker.com/magazine/2003/05/19/the-aids-rebel.

[23] We Still Have Apartheid-Style Policing – Protester, NEWS 24 VIDEO (Aug. 25, 2015), http://www.news24.com/Video/SouthAfrica/News/We-still-have-apartheid-style-policing-protester-20150825.

[24] *Gunshot Detection System Helping Police Crack Down on Crime in Cape Town, supra* note 18 (quoting J.P. Smith, Cape Town's minister of law enforcement).

128 in August and 211 in July,"[25] apparently due to growing public awareness and subsequent deterrent effect.

In the United States, some cities boast impressive results which they credit to their adoption of gunshot detection surveillance. For example, Chicago, which has installed these detection devices extensively across high-crime areas, reported a thirty percent decrease in murders during the first three months of 2019 as compared to the same time period during 2018.[26] Police credit the gunshot detection devices with lowering shootings in Englewood, known as one of Chicago's most dangerous communities,[27] by forty-three percent in 2017.[28]

New York City, in partnership with Microsoft, has developed a very effective predictive crime model. This Domain Awareness System (DAS) uses data from closed-circuit television cameras, license plate readers, other sensors, and 911 calls to send a dashboard alert when a 911 call is received or a sensor is triggered.[29] After the 2012 agreement between Microsoft and New York City went into effect, Microsoft began selling DAS to other cities, with the city receiving thirty percent of the profits.[30] This money was earmarked specifically for high-tech counterterrorism efforts.[31] The city's adoption of high-tech crime prevention techniques appears to be paying off. After a tiny uptick in 2013 in the overall rate

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[25] Ishani Chetty, *Spotshotter Increases Crime Detection across Cape* Town, CAPE TOWN ETC (June 22, 2018), https://www.capetownetc.com/news/shotspotter-increases-crime-detection-across-cape-town/ (quoting J.P. Smith, Cape Town's minister of law enforcement).

[26] *Chicago Police Department Says Murders Down 30 Percent, Shootings Down 17 Percent through March,* CBS CHICAGO (Apr. 1, 2019), https://chicago.cbslocal.com/2019/04/01/chicago-crime-statistics-march-2019/.

[27] Mark Suppelsa, *"It's Englewood:' 12 Hours in One of Chicago's Most Dangerous Neighborhoods,* WGN (Aug. 25, 2013), https://wgntv.com/2013/08/25/its-englewood-12-hours-in-one-of-chicagos-most-dangerous-neighborhoods/.

[28] Matt Finn, *Spotshotter Technology Makes Dent in Chicago's Crime - But Raises Privacy Concerns*, FOX NEWS (Jan. 23, 2018), https://www.foxnews.com/us/shotspotter-technology-makes-dent-in-chicagos-crime-but-raises-privacy-concerns.

[29] Neal Ungerleider, *NYPD, Microsoft Launch All-Seeing "Domain Awareness System" With Real-Time CCTV, License Plate Monitoring*, FAST COMPANY (Aug. 8, 2012), https://www.fastcompany.com/3000272/nypd-microsoft-launch-all-seeing-domain-awareness-system-real-time-cctv-license-plate-monito.

[30] *Developing the NYPD's Information Technology,* NYC GOVERNMENT (2012), http://home.nyc.gov/html/nypd/html/home/POA/pdf/Technology.pdf.

[31] *Id.*

of the seven major felony offenses committed in the city, New York has reported subsequent decreases in this rate each year since.[32]

B. A DEEPER LOOK AT ONE CITY'S INITIATIVE: ATLANTA'S SMART-CITY TECHNOLOGY AND ITS IMPLICATIONS FOR PUBLIC SAFETY AND PRIVACY

Atlanta, Georgia, is adopting smart-city technology to improve the lives of its residents. The Georgia Power Company, GE and AT&T have partnered to provide a digital infrastructure for Atlanta's smart-city technology.[33] The initiative includes many players – Georgia Power, GE, AT&T, Atlanta's Department of Public Works, Traffic Management Department, Parking Department, Police Foundation, Police Department, and Renew Atlanta – an entity which oversees a $250 million bond and is charged with repairing Atlanta's infrastructure and managing and easing Atlanta's traffic.[34] Additionally involved are researchers from the Georgia Institute of Technology and Georgia State University.[35]

One of the projects in which Georgia Power is integrally involved is installation of data collection and processing devices on streetlights in Atlanta. Georgia Power has 850,000 street lights installed in the state of Georgia, all of which are potential data collection hubs.[36] In addition to licensing network carriers to attach small devices to the streetlight poles to enable 5G infrastructure, Georgia Power has also begun installing special lighting nodes on certain poles throughout the city of Atlanta.[37] About 200 of these nodes were projected to be installed in Atlanta by the end of 2018.[38]

Each of the new nodes being installed by Georgia Power has devices that perform four functions. First there is a light grid which enables adaptive dimming so that the streetlight is activated only when movement is detected, producing

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[32] *Historical New York City Crime Data*, NEW YORK CITY POLICE DEPARTMENT (2019), https://www1.nyc.gov/assets/nypd/downloads/pdf/analysis_and_planning/historical-crime-data/seven-major-felony-offenses-2000-2018.pdf.

[33] Christine Primmer, Smart Cities Strategy & Bus. Dev. Manager at Georgia Power, Building the Future of Energy through Smart Cities, Address at the ARC Industry Forum, Orlando, Fla. (Feb. 13, 2018), https://www.youtube.com/watch?v=x7w5cRnqvI0.

[34] *Id.*; RENEW ATLANTA TSPLOST, https://renewatlantabond.com/.

[35] "Georgia Tech, Georgia State University, and the city of Atlanta were among the first city-university partnerships to join the MetroLab Network, which is part of the White House's Smart Cities Initiative." T.J. Becker, *Smart Cities*, 1 GA. TECH RES. HORIZONS (2017), http://www.rh.gatech.edu/features/smart-cities.

[36] Primmer, *supra* note 32.

[37] *Id.*

[38] *Id.*

energy savings.[39] Second is a video management system called Genetec which enables law enforcement to pull video files from the node and then share the files through law enforcement evidence storage systems.[40] Third is CivicSmart, functionality which can help drivers locate available parking and will alert parking control when vehicles are illegally parked. The fourth device is ShotSpotter, a gunshot detection and alert device.[41]

Because each of the new lighting nodes has two cameras, two audio sensors, and edge processing capability, metadata on traffic count and vehicular speeds is generated and captured.[42] Likewise, video of passing vehicles is available from two camera views.[43] The gunfire detection device on each node is designed only to detect the sound of gunshots and send alerts to law enforcement, but audio recording is constantly captured. In November 2018, the Atlanta Police Department started a pilot program to determine the effectiveness of the newly installed gunfire detection devices.[44] The system is currently being piloted in a five square-mile area, and researchers at Georgia State University are analyzing the effectiveness of the system.[45] About twenty sensors are necessary for a square mile of gunfire detection,[46] so the pilot project involves installation of about 100 sensors.

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[39] Primmer, *supra* note 32.

[40] *Id.*

[41] *Id.*

[42] Interview by Jason Hiner, Editorial Director of CNET, with Michael Zeto, AT&T's Gen. Manager of Smart Cities Bus., *supra* note 15.

[43] Primmer, *supra* note 32.

[44] *Closer Look: Conversations on Safety from Local Neighborhoods to School Districts*, PUBLIC BROADCASTING ATLANTA (Jan. 11, 2019), https://www.wabe.org/episode/closer-look-conversations-on-safety-from-local-neighborhoods-to-school-districts/ (conversation with Major John Quigley, executive officer in the Atlanta Police Department's Strategy and Special Projects Division).

[45] *Id.*

[46] *Id.*

C. BALANCING EROSION OF PRIVACY WITH THE ADVANTAGES OF SMART-CITY TECHNOLOGY

An initial issue which must be determined in smart-city development is ownership of the data collected by sensors and other devices, data which can not only be used for law enforcement purposes but also can pinpoint and aggregate consumer activity, enabling forecasting of future consumer activity. Professor Jennifer Clark, director of Georgia Tech's Center for Urban Innovation and associate director of Georgia Tech's Smart Cities and Inclusive Innovation initiative, has voiced concern that city managers who are eager to adopt smart-city technology and worried about falling behind other cities' implementation of smart-city planning too often trade data for free infrastructure.[47] The data, if handled properly and ethically, could have tremendous value; the data could potentially generate revenue that cities could use for their citizens' needs.[48] But Clark stated that she knows of no city that "has thought really seriously about the [forfeited] value."[49] In addition, there is the potential for misuse of the data.

Data collected by smart-city devices generally needs to be de-identified at the source. If such de-identification does not occur automatically, city residents should have the ability to opt out of data collection. The European Union recently enacted[50] the General Data Protection Regulation (GDPR), a sweeping piece of legislation which gives individuals control of their data and the right to demand its destruction, but the United States has no such law. Incorporated in the GDPR was the concept of "Privacy by Design," created and advocated by Dr. Ann Cavoukian, an internationally recognized privacy expert who served as Privacy Commissioner of Ontario, Canada, for three terms.[51] The guiding principles of the GDPR are lawfulness, fairness and transparency, purpose limitation, data minimization, accuracy, storage limitation, integrity and confidentiality, and accountability.[52]

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[47] Brian Barth, *Smart Cities or Surveillance Cities?* PLANNING (Mar. 2019), https://www.planning.org/planning/2019/mar/smartcities/.

[48] *Id*.

[49] *Id*. (quoting Georgia Tech Professor Jennifer Clark).

[50] The new EU law was enacted in 2016 and went into effect in May 2018. Jeff John Roberts, *The GDPR Is in Effect: Should U.S. Companies Be Afraid?* Forbes (May 25, 2018), http://fortune.com/2018/05/24/the-gdpr-is-in-effect-should-u-s-companies-be-afraid/.

[51] Hessie Jones, *Will Privacy First Be the New Normal? An Interview with Privacy Guru, Dr. Ann Cavoukian*, FORBES (Aug. 13, 1918), https://www.forbes.com/sites/cognitiveworld/2018/08/13/will-privacy-first-be-the-new-normal-an-interview-with-privacy-guru-ann-cavoukian/#3bcc7a2225dc.

[52] Parliament and Council Regulation 2016/679 of April 27, 2016 on the Protection of Natural Persons with regard to the Processing of Personal Data and on the Free Movement of Such Data,

A few years after Cavoukian left her position as Ontario's Privacy Commissioner,[53] she became involved with development of a smart-city project in Toronto. Because of a conflict over how to handle collected data, this planned neighborhood in Toronto has become a tinderbox of concern and debate over compromised privacy. The sensor-laden neighborhood, Quayside, was being developed by Sidewalk Labs, a sister company to Google,[54] in collaboration with Waterfront Toronto, a government agency.[55] In 2017, Cavoukian was hired in a consulting role.[56] She advocated that a plan be put in place to de-identify any collected data at its source.[57] In October of 2018, however, she resigned from her role in the project when she discovered that third parties involved in the development and management of the smart city might gain access to individual data.[58] In her resignation letter, Cavoukian said, "I imagined us creating a Smart City of Privacy, as opposed to a Smart City of Surveillance."[59] Her fears were not just about misuse of the data for purposes of profit by marketers tracking consumer activity; even more she feared breach by potential hackers and thieves.

Data collected for public safety purposes poses a particular challenge for privacy advocates as it must be handled differently from data collected for consumer-tracking or simply for making lives simpler and tasks faster. De-identification of data may not be possible or logical when the data is being used for law enforcement purposes. Additionally, when crime fighting can be successfully enhanced by technology and especially in areas which suffer badly from violent crimes, it is likely that many residents and government officials would opt for

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and Repealing Directive 95/46/EC (General Data Protection Regulation), 2016 O.J. (L 119), art. 5, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1552662547490&uri=CELEX%3A32016R0679.

[53] Ann Cavoukian is recognized as one of the world's leading experts on privacy and technology. She served as Ontario's Privacy Commissioner from 1997 to 2014. *Privacy and Big Data Institute: About Dr. Ann Cavoukian*, Ryerson University, https://www.ryerson.ca/pbdi/About/Members/anncavoukian/.

[54] Gabrielle Canon, *"City of Surveillance": Privacy Expert Quits Toronto's Smart-City Project*, THE GUARDIAN (Oct. 23, 2018), https://www.theguardian.com/world/2018/oct/23/toronto-smart-city-surveillance-ann-cavoukian-resigns-privacy.

[55] *Sidewalk Labs' Vision and Your Data Privacy: A Guide to the Saga on Toronto's Waterfront*, GLOBE AND MAIL (Dec. 7, 2018), https://www.theglobeandmail.com/canada/toronto/article-sidewalk-labs-quayside-toronto-waterfront-explainer/.

[56] *Id.*

[57] *Id.*

[58] Canon, *supra* note 53.

[59] *Id.*

increased law enforcement protection provided by technological surveillance in exchange for lowered expectation of privacy. In fact, some advocates for smart-city technology do not view lowered expectation of privacy as a troubling factor whatsoever. Michael Zeto, AT&T's General Manager of Smart Cities Technology, recently put it like this: "It's really not about Big Brother at the end of the day . . . . This is about emergency preparedness for first responders. It's about gathering data ahead of time after an incident, so that people can be prepared when they get to the scene . . . . So it not only helps to improve the chances of decreasing property loss and saving lives of the citizens, but also protecting those first responders."[60]

D. A RELATIVELY NEW, POPULAR CRIME FIGHTING TOOL -- SHOTSPOTTER

When new technology for fighting crime has been adopted, most notably gunshot detection devices, license plate scanners, body cameras, and GPS tracking devices, constitutional debate has ensued. The most popular gunshot detection device, and the one installed on Atlanta's new lighting nodes, is called ShotSpotter, and it has certainly inspired debate. On one side of the debate are those who believe its effectiveness at crime fighting outweighs privacy concerns, more so because the recordings occur in public places.[61] On the other side of the debate are those that liken ShotSpotter to a wiretap which they assert would require a warrant.[62] Those on the latter side of the debate are troubled by cities being laden with sensors which they see as little more than listening devices.

ShotSpotter is manufactured by a California-based company of the same name, and in the last decade ShotSpotter has been installed in more than ninety cities in the United States, as well as in Cape Town, South Africa, and Nassau, Bahamas.[63] Here is how ShotSpotter works: Audio sensors – microphones with computers attached – pick up the sound of gunfire, and audio triangulation

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[60] Interview by Jason Hiner, Editorial Director of CNET, with Michael Zeto, AT&T's Gen. Manager of Smart Cities Bus., *supra* note 15.

[61] The U.S. Supreme Court has recognized that where there is no reasonable expectation of privacy, like in conversation occurring on a public street, Fourth Amendment concerns do not arise. Katz v. United States, 389 U.S. 347 (1967). "[C]onversations in the open would not be protected against being overheard, for the expectation of privacy under the circumstances would be unreasonable." *Katz*, 389 U.S. at 361 (Harlan, J., concurring).

[62] Government wiretapping is generally subject to the warrant requirement of the Fourth Amendment. Katz v. United States, 389 U.S. 347 (1967). *But see* Kee v. City of Rowlett, Tex., 247 F.3d 206 (5th Cir. 2001) (holding that wiretap of an outdoor conversation at funeral of two murdered children did not violate the speakers' expectation of privacy).

[63] *Learn Why 90+ Cities Trust ShotSpotter*, SHOTSPOTTER GUNSHOT DETECTION AND LOCATOR SERV., https://www.shotspotter.com/.

pinpoints the location of the shots.[64] The recorded audio is analyzed by algorithms and information is then transmitted to ShotSpotter's Incident Review Center in Newark, California.[65] At the Incident Review Center, ShotSpotter employees further analyze the information and, if possible, add tactical information for law enforcement, for example, automatic weapons are being used or multiple shooters are present.[66]

Within sixty seconds of the gunfire, alerts are sent to 911 dispatch centers, mobile data terminals in officer patrol cars, and officer smartphones.[67] The speed of the system enables rapid law enforcement response, and pinpointing the location of the gunfire enables accurate response and investigation. When gunfire is reported the old fashioned way, by report from a neighbor who heard it, officers cannot discern the location with more accuracy than an area spanning 200 to 300 addresses, but ShotSpotter's audio triangulation narrows down the search to about a thirty-foot area.[68] Atlanta police are trained that when they respond to a ShotSpotter alert, they should search an area with a radius of about twenty-five meters (eighty-two feet) for shell casings and bullets.[69]

The ShotSpotter privacy policy states that the "entire system is intentionally designed not to permit 'live listening' of any sort. Human voices do not trigger ShotSpotter sensors."[70] However, ShotSpotter recordings contain audio of several seconds before and after the gunfire,[71] and the company generally claims

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[64] *How ShotSpotter Works*, SHOTSPOTTER GUNSHOT DETECTION AND LOCATOR SERV., https://www.shotspotter.com/.

[65] *Id.*

[66] *Id.*

[67] *Id.*

[68] Primmer, *supra* note 32.

[69] Major John Quigley of APD's Strategy and Special Projects Division explained that that was the area necessary for police to search, and the Atlanta Police Department was looking into purchasing metal detectors to make the investigation even more efficient. *Closer Look: Conversations on Safety from Local Neighborhoods to School Districts*, PUBLIC BROADCASTING ATLANTA (Jan. 11, 2019), https://www.wabe.org/episode/closer-look-conversations-on-safety-from-local-neighborhoods-to-school-districts/.

[70] *ShotSpotter – Privacy Policy*, SHOTSPOTTER GUNSHOT DETECTION AND LOCATOR SERV., https://www.shotspotter.com/apps/privacy/.

[71] ShotSpotter CEO Ralph A. Clark stated that the "system basically truncates the noise; two seconds before, maybe three seconds after." Cale Guthrie Weissman, *The NYPD's Newest Technology May Be Recording Conversations*, BUSINESS INSIDER (Mar. 26, 2015),

ownership of all recordings.[72] Two murder cases, both of which resulted in convictions, have established that human voices can indeed be included in SpotShotter recordings.

First was the shooting death of Tyrone Lyles in June 2007 on a street in Oakland, California, in what was reportedly a dispute over drugs.[73] As Lyles lay dying in the street, the last words he uttered were "'Ar, Ar, why are you going to do me like that, Ar?'"[74] These words were not overheard by police or a witness. They were captured by ShotSpotter devices installed and utilized by the Oakland Police Department.[75] The ShotSpotter recording was introduced into evidence, and Arlito Johnson, whose nickname is "Ar," was convicted of, among other things, second degree murder.[76] He was sentenced to 64 years to life in prison.[77]

The second case was reported to have started with a derogatory comment posted on Facebook.[78] Here are the events reported to have occurred in the wee hours of December 2, 2011 in New Bedford, Massachusetts: Because of the derogatory Facebook comment, two young women made plans to meet for a fistfight.[79] The two women were the then current and ex-girlfriends of a twenty-

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https://www.businessinsider.com/the-nypds-newest-technology-may-be-recording-conversations-2015-3.

[72] Jason Tashea, *Should the Public Have Access to Data Police Acquire through Private Companies?* ABA JOURNAL (Dec. 1, 2016), http://www.abajournal.com/magazine/article/public_access_police_data_private_company.

Generally, ShotSpotter contracts specify that the data collected is proprietary. However, there are exceptions. Scott Jones, Acting Director of Electronic Frontiers Georgia, reported that the data collected by ShotSpotter devices installed in the new lighting nodes in Atlanta is owned by the City of Atlanta.

Closer Look: Conversations on Safety from Local Neighborhoods to School Districts, PUBLIC BROADCASTING ATLANTA (Jan. 11, 2019), https://www.wabe.org/episode/closer-look-conversations-on-safety-from-local-neighborhoods-to-school-districts/.

[73] Paul T. Rosynsky, *Oakland Man Sentenced for 2007 Murder*, EAST BAY TIMES (Aug. 15, 2016), https://www.eastbaytimes.com/2011/01/14/oakland-man-sentenced-for-2007-murder/.

[74] People v. Johnson, 2013 WL 740387 (Cal. Ct. App., Feb. 27, 2013).

[75] *Id.*

[76] *Id.*

[77] *Id.*

[78] Brian Fraga, *Facebook Post Sparked New Bedford Fight that Ended in Deadly Shooting*, S. COAST TODAY (Jan. 7, 2012), https://www.southcoasttoday.com/article/20120107/NEWS/201070327.

[79] *Id.*

year-old named Jason Denison.[80] Denison, his twenty-year-old friend Michael Pina, and another twenty-year-old named Jonathan Flores were in attendance at the street fight.[81] Somehow the fistfight escalated to a gunfight between two of the young men in attendance. Denison chased Flores, firing at him. Flores fired back at Denison, missing him but accidentally shooting Denison's friend Pina.[82] The stray bullet struck Pina in the brain, and he subsequently died. Both Flores and Denison were charged with murder.[83]

This case is extraordinary and tragic. The case is tragic as the senseless fistfight turned gunfight resulted in the tragic death of one very young man and the long-term incarceration of two others. The case is extraordinary because New Bedford utilized ShotSpotter, and the following was recorded by the gunfire detection system: "'Oh my God! You're crazy!' and then 'Jason don't!' several times, followed by a number of gunshots. After the gunshots, a female was heard yelling 'You . . . missed and they shot him!' 'You're going to jail!'"[84] A motion to suppress this evidence was granted in Denison's case, as the judge ruled that the ShotSpotter recording violated the Massachusetts Wiretap Act,[85] but Denison was still convicted of manslaughter.[86] Flores, the young man who fired the stray bullet which killed Pina, was also convicted of manslaughter.[87]

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[80] *Id.*

[81] *Id.*

[82] *Id.*

[83] *Id.*

[84] Brief of Commonwealth, Commonwealth v. Denison, No. SJC-12038, 2016 WL 1423883, at *13 (Mass. 2016) (quoting transcript of motion hearing held on June 12, 2015).

[85] *Id* at *3-4.

[86] As a result of a plea bargain, Denison pled guilty to manslaughter, carrying a firearm without a license, and armed assault with intent to murder. In 2016 he was sentenced to serve not less than nine nor more than twelve years for the most serious crime – manslaughter. His lesser sentences for the second and third crimes are being served concurrently, and he was given credit for the time he had already spent behind bars. Commonwealth v. Denison, No. BRCR2012-00029 (Mass. Super. Ct. Bristol Cty. 2012). The state had appealed the grant of the motion to suppress the ShotSpotter evidence, and although the Supreme Judicial Court of Massachusetts recognized that determination of its admissibility was "important and capable of repetition," the state's appeal was dismissed as moot when Denison's case was concluded through plea bargaining. Commonwealth v. Denison, No. SJC-12038 (Mass. 2016).

[87] Flores also entered into a plea bargain. In 2015, he was sentenced for the same three crimes as Denison. Flores was sentenced to serve not less than ten nor more than thirteen years for manslaughter, with the sentences for the lesser crimes to be served concurrently, and with credit for time served. Commonwealth v. Flores, No. BRCR2012-00030 (Mass. Super. Ct. Bristol Cty. 2012).

ShotSpotter is intended as a device to alert law enforcement when gunfire is detected and to provide the location where the gunfire was heard. The use of such technology is lauded for its ability to reduce gun violence in the United States. Its use is problematic, however, when ShotSpotter is not merely used for gunfire alert and location purposes but when its recordings end up as primary evidence in high-stakes criminal trials. ShotSpotter recordings and reports are regularly admitted into evidence.[88] In fact, in the New Bedford trial of Jason Denison, the judge who heard the motion to suppress disallowed the ShotSpotter recording of human voices but allowed the audio of the gunshots themselves.[89] Many defendants have argued, mostly unsuccessfully, that ShotSpotter technology is not reliable as it is not generally or widely accepted in the scientific community.[90] Other critics of admitting SpotShotter evidence demand that ShotSpotter be transparent, allowing criminal defendants a chance to test the reliability of the science by, inter alia, examining its source code.[91] ShotSpotter has resisted disclosure, claiming it would violate the company's protected trade secret.[92]

When audio recording devices are combined with the use of video recording devices, even more of an infrastructure of surveillance is created. Combining robotic ears with robotic eyes may indeed provide effective police surveillance, but when a neighborhood is laden with these surveillance sensors the feeling of Big Brother watching and listening is pronounced. ShotSpotter's website explains that the system can be set up so that gunfire detection by the ShotSpotter sensors will

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[88] *See, e.g.* State v. Lessley, 919 N.W.2d 884 (Neb. 2018); Johnson v. State, No. 71A03-1603-CR-672 (Ind. Ct. App. 2016).

[89] Brief of Commonwealth, *supra* note 83, at *3-4.

[90] *But see* People v. Gillard, No. 05-164044-0 (Cal. Super. Ct. Contra Costa Cty. 2014); New York. v. Simmons, 57 Misc.3d 1212(A), *rev'd and set aside,* No. 2016-0404 (Monroe Cty. Ct. 2018).

Note that some states apply the *Frye* standard for scientific evidence requiring general acceptance in the scientific community, but in many states and under the Federal Rules of Evidence the *Daubert* standard is now applied. *Daubert* recognizes a more flexible list of five factors, one of which is a requirement that the scientific evidence have widespread acceptance. *See* Frye v. United States, 293 F. 1013 (D.C. Cir. 1923); Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579 (1993).

[91] Cite Stanford law review with Gillard mentioned. *See also Closer Look: Conversations on Safety from Local Neighborhoods to School Districts*, PUBLIC BROADCASTING ATLANTA (Jan. 11, 2019), https://www.wabe.org/episode/closer-look-conversations-on-safety-from-local-neighborhoods-to-school-districts/ (conversation with Scott Jones, Acting Director of Electronic Frontiers Georgia and Sean Young, legal director of the ACLU of Georgia).

[92] People v. Gillard, No. 05-164044-0 (Cal. Super. Ct. Contra Costa Cty. 2014). *See also* Rebecca Wexler, *Life, Liberty, and Trade Secrets,* 70 STAN. L. REV. 1343, 1365-66 (2018).

"trigger other systems such as cameras to pan, tilt, and zoom in the direction of a gunshot incident." We have become generally resigned to ubiquitous video surveillance in public places, but some critics now report that camera surveillance alone, which of course predated ShotSpotter technology, has not proved to effectively reduce crime.[93] To heighten surveillance, some cities which already had surveillance cameras installed in high-crime areas integrated these camera systems to work in conjunction with SpotShotter.[94] Other cities, like Atlanta, are installing new equipment that houses both video recording devices and gunshot detection devices.[95] This combination of robotic eyes and ears is effectively utilized in South Africa, where ShotSpotter was first installed in Kruger National Park to cut down on poaching of wildlife but is now installed in the high-crime Cape Flats to preserve human life.[96] In Boston, a three-pronged procedure has been adopted: ShotSpotter devices detect gunfire, surveillance cameras record video of the area surrounding the gunfire, and police surveilling the feed use additional technology to remotely detect probationers and parolees in the area who are wearing GPS trackers.[97]

The traditional test for a warrant requirement under the Fourth Amendment is whether a speaker holds a reasonable expectation of privacy. This expectation does not exist when a conversation on a public street is overheard by a passerby or a police officer; however, the question is more complex when a conversation is overheard by smart-city technology. As this technology becomes more commonplace and ubiquitous, our reasonable expectation of privacy from recording devices will likely diminish. When such technology is present on city

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[93] Kary L. Moss, executive director of the American Civil Liberties Union of Michigan recognized that '"The positive expectations that we have of cameras improving crime are shown to not be true,' . . . they simply move the crime to areas where the cameras can't see. 'Research is showing that [cameras] create a false sense of security. People think that they're safe, but they're not — putting them in more danger.'" Mark Kurlyandchik, *How ShotSpotter and New Technologies Help Police Fight Crime*, HOUR DETROIT (May 31, 2011), https://www.hourdetroit.com/community/how-shotspotter-and-new-technologies-help-police-fight-crime/.

[94] Gunshot Location and Detection System Adds Video Camera Integration, Gov't Tech. (July 19. 2005), https://www.govtech.com/products/Gunshot-Location-and-Detection-System-Adds.html (explaining how the two devices were integrated in Gary, Indiana).

[95] Primmer, *supra* note 32.

[96] *Gunshot Detection System Helping Police Crack Down on Crime in Cape Town*, *supra* note 18.

[97] Alysha Palumbo, Cameras, GPS Technology Help Boston Police Combat Crime, NECN (Feb. 27, 2014), http://www.necn.com/news/new-england/_NECN__Cameras__GPS_Technology_Help_Boston_Police_Combat_Crime_NECN-247633921.html.

streets and the public has been given notice of it, there may someday exist no reasonable expectation of privacy from any type of listening or recording device on these city streets.

CONCLUSION

Smart-city technology is being adopted in cities all around the world to simplify our lives, save us time, ease traffic, improve education, reduce energy usage, and keep us healthy and safe. Its adoption is necessary because of changes that are predicted for urban dwellers over the next three decades; urban population and travel are predicted to increase dramatically and our population is graying, meaning the population will include a much greater number of elderly citizens. As these changes occur, smart-city technology can have a huge impact on public safety, improving the ability of law enforcement to investigate crimes, both with increased speed and increased accuracy. Additionally, first responders can shave minutes off critical response times.

As cities experience technology-driven transition, data ownership must be determined. Collected data must be made secure from hackers and thieves and must be de-identified at the source when possible. When data is collected for law enforcement investigations, however, de-identification may be neither possible nor logical. One relatively new tool for law enforcement, ShotSpotter gunfire detection devices, is particularly effective when used in conjunction with surveillance cameras. ShotSpotter acts as robotic ears, listening for gunfire, while surveillance cameras act as robotic eyes, watching for criminal activity. The combination provides excellent surveillance and has been proven effective in reducing gun violence in many cities, but not without raising concern over erosion of privacy.

We must reach a balance between our goal of making our cities safer and our necessity to guard city-dwellers' privacy. Policies governing smart-city privacy concerns need to be developed at the national level. Smart-city technology will make our lives simpler, our tasks faster, and our cities safer. As these improvements occur through greater network connectivity, city planners and legislators must be vigilant not to trade our privacy.