Received 7/3/2024 10:45:42 AM Supreme Court Western District

Filed 7/3/2024 10:45:00 AM Supreme Court Western District
12 WAP 2024

**IN THE SUPREME COURT OF PENNSYLVANIA**

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**No. 12 WAP 2024**

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COMMONWEALTH OF PENNSYLVANIA,
Appellee,
v.
JAMAR FOSTER,
Appellant.

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# BRIEF OF *AMICI CURIAE* THE AMERICAN CIVIL LIBERTIES UNION AND AMERICAN CIVIL LIBERTIES UNION OF PENNSYLVANIA IN SUPPORT OF APPELLANT

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Appeal from the Order of the Superior Court of Pennsylvania, 619 WDA 2022 dated July 17, 2023, affirming the judgment of sentence of the Court of Common Pleas of Allegheny County, CP-02-CR-0013992-2019 dated May 5, 2022.

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## STATEMENTS OF INTEREST OF *AMICI CURIAE*[1]

**The American Civil Liberties Union** ("ACLU") is a nationwide, nonprofit, nonpartisan organization dedicated to defending the principles embodied in the Federal Constitution and our nation's civil rights laws. The **ACLU of Pennsylvania,** the state affiliate of the ACLU, has a long-standing interest in protecting Pennsylvanians' rights to due process and privacy in the face of evolving technologies. The ACLU and the ACLU of Pennsylvania have frequently appeared before the United States Supreme Court and other state and federal courts, including this Court, in cases implicating Americans' rights in the digital age, including as counsel in *Carpenter v. United States*, 585 U.S. 296 (2018), and as amicus in *Riley v. California*, 573 U.S. 373 (2014), *Commonwealth v. Johnson*, 240 A.3d 575 (Pa. 2020), and *Commonwealth v. Weeden*, 304 A.3d 333 (Pa. 2023).

## INTRODUCTION

Defendant Jamar Foster was sitting with a friend in a parked car when police detained and questioned him. The police did so on the sole basis of a "ShotSpotter" alert, which purportedly indicated that a gun had been fired in the car's vicinity. But a ShotSpotter alert is not evidence that a gun was fired, only that there was some percussive sound in a location. And while ShotSpotter successfully marketed itself

[1] No other person or entity paid for or authored this Brief. All parties have consented to the filing of this brief.

into a widely used police tool, the tide is turning: after seeing their police officers sent on too many wild goose chases, many cities have canceled their ShotSpotter contracts.

The trial court wrongly assumed the contrary when it stated that ShotSpotter "established" that gun shots had been fired near where Mr. Foster was located at the time he was detained. The public record establishes that ShotSpotter is an unreliable technology that alerts more often than not when there were no gunshots fired.

- ShotSpotter microphones and associated software are not able to reliably distinguish gun shots from other percussive noises.
- ShotSpotter software consists of opaque, proprietary algorithms that have not been vetted by independent experts, and the company has turned down a request by a security technology research publication to independently evaluate the technology.
- ShotSpotter is not (as is widely assumed) a high-tech, automated system, but fundamentally relies on non-expert, fallible human analysts at a call center, who, within a minute or two, review automated sound reports and make their own assessment about whether a gun was fired.
- Investigations from government officials (the Chicago Inspector General and the New York City Comptroller) and watchdog organizations (the ACLU of Massachusetts and the Surveillance Technology Oversight Project ("STOP")

and the MacArthur Justice Center) extensively document ShotSpotter's inaccuracy.

Here, without the ShotSpotter alert, there were no facts supporting a reasonable suspicion that Mr. Foster was engaged in illegal activity. He was sitting with a friend in a parked car that had its headlights on. Based on these facts alone, the officer started to detain and question him. At this point, Mr. Foster got out of the car and walked away. The officer then stopped him and searched him for a gun. There was no gun. But for the unreliable ShotSpotter report, there would have been no colorable basis to detain Mr. Foster.

Despite ShotSpotter's high rate of false alerts, *amici* do not contend that police may not use those alerts to deploy to a particular area. But any such alert supports no more than a hunch or speculation, and more evidence of illegal behavior is required for police to establish reasonable suspicion (or probable cause) that could justify an investigatory stop, a search, or an arrest. Police cannot lawfully depend on an unreliable system to determine whether to detain Pennsylvanians.

*Amici* submit this brief to better inform the Court about the many flaws inherent in the ShotSpotter technology. Its lack of reliability in Mr. Foster's case is not an outlier. This Court should reverse the Superior Court and remand with instructions that the trial court should give little to no weight to the ShotSpotter alert in its assessment of the sufficiency of the officer's reasons for detaining Mr. Foster.

## ARGUMENT

### I. The trial court assumed ShotSpotter is reliable, and its finding of suspicious circumstances depended entirely on that assumption.

The trial court determined that there was reasonable suspicion justifying the detention of Mr. Foster based on the ShotSpotter alerts. In arriving at that conclusion, the court made clear that it assumed that the alerts were credible indications of gunshots in a particular location. It compared Mr. Foster's case to *Commonwealth v. Raglin*, 178 A.3d 868 (Pa. Super. Ct. 2018), noting that in that case "the data received from the 'ShotSpotter' itself … *established* that a shot had been fired." *Commonwealth v. Foster*, 303 A.3d 757, No. 619 WDA 2022, 2023 WL 4557061, at *6 (Pa. Super. Ct. July 17, 2023) (emphasis added). The court stated that it "agree[d] with" the Commonwealth that "ShotSpotter *detected* . . . that a total of five shots *had been* fired . . . ." *Id*. at 6–7 (emphasis added). In particular, the court recited the "Commonwealth['s] belie[f]" that the multiple reports "would allow for even less probability of error than in an instance such as *Raglin* where only a single shot was detected." *Id*. at 6.[2] And it concluded that "[t]he totality of the circumstances in this case were at least equivalent to, if not more significant, than those in *Raglin* in terms of demonstrating reasonable suspicion to validate the investigative detention."

[2] This assertion misapprehends the reasons that ShotSpotter is unreliable. ShotSpotter is known to alert to fireworks, for example. Five fireworks could produce five alerts. The number of alerts is not evidence that the fireworks were actually gunshots.

*Id.* at 7.

But the court's purported application of a "totality of the circumstances" test boiled down to a **single** indication that something illicit had taken place in Foster's proximity: the ShotSpotter alerts. Remove that unreliable report from the calculation and there is just a man sitting in his car with a friend, headlights on, at 2:00 AM. *See Foster*, 2023 WL 4557061, at *1. The officer initiated the stop at this point, so the fact that Mr. Foster walked away when the police arrived is of no relevance. Even if it were, though, people are within their rights to avoid police officers, and doing so does not contribute to reasonable suspicion. *See Commonwealth v. Adams*, 205 A.3d 1195, 1199 (Pa. 2019) (citizens free to choose whether to engage with the officer or to ignore and continue on their way); *Commonwealth v. Key*, 789 A.2d 282, 289 (Pa. Super. Ct. 2001) (presence in a "high crime" area is not evidence of criminal activity).

## II. ShotSpotter is not reliable.

### A. Independent investigations reveal that ShotSpotter alerts rarely lead to evidence of gunfire.

Multiple independent assessments of ShotSpotter have found it lacking in reliability, including a 2021 Chicago Inspector General report,[3] a recent New York

[3] City of Chicago Off. Inspector Gen., *The Chicago Police Department's Use of ShotSpotter Technology* 4 (2021), https://perma.cc/68HK-Q9NJ ("Chicago OIG Report").

City Comptroller investigation,[4] and an April 2024 ACLU of Massachusetts analysis based on public records.[5]

First, the Chicago Inspector General issued a report in 2021 that found that 90.9 percent of confirmed probable gunshot alerts by ShotSpotter in Chicago did not result in police finding any evidence of a gun-related offense.[6] As for investigatory stops following ShotSpotter alerts, the available data revealed that on average fewer than 20 percent of alerts resulted in the recovery of a gun.[7] The Mayor of Chicago has announced that the city will stop its use of ShotSpotter.[8]

Second, a June 2024 audit by the New York City Comptroller found that, during a sampling of months in 2022 and 2023, ShotSpotter alerts only resulted in confirmed shootings between 8 percent and 20 percent of the time.[9] During the month of June 2023, for example, 82 percent of alerts were either unconfirmed or unfounded, and only 13 percent confirmed as shootings.[10]

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[4] Alyce McFadden, *Gunshot Detection System Wastes N.Y.P.D. Officers' Time, Audit Finds*, N.Y. Times (June 20, 2024), https://perma.cc/YZZ9-9GXX (“NYPD Article”).

[5] Julie Lee, *Boston Police Records Show Nearly 70 Percent of ShotSpotter Alerts Led to Dead Ends*, ACLU of Massachusetts (Apr. 8, 2024), https://perma.cc/MJ6A-HP6W (“ACLU Massachusetts Review BPD”).

[6] Chicago OIG Report 3.

[7] Chicago OIG Report 16.

[8] Diba Mohtasham, *Chicago Will Drop Controversial ShotSpotter Gunfire Detection System*, Nat'l Pub. Radio (Feb. 15, 2024), https://perma.cc/3W5Q-AFZX.

[9] NYPD Article.

[10] N.Y.C Off. Comp., No. FP23-074A, *Audit Report on the New York City Police Department's Oversight of its Agreement with ShotSpotter Inc. for the Gunshot Detection and Location System*

Third, a 2024 ACLU of Massachusetts study of Boston police records shows that police found no evidence of gunfire in nearly 70 percent of alerts.[11] 16 percent of alerts corresponded to common urban sounds: balloons, vehicles backfiring, garbage trucks and construction.[12] Approximately 10 percent were fireworks.[13]

Overall, research shows that ShotSpotter does not help police identify more shootings overall or reduce crime.[14]

### B. Cities have cancelled their contracts with ShotSpotter because the system sent their officers out on too many wild goose chases.

Due to ShotSpotter's lack of reliability in accurately detecting gunfire, cities and towns across the country, including Houston, Texas, Dayton and Canton, Ohio, Mobile, Alabama, and Charlotte and Durham, North Carolina, have decided to cancel or not renew contracts with ShotSpotter.[15] And officials in York,

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12 (2024), https://perma.cc/ZNB7-5W8U ("NY Audit Report").

[11] ACLU Massachusetts Review BPD.

[12] *Id*.; Nick Selby *et al.*, *CSG Analysis-ShotSpotter Gunshot Location System Efficacy Study* 25 (2017), https://perma.cc/9AF7-L3Q3 ("The most commonly reported sources of false positive activations are, in no particular order: dumpsters, trucks, motorcycles, helicopters, fireworks, construction, vehicles traveling over expansion plates on bridges or into potholes, trash pickup, church bells, and other loud, concussive sounds common to urban life.").

[13] ACLU Massachusetts Review BPD.

[14] *See* Mitchell L. Doucette *et. al.*, *Impact of ShotSpotter Technology on Firearm Homicides and Arrests Among Large Metropolitan Counties: A Longitudinal Analysis, 1999-2016*, 98 J. Urban Health 609 (2021); Dennis Mares & Emily Blackburn, *Acoustic Gunshot Detection Systems: A Quasi-Experimental Evaluation in St. Louis, MO*, 17 J. Experimental Criminology 193 (2020); Jerry H. Ratcliffe *et al.*, *A Partially Randomized Field Experiment on the Effect of an Acoustic Gunshot Detection System on Police Incident Reports*, 15 J. Experimental Criminology 67, 75 (2018).

[15] ACLU Massachusetts Review BPD; Andrea Ramey, *Mobile Not Renewing Shot Spotter*

Pennsylvania, and Trenton, New Jersey, have admitted that the technology does not work.[16]

In Fall River, Massachusetts, the police department decided to stop using ShotSpotter after finding that the system worked less than 50 percent of the time and often failed to detect gunshots.[17] In San Diego, the police department ended its contract with ShotSpotter after using the program for four years, during which only two arrests were made in response to a ShotSpotter notification.[18] The San Antonio Police Department similarly stopped using ShotSpotter after officers only made four arrests as a result of the program after over a year of use, during which officers found no evidence of a shooting about 80 percent of the time.[19]

## III. The ShotSpotter system is subjective, unvalidated, and unreliable.

ShotSpotter is a fundamentally subjective system dependent on faulty technology and human guesswork.

### A. ShotSpotter alerts depend on unreliable hardware and software.

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*Contract*, NBC 15 News (Apr. 19, 2024), https://perma.cc/T9DX-G63K.

[16] Paul Van Osdol, *Critics Say Gunshot Detection System Misfires*, WTAE (July 5, 2013), https://perma.cc/6GHR-8ALU.

[17] Brian Fraga, *After Too Many Shots Missed, Fall River, Mass., Ends Deal with ShotSpotter*, GovTech (Apr. 23, 2018), https://perma.cc/WU7J-TVXM.

[18] Kara Grant, *ShotSpotter Sensors Send SDPD Officers to False Alarms More Often Than Advertised*, Voice of San Diego (Sept. 22, 2020), https://perma.cc/DJ3A-YZJF.

[19] Vianna Davila, *San Antonio Police Cut Pricey Gunshot Detection System*, San Antonio Express News (Aug. 17, 2017), https://perma.cc/R525-DB26.

ShotSpotter, owned by the company SoundThinking,[20] markets itself as a tool to accurately identify and locate gunfire so that police can quickly dispatch officers to investigate. The company's software sends alerts to officers—often through an app on their mobile devices—telling them that gunshots were fired in a particular location, plotted with a pin on a map. It is also used to generate reports containing additional information regarding the alerts.

A ShotSpotter alert begins with a network of microphones that are typically installed on poles or rooftops and are always listening and recording.[21] These microphones, which are paired with audio-processing circuitry and a cell-network connection, are calibrated to detect "impulsive sounds that *may* represent gunfire."[22] Any loud sounds that pop, or are percussive in nature, such as firecrackers, car backfires, and construction equipment, can trigger the ShotSpotter sensors.[23] A sound-detection system like this one needs regular, site-specific calibration and testing.[24] The record does not reflect whether the Pittsburgh Police Department

[20] ShotSpotter, SoundThinking, https://perma.cc/W42X-6LWK.

[21] Helen Webley-Brown *et. al.*, Surveillance Technology Oversight Project, *ShotSpotter and the Misfires of Gunshot Detection Technology* 3–5 (2022), https://perma.cc/3X76-HU8B ("STOP Report").

[22] ShotSpotter Frequently Asked Questions, ShotSpotter, https://perma.cc/NAL8-RLF8 (emphasis added) ("ShotSpotter FAQ").

[23] *Id.*; STOP Report 5.

[24] Michael Litch & George A. Orrison, IV, *Draft Technical Report for SECURES Demonstration in Hampton and Newport News, Virginia* 24 (2011), https://perma.cc/2U75-SL8J.

properly maintained its ShotSpotter network, but if not, failure to calibrate is an additional reason to disbelieve ShotSpotter alerts.

Microphones that perceive a percussive sound upload audio snippets of the noise to ShotSpotter's computers.[25] Those audio snippets contain the loud noise that triggered the sensor plus one second of audio before and after.[26]

Next, ShotSpotter runs those snippets are run through secret, proprietary audio-screening algorithms that make a first attempt at classifying the noise—as fireworks, thunder, helicopter, gunshot, etc.—and determining its location.[27] The software does not make the final decision to send out an alert to police or to generate a report. Instead, call-center-style, ShotSpotter staff listen to disembodied, isolated, and contextless audio snippets passed along from the software algorithm and decide, based on their subjective impression of the sound and a visual waveform generated by the software, whether to trigger a gunshot alert.[28]

ShotSpotter's operators do not appear to be forensic audio experts. The operator position requires no expertise beyond customer service experience, and as

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[25] ShotSpotter FAQ.

[26] *Id*.

[27] Chicago OIG Report 4 ("the ShotSpotter system approximates the location of the possible gunshots via triangulation and multilateration—two techniques for computing the source location of a sound based on the time of arrival and angle of arrival of sound waves at multiple surrounding sensors").

[28] *Id*.; *see also* Chris Mills Rodrigo, *Gunshot Detection Firm ShotSpotter Expands With New D.C. Office*, The Hill (July 14, 2021), https://perma.cc/HW4T-BXJD.

detailed below, whatever on-the-job training or proficiency testing they may receive from ShotSpotter is shrouded in secrecy.[29] Any basic guidelines that these operators are supposed to follow have not been publicly released or analyzed—something that is also true regarding the company's initial algorithmic screening tool.[30]

If a ShotSpotter operator reviewing a noise labels it as a gunshot or "possible gunshot," the company sends an alert to the police.[31] ShotSpotter operators can—and do—issue alerts for noises that the computer initially classified as something other than gunshots.[32] Because ShotSpotter touts the immediacy of its system as a selling point, the operators review the sounds under extreme time pressure; ShotSpotter trumpets that the entire process—from initial noise detection through alert to police—typically happens in less than one minute.[33]

Police receive alerts via proprietary ShotSpotter apps on their computers, mobile phones, and tablets in the field.[34] These apps present officers with a display showing the number of purported gunshots and an allegedly precise location

[29] *See* STOP Report 7.

[30] Research Findings, MacArthur Justice Center, https://perma.cc/KVM6-N3PK.

[31] STOP Report 7.

[32] Garance Burke *et al.*, *How AI-Powered Tech Landed Man in Jail With Scant Evidence,* Associated Press (Mar. 5, 2022), https://perma.cc/T9TC-359P ("AP AI Article").

[33] ShotSpotter FAQ.

[34] Chicago OIG Report 7; ShotSpotter FAQ.

indicated with a single pin on a street-view map, along with a link to the audio snippets.[35]

### B. The ShotSpotter system relies on fallible human subjectivity.

ShotSpotter relies on human operators to review, vet, and classify percussive sounds.[36] The operators have broad discretion to override the initial determinations of software algorithms and reclassify certain sounds as gunshots, even if the algorithm first classified the detected sound as some other loud sound, such as thunder or fireworks.[37]

ShotSpotter claims that human review actually improves accuracy. But there is no public evidence about whether the operators vetting the audio snippets can reliably classify sounds as gunfire. ShotSpotter's operators do not appear to be forensic experts. ShotSpotter has posted requirements for this position requiring only prior customer service experience and the vague "ability to 'listen to audible notifications with a high level of accuracy.'"[38] Little is known about the training they receive. ShotSpotter has told journalists that it "has a two-month, four phase training program," but to *amici*'s knowledge the company has never disclosed the content of

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[35] *See* ShotSpotter: Protect & Serve, SoundThinking, https://perma.cc/DT35-MEQZ; ShotSpotter Technology Improvements, SoundThinking, https://perma.cc/6S8B-M35N.

[36] *See* Garance Burke & Michael Tarm, *Confidential Document Reveals Key Human Role in Gunshot Tech*, Associated Press (Jan. 20, 2023), https://perma.cc/5HU6-DB39.

[37] *Id*.

[38] STOP Report 7.

that training program or, crucially, whether (and, if so, how) it tests operators for proficiency at distinguishing gunfire from known samples of confounding noises like engine backfires.[39] The system relies fundamentally on the subjective views of operators, yet neither police nor courts know what methods the operators use to distinguish gunshots from other sounds.

This subjectivity infects the ShotSpotter process in multiple ways. In fact, there are a number of examples of the system's malleability producing disastrous outcomes in criminal prosecutions.[40] For example, in Rochester in 2016, a ShotSpotter analyst manually overrode the program's results—*at the request of the city's police department*.[41] In that case, the police shot a passenger, Silvon Simmons, in the wrong car while looking for a suspicious vehicle.[42] ShotSpotter had at first identified loud sounds as coming from a helicopter, but the analyst revised the conclusion to three gunshots "per the customer's instruction" after the police informed the company they were investigating an officer-involved shooting.[43] After further communications with the police, ShotSpotter revised its conclusions to four

[39] *See* ShotSpotter, *ShotSpotter Responses to the Associated Press* 5 (Aug. 12, 2021), https://perma.cc/F8J7-V2EJ.

[40] STOP Report 8–10.

[41] STOP Report 9; Reade Levinson & Lisa Girion, *Shots in the Dark: A High Stakes Gamble*, Reuters (Nov. 17, 2020), https://perma.cc/9TSU-E9RX.

[42] *Id*.

[43] *Id*.

gunshots—the number of times the officer fired on Simmons. After the police asked ShotSpotter yet again to locate a fifth shot—in support of the police's argument that the passenger had fired first at them—ShotSpotter revised the report once again to include an additional gunshot, even though no physical evidence supported this finding and the police refused to test Mr. Simmons's hands and clothing for gunshot residue.[44] Mr. Simmons endured a criminal trial and was ultimately acquitted by a jury of attempted murder while a judge overturned his conviction for possession of a gun due in part to ShotSpotter's unreliability.[45]

Similarly, in Chicago in 2018, a ShotSpotter analyst overrode the algorithm's finding that two gunshots were fired in a shooting involving a federal agent after the Chicago Police Department requested that ShotSpotter search for additional audio clips of gunshots.[46] The analyst later revised ShotSpotter's findings to include five additional gunshots.[47] This change supported the government's allegation that Ernesto Godinez, who had been charged with shooting a federal agent, fired five shots at a federal agent from a doorway, even though the surveillance video of Mr.

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[44] *Id*.

[45] *Id*.; Lisa Girion & Reade Levinson, *Shots in the Dark: An Uphill Battle*, Reuters (Nov. 17, 2020), https://perma.cc/47G7-N9JQ.

[46] Todd Feathers, *Police Are Telling ShotSpotter to Alter Evidence From Gunshot-Detecting AI*, Vice (July 26, 2021), https://perma.cc/YW9Q-CYQF (Vice issued a correction after publication, but that correction did not change the information *amici* cite.).

[47] *Id*.

Godinez showed no muzzle flashes from the doorway and the shell cases found nearby did not match the bullets that hit the agent.[48] The federal appeals court held that the trial judge erred in not allowing Mr. Godinez to challenge the accuracy of ShotSpotter or the qualifications of the company's expert witness. *United States v. Godinez*, 7 F.4th 628, 638 (7th Cir. 2021) [49]

Also in Chicago in May 2020, a ShotSpotter analyst "relabeled" a loud noise, which the system's algorithms had first identified as fireworks, as a gunshot."[50] This alteration by an analyst turned the ShotSpotter report into the only key piece of evidencing linking one man, Michael Williams, with a murder.[51] The prosecutors eventually dismissed the case against Williams for lack of sufficient evidence after his defense attorney subpoenaed ShotSpotter for communications between the company and prosecutors.[52] But the dismissal of charges did not occur until Williams had already spent 11 months in jail and suffered two COVID infections behind bars that left him with uncontrollable tremors.[53]

ShotSpotter officials have themselves admitted in court testimony that police departments often ask their analysts to reconsider and change the company's

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[48] *Id*.

[49] *Id*.

[50] AP AI Article.

[51] *Id*.

[52] *Id*.

[53] *Id*.

conclusions about percussive sounds that are picked up by sensors or to search for additional sounds that could be gunshots.[54] The company obliges law enforcement requests "all the time."[55] Further, police departments and city dispatchers can also make these types of changes.[56] ShotSpotter has perverse incentives to make alterations—profitability and keeping customers happy. These incentives, however, run counter to the need for members of the public to trust that policing tools that accuse us of misconduct are reliable, and depend on objective scientific data.

### C. ShotSpotter's methods of distinguishing gunfire from other loud noises are not validated and are shrouded in secrecy.

Every stage of ShotSpotter's gunshot detection process—from placement of the microphone and initial sound detection through the algorithmic processing to the operator's decision to send an alert and generate a report—is unvetted and riddled with opportunities for technological and human error.

ShotSpotter has admitted that it trains its machine-learning model to classify sounds as being or not being gunshots by relying on crime scene observations input by patrol officers.[57] For example, patrol officers can add information about shell casings, bullet holes, witness testimony, and other gunfire evidence on ShotSpotter's

[54] *See id*.

[55] *Id*.

[56] *Id*.

[57] AP AI Article.

software.[58] Experts have warned that such an approach could contaminate the reliability of ShotSpotter's model because officers could input incorrect or incomplete data.[59]

Given the investigations documenting ShotSpotter's unreliability, one might expect that ShotSpotter would seek to answer those questions by releasing data or publishing peer-reviewed studies testing its system's ability to reliably distinguish gunfire from other sounds. Yet ShotSpotter has never published or shared its algorithm with independent experts—and has turned down a request by independent security technology research publication IPVM to test its technology.[60]

### D. ShotSpotter's accuracy claims look at how often it misses a gunshot, not how often the system alerts when no shots were fired.

One of the system's central flaws is that there is a perverse incentive for ShotSpotter's human operators to regularly send alerts to police in response to sounds that are *not* gunfire.[61] ShotSpotter's contracts with cities explicitly state that it will send alerts to police not just when there is "[h]igh confidence [that an] incident

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[58] *Id*.

[59] *Id*.

[60] Donald Maye, *MacArthur Justice Center vs ShotSpotter Commissioned Report,* IPVM (Aug. 13, 2021), https://perma.cc/J9Z8-FPG9; *see also* Timothy McLaughlin, *The Tech Site That Took On China's Surveillance State*, The Atlantic (Sept. 29, 2022), https://perma.cc/N96D-RNFG.

[61] *See, e.g.*, Press Release, MacArthur Justice Center, *ShotSpotter Generated Over 40,000 Dead-End Police Deployments in Chicago in 21 Months, According to New Study* (May 3, 2021), https://perma.cc/5MNT-2UAT (reporting that an analysis of Chicago ShotSpotter data found that 89 percent of reports "turned up no gun-related crime" and 86 percent "led to no report of any crime at all").

is gunfire," but also when it is "uncertain if [an] incident is gunfire or not."[62] In other words, ShotSpotter dispatches police in response to "possible gunfire" that ShotSpotter itself admits is "uncertain."[63]

ShotSpotter's contracts also promise to send alerts in response to at least 90 percent of outdoor, unsuppressed gunshots fired from greater than .25 caliber weapons inside the coverage area.[64] Crucially, however, the contracts make no corresponding guarantee to keep false alerts triggered by non-gunfire noises below a threshold.[65] Thus, contractually, ShotSpotter has no responsibility to avoid dispatching police and generating reports in response to noises that are not gunfire, but has a strong incentive to over-report noises as gunfire in order to reduce the risk of "missing" a gunshot.

In the recent New York City report, the City Comptroller pointed out that the contractual metric for assessing ShotSpotter accuracy counts how reliably the tool alerts when there is gunfire—the rate of false negatives.[66] By that metric, the tool appears to do reasonably well. But it produces very low rates of confirmed shots

[62] City of Chicago, *Area Acoustic Gun Shot Detection Subscription Service* 96 (2018), https://perma.cc/9TH6-CC2S (follow "71366" hyperlink under "Contract Details").

[63] *Id.*

[64] *Id.* at 96, 99.

[65] *Id.*

[66] NY Audit Report 7 ("The Performance Standard Adopted By NYPD Results In Artificially High Ratings For ShotSpotter").

detected, an apparently very high false positive rate.[67]

The report criticized the contractual performance standard based on false negative measurement. In response, the New York Police Department ("NYPD") claimed that the number of confirmed incidents could be higher, if subsequent investigation turned up gunshots, but there was no data to support that hypothesis.[68] The report concluded that the NYPD should start collecting data about whether alerts it receives result in confirmed shootings, in anticipating of an upcoming decision about whether to renew ShotSpotter's license with the city.[69]

Testing for false positives is standard practice for other detection technologies: Radar guns, for instance, must be tested and calibrated to ensure their speed readouts are accurate. *See* 75 Pa. C.S. § 3368(b). Similarly, Pennsylvania law requires that breathalyzer testing equipment must be properly calibrated and tested for accuracy within a time period and manner specified by the Department of Health and Transportation's regulations. *See* 75 Pa. C.S. § 1547(c)(1). ShotSpotter's system has never been subjected to analogous accuracy testing.

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[67] *Id*. at 9 ("Very Low Rates of Confirmed Shots Detected"). The auditors sampled months between January and June 2023. During this period, the percentage of confirmed shooting incidents ranged from 8 percent to 13 percent.

[68] *Id*.

[69] *Id.* at 22, 23.

ShotSpotter's promotional materials proclaim a "97 [percent] aggregate accuracy rate" and a "false positive rate of less than 0.5 [percent]."[70] These marketing statements are deeply misleading and scientifically meaningless. The figures are not based on actual testing of the system. Instead, ShotSpotter calculates these "accuracy" figures by simply assuming that every alert was triggered by actual gunfire unless a police customer affirmatively flags an error.[71] The figures are simply tallies of voluntary customer complaints with no known effort by ShotSpotter to collect information on misidentified or mislocated gunshots.

The fallacy in these supposed "accuracy" statistics is obvious if one considers how this methodology would apply to other investigative methods: a radar gun would be deemed 100 percent "accurate" unless police officers had submitted error reports to the manufacturer confessing that they stopped people for speeding who were actually driving at the lawful limit.

These supposed "accuracy" numbers are especially misleading when it comes to assessing false alerts to non-gunfire. This is because police officers are not obligated to report such errors, are unlikely to take the time to do so voluntarily, and

[70] ShotSpotter FAQ.

[71] Edgeworth Analytics, *Independent Audit of the ShotSpotter Accuracy* 2 (2022), https://perma.cc/4TNR-UWL7 ("Information on potential errors relies on clients reporting those potential errors to ShotSpotter.").

will rarely, if ever, know what non-gunfire noise actually triggered an alert.[72] Officers who arrive at the scene of a false alert probably will find nothing. They typically will have no way to tell whether ShotSpotter was triggered by something like a blown tire or fireworks, and so they have no basis to report an error.

In Chicago, police did not report a single false positive to ShotSpotter among more than 20,000 alerts in the first half of 2021.[73] This is particularly striking given that, according to Chicago's Inspector General, 90.9 percent of ShotSpotter alerts led police to find no gun-related incident of any kind at the scene.[74] Consider those facts together: nine out of ten times that ShotSpotter alerts sent police to locations in Chicago they found no evidence of gunfire, yet ShotSpotter is not counting any of those alerts as a false positive. That is a transparently misleading statistic.

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[72] Indeed, even when recording additional information during traffic and pedestrian stops is mandated by court order, underreporting is often a significant challenge. *See, e.g.*, Seventh Report of the Independent Monitor at 38–45, *Floyd v. City of New York*, 959 F. Supp. 2d 540 (S.D.N.Y. 2013) (No. 08-1034) , ECF No. 576, https://a860-gpp.nyc.gov/concern/parent/mk61rk42c/file_sets/1z40kw230 (finding substantial numbers of stops that officers failed to document as required); City of Milwaukee Settlement Agreement, Third Annual Report at 37–41, *Collins v. Milwaukee,* No. 17-234, (E.D. Wis. Sept. 23, 2021), ECF No. 169, https://perma.cc/A53P-TMN7 (finding Milwaukee out of compliance with requirements to document all traffic stops, field interviews, no-action encounters, frisks, and searches).

[73] ShotSpotter, *Chicago Performance Overview 2021* 3 (2021), https://perma.cc/X9PK-B5MB (documenting the number of "Reported False Positive Incidents" as zero).

[74] Chicago OIG Report 3.

## IV. False positive ShotSpotter alerts are harmful.

When SpotSpotter incorrectly identifies a percussive sound as gunfire and alerts local police officers, the consequences can be devastating for any person who happens to be near the location flagged by the alert. As discussed above, law enforcement might rely on ShotSpotter alerts to wrongfully stop, arrest, and prosecute innocent individuals. Further, as police respond to a particular place with expectations that a person there is armed with a gun, they may mistake innocent interactions or movements as threats and respond with unnecessary, and sometimes deadly, force.[75] In Chicago, for example, police shot at (but thankfully missed) an unarmed teenager playing with fireworks after ShotSpotter mistook the fireworks for gunfire.[76]

Since ShotSpotter microphones are predominately placed in neighborhoods inhabited by people of color, false positive alerts can also exacerbate over-policing of these communities and cause increases in discriminatory stops, frisks, searches, and citations.[77] In Chicago, ShotSpotter was deployed in 12 districts with the highest proportion of Black and Latine residents, leading to a dramatic increase in police

[75] *See* Jay Stanley, *Four Problems with the ShotSpotter Gunshot Detection System*, ACLU (Aug. 24, 2021), https://perma.cc/Z2VA-2CMV.

[76] Adam Schwartz, *Responding to ShotSpotter, Police Shoot at Child Lighting Fireworks*, Elec. Frontier Found.(Mar. 22, 2024), https://perma.cc/2FDX-L8M3.

[77] *See* Todd Feathers, *Gunshot-Detecting Tech is Summoning Armed Police to Black Neighborhoods*, Vice (July 19, 2024), https://perma.cc/9B28-JDZ*3*.

responses to unfounded gunshot reports relative to neighborhoods without ShotSpotter sensors that relied only on 911 reports of gunfire.[78] Such leads to "inflated gunfire statistics" that contribute to false justifications for the over-policing of Black and Latine neighborhoods.[79]

Indeed, the Chicago OIG noticed something additionally disturbing: police are influenced by aggregate ShotSpotter alerts when making decisions about whether to detain someone. Even in the absence of an alert, and despite inaccuracy, some officers at least some of the time "cite the frequency of ShotSpotter alerts in a given area as an element of the reasonable suspicion upon which an investigatory stop is predicated."[80]

Similarly, the ACLU of Massachusetts review of Boston Police Department ("BPD") records between 2020 and 2022 revealed that "ShotSpotter perpetuates the over-policing of communities of color, encouraging police to comb through neighborhoods and interrogate residents in response to what often turn out to be false alarms."[81] For example, in response to a ShotSpotter alert in 2021, the BPD pulled over a vehicle and cited the driver for having an "'expired registration, excessive

[78] *ShotSpotter is Deployed Overwhelmingly in Black and Latinx Neighborhoods in Chicago*, MacArthur Justice Center, https://perma.cc/567P-CR3L.

[79] *Id*.

[80] Chicago OIG 19.

[81] ACLU Massachusetts Review BPD.

window tint, and failure to display a front license plate,'" none of which are related to gun violence.[82] And in New York City, false ShotSpotter alerts have led to "a violent altercation between officers and a crowd in Harlem" as well as police officers tackling, punching, kicking and beating a man in Brooklyn who was allegedly smoking marijuana.[83] In both instances, police never recovered a gun or evidence of gunfire.[84]

In the many instances when ShotSpotter sends an alert but there was no gunfire, residents of mostly Black and brown communities are confronted by police officers looking for shooters who may not have existed, creating potentially dangerous situations for residents and heightening tension in an otherwise peaceful environment.

## V. The Lower Court relied almost entirely on ShotSpotter's alert in determining whether the officer had reasonable suspicion to detain the defendant.

To perform an investigative detention—as was performed on Mr. Foster here—police must have a "reasonable, articulable suspicion that criminal activity is afoot." *Illinois v. Wardlow*, 528 U.S. 119, 123 (2000); *see Terry v. Ohio*, 392 U.S. 1, 30 (1968). While this "reasonable suspicion" analysis is based on the totality of

[82] *Id*. (quoting BPD offense/incident report).

[83] Gabriel Sandoval *et. al.*, *'ShotSpotter' Tested as Shootings and Fireworks Soar, While Civil Rights Questions Linger*, The City (July 5, 2020), https://perma.cc/BW25-RF4C.

[84] *Id*.

the circumstances, there must be a "particularized and objective basis" for suspecting that the particular individual is involved in criminal activity. *United States v. Cortez*, 449 U.S. 411, 417–19 (1981).[85] Central to the *Terry* doctrine is the requirement that an investigative detention be premised upon "specific and articulable facts *particular to the detained individual*". *Commonwealth v. Hicks*, 208 A.3d 916, 938 (Pa. 2019) (emphasis added). "The Commonwealth cannot simply point to conduct in which hundreds of thousands of citizens lawfully may engage, then deem that conduct to be presumptively criminal." *Id.* at 940. Being physically proximate to a ShotSpotter alert—being somewhere near a commonly misinterpreted percussive sound—is one of these lawful activities.

**A. Reasonable suspicion must be based on reliable information.**

To determine whether police had reasonable suspicion to perform an investigative detention, courts not only look to the content of the information used to suspect an individual as involved in criminal activity but also to that information's reliability. *See, e.g.*, *Commonwealth v. Wimbush*, 750 A.2d 807, 811 (Pa. 2000) (citing *Commonwealth v. Wilson,* 622 A.2d 293, 295–96 (Pa. Super. Ct. 1993) (quoting *Alabama v. White*, 496 U.S. 325, 330 (1990)). The "quality" of the

[85] Because the person being stopped must be suspected of a crime, an officer cannot perform an investigative detention on someone who they believe is merely a witness to a crime. *Commonwealth v. Jackson*, 302 A.3d 737, 754 (Pa. 2023) ("[I]t is not enough for the circumstances to establish a reasonable suspicion that the individual is only a witness or victim.").

information is an important factor determining whether there is sufficient cause to stop an individual. *Wimbush*, 750 A.2d at 811 (quoting *White*, 496 U.S. at 330). "If information has a low degree of reliability, then more information is required to establish reasonable suspicion." *Wimbush*, 750 A.2d at 811; *see also White*, 496 U.S. at 328–329 (because "reliability" is "highly relevant" in determining the value of information, "something more" is required when information is unreliable).

In *Wimbush*, which involved an investigative detention based on an anonymous tip that a man driving a white van had drugs in his possession, this Court made clear that corroborating evidence is necessary to establish reasonable suspicion when the source is unreliable. *Wimbush*, 750 A.2d at 811. In *Commonwealth v. Hawkins*, this Court similarly held that where a police dispatcher provides information from an anonymous call, police must have corroborating information to support reasonable suspicion. 692 A.2d 1068, 1070–71 (Pa. 1997). It is not sufficient that a suspect resembles the anonymous caller's description, "for anyone can describe a person who is standing in a particular location at the time of the anonymous call. Something more is needed to corroborate [ ] allegations of criminal conduct." *Id.* at 1070.

### B. Unreliable ShotSpotter's alerts were insufficient to establish reasonable suspicion to stop Foster in this case.

Given ShotSpotter's documented unreliability, it was error for the appellate court to deem the ShotSpotter alert a reliable indication that gunshots had been fired.

The court below compared the ShotSpotter technology to an anonymous tip, agreeing with the State that the technology was more reliable. *Foster*, 2023 WL 4557061 at 6 (citing *Raglin*, 178 A.3d at 873). ShotSpotter's alerts differ from anonymous tips in key respects that render ShotSpotter even less reliable. Anonymous tips, of course, are potentially relevant but potentially untrustworthy because the investigators cannot know if the reporting party is being honest or if they had an opportunity to perceive what they are reporting. People's observations may be flawed because the lighting was dim or they were confused. As fellow humans, we have a common sense understanding these points of failure.

The technological component to ShotSpotter's unreliability means that we do not have an inherent understanding of the credibility of the report, as we have for anonymous tips. The tool cannot consistently distinguish between percussive noises caused by guns, fireworks, or other events. The operation of the tool is a closely held business secret that has not been independently validated. The human subjectivity aspect of ShotSpotter's reports can introduce flaws because the analyst may be receiving faulty information, be poorly trained, or the company is operating in accordance with perverse incentives. If five witnesses tell the same story, the story is more likely to be true. If five firecrackers go off, and ShotSpotter alerts to percussive sounds, it just means there were five firecrackers. The relationship of the number of alerts to accuracy is nothing like an anonymous tip.

Courts have, accordingly, recognized that the questionable reliability of ShotSpotter alerts is highly relevant to the reasonable suspicion analysis. *See United States v. Vallo*, 608 F. Supp. 3d 1071, 1078–79 (D.N.M. 2022) (finding that even if ShotSpotter was reliable, some corroboration would be necessary to establish reasonable suspicion); *United States v. Rickmon*, 952 F.3d 876, 879 n.2 (7th Cir. 2020) (noting that at some point the court may need to consider the reliability of ShotSpotter, though not in the case at bar due to sufficient additional corroboration); *People v. Jones*, 220 N.E.3d 475, 490 (Ill. App. Ct. 2023) (holding that the district court below did not err in allowing the defendant to seek discovery from ShotSpotter to challenge the tool's reliability where the only reason police stopped defendant's vehicle and ordered him out of it was a ShotSpotter alert).

When additional evidence about the unreliability of a forensic technology comes to light, courts must reevaluate assumptions that were made without the benefit of that knowledge.[86] *See Commonwealth v. Ross*, No. 1738 WDA 2018, 2019 WL 6211324, at *6 (Pa. Super. Ct. Nov. 21, 2019) (holding that trial court abused its discretion in refusing to hold a Frye hearing regarding the reliability of bite mark analysis where defendant showed that it was no longer a generally accepted

[86] *See, e.g.*, Ryan Gabrielson, *Roadside Drug Tests Used to Convict People Aren't Particularly Accurate. Courts Are Beginning to Prevent Their Use*, ProPublica (Apr. 25, 2023), https://perma.cc/EJJ9-G4N2; U.S. Dep't Com., NIST IR 8352, *Bitemark Analysis: A NIST Scientific Foundation Review* 24 (2023), https://perma.cc/2W2M-WH9H (finding that bite mark analysis is scientifically unfounded).

technique). Failure to do so results in over-policing, unconstitutional searches and seizures, and false convictions.[87]

## CONCLUSION

For these reasons, this Court should reverse the Superior Court and hold that the trial court erred by placing too much weight on the ShotSpotter alert to justify stopping Mr. Foster.

Dated: July 3, 2024

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[87] *See* Comm. on Identifying the Needs of the Forensic Sci. Cmty., Nat'l Rsch. Council, No. 228091, *Strengthening Forensic Science in the United States: A Path Forward* 4 (2009), https://perma.cc/6FTL-GTVQ; Leora Smith, *How a Dubious Forensic Science Spread Like a Virus*, ProPublica (Dec. 13, 2018) https://perma.cc/5K97-YU5B.

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## CERTIFICATES OF COMPLIANCE

I certify that this brief complies with the word-count limits of Pa.R.A.P. 531, as it contains fewer than 6,603 words, exclusive of excluded materials.

Pursuant to Pa. R.A.P 127, I certify the brief complies with the provisions of the Public Access Policy of the Unified Judicial System of Pennsylvania – Case Records of the Appellate and Trial Courts requiring the filing of confidential information and documents differently than non-confidential information and documents.

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