

NOTICE: All slip opinions and orders are subject to formal revision and are superseded by the advance sheets and bound volumes of the Official Reports. If you find a typographical error or other formal error, please notify the Reporter of Decisions, Supreme Judicial Court, John Adams Courthouse, 1 Pemberton Square, Suite 2500, Boston, MA, 02108-1750; (617) 557-1030; SJCRreporter@sjc.state.ma.us

SJC-13014

COMMONWEALTH vs. MATTHEW DAVIS.

Suffolk. February 1, 2021. - May 17, 2021.

Present: Budd, C.J., Gaziano, Lowy, Cypher, Kafker,
& Georges, JJ.

Armed Assault with Intent to Murder. Assault and Battery. Attempt. Firearms. Electronic Surveillance. Global Positioning System Device. Evidence, Videotape, Photograph, Authentication, Identification, Scientific test. Practice, Criminal, Probation, Required finding.

Indictments found and returned in the Superior Court Department on May 16, 2016.

The cases were tried before Peter M. Lauriat, J.

After review by the Appeals Court, the Supreme Judicial Court granted leave to obtain further appellate review.

David Rassoul Rangaviz, Committee for Public Counsel Services, for the defendant.

Andrew S. Doherty, Assistant District Attorney, for the Commonwealth.

Maria Gonzalez Calvet, of the District of Columbia, Daniel W. Richards, of California, Michael A. Morales, of New York, Radha Natarajan, Katharine Naples-Mitchell, & Kirsten V. Mayer, for New England Innocence Project & another, amici curiae, submitted a brief.

LOWY, J. On September 15, 2015, a Black man with long hair wearing a red or pink shirt or sweatshirt fired multiple shots at the driver's side window of a moving blue sedan. The driver of the sedan, who was uninjured, fled from the scene and did not testify at trial. The sole civilian witness who testified at trial did not witness the shooting itself but did see a Black man with braids and a red shirt running away from the location of the shooting.

The defendant, Matthew Davis, became a suspect after police made an inquiry whether anyone wearing a global positioning system (GPS) device at the relevant time was in the vicinity of the shooting. Due to his probation on a Federal drug charge, the defendant was wearing a GPS ankle monitor called an "ExactuTrack 1" (ET1), manufactured by BI, Inc. (BI). Data from the defendant's GPS device showed he was at the location where the shooting took place very close in time to the shooting, and his speed matched the shooter's movements, according to surveillance footage and testimony from the civilian witness. After a jury trial, the defendant was convicted of armed assault with intent to murder, G. L. c. 265, § 18 (b), and related charges.

On appeal, we consider whether the GPS evidence was sufficiently reliable to be admitted. We conclude that the

judge abused his discretion in admitting the speed evidence, where the ET1's ability to measure speed had never been formally tested. Because this error was prejudicial, we reverse the defendant's convictions.

We also address the defendant's argument that the evidence was insufficient to support his convictions and hold that it was sufficient. Finally, we address other arguments the defendant raised on appeal that may recur at retrial, including whether maps of the GPS data violated the defendant's confrontation rights, whether a cell phone video recording (video) of surveillance footage was properly authenticated, and whether it was proper for the prosecutor to ask the jury to identify the defendant as the shooter based on footage that did not show the shooter's face.¹

Background. Because the defendant raises a sufficiency challenge, we recite the facts the jury could have found, in the light most favorable to the Commonwealth, reserving certain details for later discussion. See Commonwealth v. Latimore, 378 Mass. 671, 676-677 (1979).

On the morning of September 15, 2015, at the corner of Baker Avenue and Quincy Street in the Dorchester section of

¹ We acknowledge the amicus brief submitted by the New England Innocence Project and Charles Hamilton Houston Institute for Race & Justice.

Boston, a man fired multiple gunshots at a blue sedan.

Dispatchers received a 911 call reporting the shooting at 10:28 A.M. Responding police officers found an unoccupied blue sedan, with multiple bullet holes in the front window, crashed into a light pole. Several shell casings and bullet fragments were on the ground.

One of the responding officers, Sergeant Thomas Carty, canvassed the area for potential witnesses as well as any cameras that may have captured the shooting. He noticed a video camera affixed to a residential property on Baker Avenue. A resident of that address allowed Carty to view the surveillance video, but the resident did not know how to download it or copy it to another device. Carty instead used his cell phone to record a video of the surveillance video as it played on a computer screen.

The resulting video -- which is not very high resolution -- shows a Black man with long braids or dreadlocks in a red or pink shirt or sweatshirt wearing a gray hat or cap. The man runs towards an intersection raising his arm while holding a handgun. As the man holds up the gun, a blue sedan is driven into the frame from the opposite direction and then collides with a light pole at the corner of the intersection. After the crash, the driver gets out of the car and runs down the street. A little over a minute later, a man who appears to be the driver

returns to the car and gets into the driver's seat, before getting out of the car and again jogging away, across the street. The video is not high enough resolution and is taken from too far away to discern any features of the shooter's face.

At approximately 10:30 A.M. on the day of the shooting, a woman named Ilene Rock was standing on Bodwell Street near the corner of Columbia Road -- a couple of blocks away from the location of the shooting -- when she heard a noise that sounded like gunshots or a car backfiring. Shortly after hearing the noise, she saw a Black man with thin braids wearing a red shirt run past her with his hand in his pocket.² The man came within five or six feet of her, but she did not get a good look at his face because she was focused on his hands in his pocket. The man ran down Bodwell Street and turned right onto Columbia Road toward Quincy Street. Shortly thereafter, Rock heard sirens and saw police.

² Rock described the man she saw running as having "thin braids" and a "red shirt." Thus, when referring to her testimony, we use that terminology. The shooter's hair and dress are less clear from the video. Thus, when describing the shooter in the video, we describe his hair as "braids or dreadlocks" and his clothing as a "red or pink shirt or sweatshirt." The defendant asserts that he had dreadlocks, not braids, around the time of the shooting. The photograph of him taken the day after the shooting that was admitted in evidence appears to confirm this.

At a later date, police showed Rock a photographic array that contained an image of the defendant. Rock later testified that she "saw a few people that [she] thought looked similar [to the man she saw running], but [she] couldn't make a positive identification of him" because she "wasn't sure of the facial features enough to make a selection." On three of the eight photographs, she made the notations "maybe the person I saw," "This might be him 80%," and "This is possibly the man I saw running." None of those three photographs depicted the defendant.

As part of their investigation, police made an inquiry into whether anyone wearing a GPS device was in the area at the time of the shooting.³ The defendant, who was wearing a GPS ankle monitor as part of his probation on a Federal drug case, had been. The defendant's GPS device purported to show that at 10:25 A.M. on the day of the shooting, he had been on Columbia Road near Brunswick Street travelling northeast at twenty-two miles per hour. At 10:26 A.M., he was still travelling northeast on Columbia Road, now at thirty-two miles per hour. At 10:27 A.M., he was at the corner of Quincy Street and Baker Avenue -- the location of the shooting -- travelling at ten miles per hour. At 10:28, he was on the corner of Baker Avenue

³ The record does not describe with whom police made this inquiry.

and Bodwell Street travelling at eight miles per hour. At 10:29, he was on Columbia Road between Quincy and Bodwell travelling at eleven miles per hour. At 10:30, he was on Quincy Street travelling at twenty-two miles per hour. At 10:31, he was on Church Street travelling at fifteen miles per hour. At 10:32, he had stopped at his home.

Approximately a week after the shooting, officers executed a search warrant at the defendant's home. They found a red long-sleeved crew neck sweatshirt under a pile of clothes in the defendant's bedroom. The sweatshirt tested negative for gunshot primer residue.

After a jury trial in October 2017, the defendant was found guilty of armed assault with intent to murder, G. L. c. 265, § 18 (b), and multiple lesser charges.⁴ The defendant then filed a timely notice of appeal, and the Appeals Court affirmed his

⁴ In addition to armed assault with intent to murder (count one), the defendant was also found guilty of attempted assault and battery by means of discharging a firearm, G. L. c. 265, § 15F (count two); carrying a firearm without a license, G. L. c. 269, § 10 (a) (count three); possession of ammunition without a firearm identification card, G. L. c. 269, § 10 (h) (1) (count four); and carrying a loaded firearm without a license, G. L. c. 269, § 10 (n) (count five). On count three, the defendant had been indicted as an armed career criminal, G. L. c. 269, § 10G (b). After trial, he pleaded guilty to being an armed career criminal on that count. Count four was then dismissed at the request of the Commonwealth.

convictions. See Commonwealth v. Davis, 97 Mass. App. Ct. 633 (2020). We granted further appellate review.

Discussion. 1. Admission of expert testimony. Before the GPS evidence was introduced at trial, the judge conducted a voir dire of the Commonwealth's expert, James Buck, manager of product development at BI. Buck provided an overview of how GPS technology works in general, as well as described the ET1 model in particular. He stated that at any given time, there are twenty-four active satellites circling the globe. Signals from the satellites transmit to a receiver -- as in a GPS device -- and that data can be used to determine the device's speed and location. The more satellites from which a device is receiving signals at any given time, the more accurate the speed and location data will be.

GPS technology works slightly differently for speed from how it does for location. To triangulate a device's location, it must receive signals from a minimum of three satellites. To determine a device's speed and direction, on the other hand, it must receive signals from at least four satellites.⁵ With

⁵ This is because speed measurements are based on a different frequency and utilize the Doppler effect. In essence, the speed data is not based merely on doing algebra to calculate the average speed between two location points. Instead, the device uses a different frequency to take a reading every millisecond of a satellite's position in the sky, and then,

respect to the ET1 specifically, Buck testified that it records the wearer's location and speed once per minute and sends the data over a cellular network to BI's headquarters in Colorado.⁶ Buck stated that BI had conducted formal testing of the ET1's ability to measure location, but its ability to measure speed had never been formally tested.

a. Gatekeeper reliability. Before offering expert testimony such as Buck's, the proponent must establish a sufficient foundation for a judge to determine whether the expert's opinion satisfies gatekeeper reliability. See Commonwealth v. Patterson, 445 Mass. 626, 639 (2005), overruled on other grounds by Commonwealth v. Britt, 465 Mass. 87 (2013) ("Trial judges serve a gatekeeper function with respect to expert opinion testimony based on specialized knowledge"). See also Mass. G. Evid. §§ 104(a), 702 (2021). "If the process or theory underlying [an] . . . expert's opinion lacks reliability, that opinion should not reach the trier of fact." Patterson, supra, quoting Commonwealth v. Lanigan, 419 Mass. 15, 26 (1994).

based on that, uses the Doppler effect to determine the GPS device's velocity and direction.

⁶ Specifically, Buck testified that the device takes a sample every fifteen seconds, and then selects the best sample of the four to log. Although it is not entirely clear from the record, it appears the "best sample" is the one during which the device was communicating with the highest number of satellites.

Until 1994, we used the Frye test -- also called the general acceptance test -- to determine if proposed expert testimony was sufficiently reliable to reach the jury. Canavan's Case, 432 Mass. 304, 310 (2000). See Lanigan, 419 Mass. at 24; Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923). Under that test, "we required that in most circumstances 'the community of scientists involved [must] generally accept[] the theory or process' for it to be admitted in evidence" (citation omitted). Canavan's Case, supra. The test proved to be useful because "if there is general acceptance of a theory or process in the relevant scientific community, [it] is likely reliable." Id. "However, we recognized that 'strict adherence to the Frye test' could result in reliable evidence being kept from the finder of fact. For example, a new theory or process might be 'so logically reliable' that it should be admissible, even though its novelty prevents it from having attained general acceptance in the relevant scientific community." (Citations omitted.) Id. In short, situations could arise where our law of evidence lagged behind recognizing what was otherwise reliable science.

To account for this circumstance, in Lanigan, 419 Mass. at 26, we adopted in part the United States Supreme Court's reasoning in Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 593-594 (1993), which set forth five nonexclusive factors a

judge should consider in determining the reliability of proposed scientific evidence. The five nonexclusive factors are "whether the scientific theory or process (1) has been generally accepted in the relevant scientific community; (2) has been, or can be, subjected to testing; (3) has been subjected to peer review and publication; (4) has an unacceptably high known or potential rate of error; and (5) is governed by recognized standards." Commonwealth v. Powell, 450 Mass. 229, 238 (2007).

Although Daubert and Lanigan dealt specifically with scientific evidence, we have since recognized their application to scientific, technical, and other specialized knowledge. See Commonwealth v. Pytou Heang, 458 Mass. 827, 844 (2011). Further, the Daubert-Lanigan factors are nonexclusive, and we have recognized the potential need to consider other factors depending on the nature of the expert testimony. See, e.g., Commonwealth v. Hinds, 487 Mass. 212, 220-222 (2021) (discussing application of Daubert-Lanigan factors to social sciences); Canavan's Case, 432 Mass. at 314 n.5 ("Differing types of methodology may require judges to apply differing evaluative criteria to determine whether scientific methodology is reliable"). Using these nonexclusive factors to determine reliability is known as the Daubert-Lanigan test.

We have not, however, entirely abandoned the Frye test. In Lanigan, 419 Mass. at 26, we noted that in many cases general

acceptance will "be the significant, and often the only, issue." Lanigan's progeny make clear that reliability can still be established by general acceptance alone, without regard to the other Daubert-Lanigan factors. See Patterson, 445 Mass. at 640-641 (citing cases).

If a theory or methodology has been established as reliable in our courts using one of these two standards in the past, then a judge may take judicial notice of its reliability. See Daubert, 509 U.S. at 592 n.11 ("theories that are so firmly established as to have attained the status of scientific law, such as the laws of thermodynamics, properly are subject to judicial notice"). See also Mass. G. Evid. § 201.

In contrast, when proposed expert testimony uses a new theory, or new methodology to apply an accepted theory, the proponent must establish its reliability using a Daubert-Lanigan analysis. See Patterson, 445 Mass. at 648-649. For example, in Patterson, the Commonwealth sought to introduce fingerprint evidence. Id. at 627. We held that the judge acted well within her discretion in finding that using the theory underlying fingerprint analysis was generally accepted. Id. at 641. However, we also held that the judge erred by failing to conduct a Daubert-Lanigan analysis to determine whether a new technique based on that accepted theory was reliable. Id. at 648-649. Similarly, in Commonwealth v. Camblin, 471 Mass. 639, 645 (2015)

(Camblin I), S.C., 478 Mass. 469 (2017) (Camblin II), we held that the judge erred by failing to conduct a Daubert-Lanigan analysis to determine the reliability of a new generation of breathalyzer devices, which used different techniques from those previously found reliable by our courts.

Under both Daubert-Lanigan and Frye, we review a judge's decision to admit expert testimony as satisfying gatekeeper reliability under the abuse of discretion standard. See Canavan's Case, 432 Mass. at 312. "While our review under this standard is deferential and limited, it is not perfunctory. A judge's findings must apply the correct legal standard to the facts of the case and must be supported by an examination of the record." Patterson, 445 Mass. at 639.⁷

⁷ The defendant also cites to cases that pertain not to the Daubert-Lanigan reliability standard, but to the necessity of a foundational showing of accuracy. See Commonwealth v. Torres, 453 Mass. 722, 737 (2009); Commonwealth v. Whyngaught, 377 Mass. 14, 17 (1979); Commonwealth v. Podgurski, 81 Mass. App. Ct. 175, 185 (2012). Usually the line between a preliminary question of fact upon which admissibility depends, such as gatekeeper reliability, see Mass G. Evid. §§ 104(a), 702, and conditional relevance, see Mass G. Evid. § 104(b), is clear. See P.C. Giannelli, Understanding Evidence § 7.03 (5th ed. 2018) (discussing conditional relevancy). Yet when the proposed evidence is the product of a technical device, such as it is in this case, the line between these evidentiary principles can blur. "Radar evidence illustrates this point. The reliability of evidence based on radar depends on (1) the validity of the underlying theory (e.g., the Doppler effect), (2) the validity of the technique applying that theory (e.g., the particular model of radar), and (3) the proper application of the technique on a particular occasion (e.g., use of tuning forks to calibrate

With this framework in mind, we turn to the GPS evidence of speed and location admitted in this case.

b. Speed. As will become clear, the Commonwealth failed to lay the proper foundation to admit the ET1's speed measurements under either the Daubert-Lanigan or the Frye test. See generally Mass. G. Evid. §§ 104(a), 702. Thus, the judge erred by admitting the speed evidence without the proper foundation.

The defendant does not dispute the reliability of GPS technology over-all, nor do we. The defendant's objection is to the reliability of the ET1 model specifically. Nevertheless, we briefly discuss the reliability of GPS theory and methodology to give context to the issues raised.

First, it is clear from both the record and our case law that GPS technology is generally accepted as reliable. The judge found that GPS evidence has "been accepted in the field for a substantial number of years by virtually most populations

the instrument)." Id. at § 24.04 endnote 39. In that scenario, the first two elements would be subject to gatekeeper reliability under Daubert-Lanigan or Frye. The third element, in contrast, would in most instances be a matter of conditional relevance. By inquiring into the third element, the judge would ask not whether the device was reliable, but rather whether a reasonable jury could find by a preponderance of the evidence that it was functioning properly at the time it was used. In essence, the relevance of a measuring device is conditioned on whether a jury could find that it was functioning properly. See Mass. G. Evid. § 104(b).

in the world." In describing the history of GPS technology, Buck testified that, as early as 1957, researchers at Johns Hopkins University theorized that satellites could be used to triangulate location. Our case law confirms that GPS technology is "widely used and acknowledged as a reliable relator of time and location data." Commonwealth v. Thissell, 457 Mass. 191, 198 (2010) (Thissell II).

Second, because GPS technology uses a different methodology to measure speed from how it does location, that methodology, too, would need to satisfy gatekeeper reliability. See Mass. G. Evid. §§ 104(a), 702. See, e.g., Patterson, 445 Mass. at 628 (new methodology based on accepted underlying theory must pass gatekeeper reliability). Had the defendant objected to the reliability of the method used by GPS technology, in general, to measure speed, we expect that the Commonwealth would have been able to demonstrate that the use of GPS to measure speed is generally accepted or meets the requirements of Daubert-Lanigan.

The defendant's objection at trial and his argument on appeal pertain to the reliability of the ET1 device specifically. He argues that the ET1 does not meet the requirements of Daubert-Lanigan. Chief among the defendant's concerns is the fact that the ET1's ability to measure speed has

never been formally tested.⁸ Given the complete lack of formal testing of the ET1 model for speed, there is also no known error rate. Moreover, the defendant asserts that because the ET1 is proprietary, it is impossible to say whether the methodology it employs is generally accepted. The proprietary nature also means it has not been subject to peer review.⁹ Finally, its accuracy is not governed by any recognized standards.

We agree with the defendant that if a new model of a device is objected to on reliability grounds, it must pass gatekeeper reliability under either Daubert-Lanigan or Frye. It is not sufficient to show merely that GPS technology is, in general, reliable without making any showing pertaining to the reliability of a particular model of a device. The Commonwealth could meet that burden by showing that the new model itself satisfies the Daubert-Lanigan factors -- for example, that it

⁸ Buck testified that BI had not done any formal testing to ensure that speed data was accurate. Moreover, he had not "figured out and formulated a way to successfully [test speed] reliably and repeatedly."

BI's informal testing consisted of having ten employees at any given time wear its devices and report back if there were any "speed irregularities." But BI only conducts a "general review of the [data] points"; BI has not compared the ET1 speed data to any independent measurements of speed.

⁹ Buck testified that there is "one person in the industry" who tests and compares different GPS devices, but the results of his testing are not made available to any of the companies in question, including BI.

has been tested or peer reviewed. That is not the only way, however, to show that a new model is reliable. For example, if an older model has previously been found reliable, the proponent need only show that the new model applies the same methodology as that prior one.¹⁰ Given that devices generally tend to improve, that will generally be sufficient to show that the new device, too, is reliable. Here, the Commonwealth made neither showing. It only showed that the GPS technology is a reliable theory. For the speed data, it has not shown that the ET1 itself -- either through testing or through its similarity to a generally accepted device -- reliably applies that accepted theory. Thus, the judge abused his discretion in admitting the ET1 speed evidence.¹¹

Because on retrial the Commonwealth may again attempt to lay the proper foundation for the speed evidence, we comment on the remainder of the analysis. If the Commonwealth attempts to show that a new model of a device is reliable by asserting that it is similar to a prior model, the defendant may object and

¹⁰ This showing must be based on facts and data, not a conclusory statement that the devices are the same.

¹¹ In addition, because speed had never been tested, Buck did not have any margin of error within which the speed data was accurate. This could lead the jury to overvalue its accuracy. For the location data, in contrast, Buck did not say that the ET1 could pinpoint one's exact location; he said that it was accurate within a certain number of feet.

move for a Daubert-Lanigan hearing on the new device. This is essentially what occurred in Camblin I, 471 Mass. at 642. There, the Commonwealth sought to introduce evidence from a particular model of breathalyzer (Alcotest) that had not previously been reviewed by our courts. Id. at 640. The defendant moved for discovery of the device's computer source code, and that request was granted pursuant to a nondisclosure agreement. Id. at 642. The defendant retained experts to examine the source code. Id. The defendant then filed affidavits and reports contending that the source code contained thousands of errors and argued that the Alcotest used methods different from previous machines that had been reviewed by our courts. Id. at 644. On appeal, we held that because neither statute nor existing case law offered guidance about the reliability of the Alcotest's methodology, the judge should have held a Daubert-Lanigan hearing. Id. at 650.¹² We remanded the

¹² This is but one example of how a defendant may assert that a new model of device uses a different methodology from previous models. We leave for another day how much a defendant needs to show to assert a device uses a new methodology in order to raise the issue. At a minimum, however, "a defendant must file an appropriate pretrial motion stating the grounds for the objections and request a hearing." Commonwealth v. Sparks, 433 Mass. 654, 659 (2001).

Further, we note that while in many scenarios it may be sufficient for the Commonwealth to show that a device applies the same methodology as prior versions, courts are not required to admit evidence from a device merely because such evidence has

case for that hearing, and then, in Camblin II, 478 Mass. at 469-470, held that the judge did not abuse his discretion in finding that the Alcotest satisfied the Daubert-Lanigan standard.¹³

c. Location. Next, the defendant objects to the admission of the ET1's location data. We hold that the judge did not abuse his discretion in admitting the location data.

previously been admitted. See Commonwealth v. Shanley, 455 Mass. 752, 763 n.15 (2010) ("we have not 'grandfathered' any particular theories or methods for all time"). We similarly leave for another day how much a defendant needs to show to call into question the reliability of a generally accepted device. See, e.g., Commonwealth v. Neal, 392 Mass. 1, 17-18 (1984) (rejecting defendant's argument that generally accepted model of breathalyzer was unreliable in light of recent discovery of its susceptibility to radio frequency interference).

¹³ Given that the issue could also arise on retrial, we briefly comment on the difference between gatekeeper reliability and conditional relevance in this scenario. If the defendant objects -- as he did here -- to the reliability of the ET1 model as a whole, then the Commonwealth bears the burden of showing that the ET1 passes gatekeeper reliability. See Mass. G. Evid. §§ 104(a), 702. See, e.g., Camblin I, 471 Mass. at 640 (reliability of Alcotest device). On the other hand, if the defendant objects to whether the specific ET1 device worn by the defendant on September 15, 2015, was functioning properly, then the issue is likely a matter of conditional relevance, for which the Commonwealth also bears the burden of laying the proper foundation. See Mass G. Evid. § 104(b). See, e.g., Commonwealth v. Torres, 453 Mass. 722, 737 (2009) (whether measuring device was calibrated); Commonwealth v. Neal, 392 Mass. 1, 19 (1984) (whether particular breathalyzer unit was accurate at time test was performed); Commonwealth v. Whynaught, 377 Mass. 14, 17 (1979) (whether individual radar speedometer was calibrated); Commonwealth v. Podgurski, 81 Mass. App. Ct. 175, 185-186 (2012) (whether individual scale was calibrated).

Unlike the speed data, the ET1's location data had been formally tested. During voir dire, Buck described in detail the circular error of probability test BI had used to ensure the ET1's location data was accurate. The test -- which was conducted at BI's headquarters in the suburbs of Boulder, Colorado -- involved leaving the device in a stationary position for six hours, and then recording the location data provided from the satellites and plotting it on a scatter graph. Buck described the area as an industrial park, with no buildings over about three stories tall. He stated that the test showed that ninety-eight percent of the ET1's location points are within sixteen feet of the expected circle, and fifty percent are within three feet.

Against this conclusion, the defendant argues that the testing was not sufficient because it occurred in prime conditions that did not simulate real-world accuracy, especially in an urban environment. Buck stated that the accuracy of a GPS device can be affected by tall buildings, which can block the signal between the satellite and the device.¹⁴ At trial, Buck

¹⁴ Specifically, Buck testified that the satellite signal can be blocked by tall buildings, which have a "multipath effect." Buck testified, "In other words, it's bouncing off of a building to get to the actual receiver which then delays your time of arrival which then increases the likelihood that you're going to have an error in [location data]."

stated that the device is tested on the rooftop in Colorado to get a "baseline" accuracy so that it can be compared to prior or future models. Buck also acknowledged that the ET1 had never been tested in Boston or in any other urban environment. That is why, he said, in the device manual BI tends to err on the side of caution in reporting the radius within which a GPS device can determine someone's location. In this case, the manual indicated that the device was accurate to plus or minus ninety feet.¹⁵ That gives a far wider margin of error than the Colorado test, which determined that ninety-eight percent of the time the location points are accurate within sixteen feet. At trial, when asked about the accuracy of each data point individually, Buck testified that they were within a margin of error of between forty feet and one-half the size of the court room.¹⁶

The judge did not abuse his discretion in ruling that the defendant's objection went to the weight of the evidence, not its admissibility. Buck acknowledged that the ET1 was likely less accurate in an urban environment than in Colorado, where

¹⁵ It is unclear from the record whether this manual corresponded to the ET1 itself, or to a prior BI GPS model. Buck stated that the manual was from 2008 or 2009.

¹⁶ The differing degrees of accuracy for each data point depended on how many satellites the GPS device was communicating with at any given time. Buck went through each minute of the defendant's GPS data and posited its accuracy.

the baseline test occurred. Consequently, Buck did not allege that BI's location points in an urban area would be within the same three- to sixteen-foot radius in which they had been in its baseline test in Colorado. His testimony shows, however, that the Colorado test is still helpful as a baseline. Unlike for speed, where there was no test of any kind to show that the ET1's speed data reliably applied an accepted methodology, for location data the Colorado test was sufficient to show that the ET1's location data did reliably apply an accepted methodology. Thus, the location data met the requirements of gatekeeper reliability, and the judge did not abuse his discretion in admitting it.

d. Prejudicial error. Because the objection to the speed GPS data on Daubert-Lanigan grounds was preserved at trial, we review for prejudicial error. "[T]he Commonwealth must show that any error 'did not influence the jury, or had but very slight effect.'" Commonwealth v. Dargon, 457 Mass. 387, 399 (2010), quoting Commonwealth v. Flebotte, 417 Mass. 348, 353 (1994). To this end, the Commonwealth argues that the speed data was not prejudicial because the other evidence was compelling and, to some extent, the speed data was "irrelevant" because the location data was itself incriminating. We disagree.

In the Commonwealth's closing argument, the prosecutor made more than ten explicit references to speed. When describing the GPS evidence, the prosecutor stated that when looking "not only [at] the locations, but also the speed, a bigger story will come up for this particular case." The prosecutor used the speed data to match the defendant's movements to those of both the shooter in the video as well as the man Rock saw running. The prosecutor stated that at the first two data points -- 10:25 A.M. and 10:26 A.M. -- the defendant's speed was twenty-two and thirty-two miles per hour, showing he was likely in a car travelling down Columbia Road. At 10:27 A.M. and 10:28 A.M., the defendant's speed slowed down to what was likely the speed of someone running. This, the prosecutor said, was consistent with the shooter in the video running at the time of the shooting and immediately after. Further, the speed was consistent with Rock's testimony of seeing a man in a red shirt running down the street with his hands in his pockets -- presumably fleeing the shooting. After that, the defendant's speed increases again, showing that he is likely back in a car.

The defendant's speed was not merely duplicative of his location. It was crucial evidence used to correlate the defendant's movements to those of the shooter in the video and to the man Rock saw running. Without the speed, a jury would have only been able to infer that the defendant was in the area

where the shooting took place. With the speed, however, the jury could match the defendant's movements to those of the shooter in the video and the man Rock saw, thereby presenting a compelling narrative that the defendant was the shooter. Thus, we cannot say that it "did not influence the jury, or had but very slight effect." Dargon, 457 Mass. at 399, quoting Flebotte, 417 Mass. at 353. We hold that admitting the speed data was prejudicial error and the defendant's convictions must be reversed.

2. Sufficiency of the evidence. The defendant moved for a required finding of not guilty at the close of the Commonwealth's case, arguing the evidence was insufficient to support a conviction. The motion was denied. He reaffirms this argument on appeal, asserting that the admitted evidence is insufficient to prove his identity as the shooter where the Commonwealth's case is circumstantial and relies on "piling inference upon inference" (quotation and citation omitted). Commonwealth v. Ashford, 486 Mass. 450, 455 (2020). We disagree.

In assessing the sufficiency of the evidence, we consider "whether, after viewing the evidence in the light most favorable to the prosecution, any rational trier of fact could have found the essential elements of the crime beyond a reasonable doubt." Latimore, 378 Mass. at 677, quoting Jackson v. Virginia, 443

U.S. 307, 319 (1979). "Circumstantial evidence is sufficient to find someone guilty beyond a reasonable doubt and inferences drawn from such circumstantial evidence 'need only be reasonable and possible; it need not be necessary or inescapable.'"

Commonwealth v. Grandison, 433 Mass. 135, 141 (2001), quoting Commonwealth v. Lodge, 431 Mass. 461, 465 (2000). "A conviction may not, however, be based on conjecture or on inference piled upon inference." Commonwealth v. Jones, 477 Mass. 307, 316 (2017).

"If the evidence at trial was legally insufficient to sustain a verdict, a new trial would violate the prohibition against double jeopardy and would therefore be impermissible." Commonwealth v. Bacigalupo, 455 Mass. 485, 489 (2009).

"Ordinarily, in determining the sufficiency of the evidence, we include evidence improperly admitted." Id. at 490. Thus, we do not exclude the improperly admitted speed evidence from our analysis and do not comment on whether the admitted evidence minus the speed data would have been sufficient to support a conviction. See id.

The Commonwealth primarily relied on three pieces of evidence to establish the defendant's guilt: the GPS data, the video, and Rock's testimony. We analyze each in turn.

First, the GPS evidence established both the defendant's speed and his location. It showed that he was at the

intersection where the shooting took place at 10:27 A.M. on the day of the shooting.¹⁷ The 911 call reporting the shooting was made approximately one minute later, at 10:28:24 A.M. It is true that "mere presence at the scene of a crime, without more, is not sufficient to support a conviction." Commonwealth v. Mazza, 399 Mass. 395, 399 (1987). Yet the GPS established not only his location, but also his speed. As discussed supra, the speed evidence helped to establish his identity as the shooter

¹⁷ The defendant argues that the Commonwealth failed to show the precise time the shooting took place, and given the importance of the purportedly precise GPS data, such evidence was necessary to establish the defendant's guilt. The defendant argues that if the shooting occurred at 10:27 A.M. -- when the defendant was at the intersection where the shooting took place -- then his location would have been incriminating, but at any other moment his location would have been exonerating.

At trial, the defendant compared the 911 call to the video, arguing that one could infer that the shooting took place at 10:28:07 A.M., when the defendant was a block away. This argument was premised on the theory that a man on his cell phone appearing approximately one minute and thirty seconds into the video was the 911 caller, and that when the 911 caller asked someone "are you all right?" that was him speaking to the victim, who had briefly returned to the car. While that was a cogent argument, the jury were not required to accept it. Whether the man on his cell phone in the video was the 911 caller is unclear. Moreover, one of the responding officers testified that she "believe[d] there was more than one call that morning." Thus, even if the man on his cell phone in the video was in fact calling 911, that does not necessarily mean he is the same caller whose call was played for the jury.

by matching his movements to those of both the shooter as well as the man Rock saw in a red shirt shortly after the shooting.¹⁸

Next, the video of the shooting showed that the gunman appeared to be a Black man with long braids or dreadlocks and a long-sleeved red or pink shirt or sweatshirt. As the prosecutor argued in closing, the video was evidence that on the corner of Quincy Street and Baker Avenue, the shooter fired several shots at a moving car. Thus, the video was probative of both the shooter's actions and his intent to kill. As discussed infra, however, because the shooter's features were not clear from the video, it cannot alone give rise to an inference that the defendant was this shooter.

Finally, Rock testified that she heard what could have been gunshots, and then saw a Black man with thin braids and a red shirt with his hands in his pocket run down Bodwell Street toward Columbia Road and turn right onto Columbia Road.¹⁹ The

¹⁸ The defendant disputes the Commonwealth's proposed inference from the speed data that the defendant was travelling in a car, then got out and started running, and then reentered the car minutes later. Absent the video or Rock's testimony, the speed data might not be probative of guilt. Yet combined with that evidence, the speed data was probative of the defendant's identity as the shooter.

¹⁹ Rock described the runner as having "thin braids" and did not describe him as having a beard. The defendant points out that he had dreadlocks, not braids, as depicted in the photograph taken the day after the shooting. Further, he had a light beard at the time.

runner's path matched the defendant's GPS device's tracked movements. The fact that Rock failed to identify the defendant in a photographic array is fodder for cross-examination, but given that Rock admitted that she did not get a good look at the runner's face because she was focused on his hands, it does not, in the light most favorable to the Commonwealth -- and when combined with the other evidence showing the defendant's speed and location -- preclude the inference that the defendant was the man she saw running.

We conclude that while the evidence at trial was not by any means overwhelming, it was sufficient to sustain the defendant's convictions. See Jones, 477 Mass. at 318. Evidence of the GPS speed and location data, the video, and Rock's observations permit the reasonable inference that the defendant was the shooter.

3. Other issues. We turn now to other issues raised on appeal that may recur upon retrial.

a. Maps depicting GPS evidence. The defendant argues that admitting maps depicting his location information violated his confrontation rights under the Sixth Amendment to the United States Constitution and art. 12 of the Massachusetts Declaration of Rights because no one from the third-party company that generated the maps testified at trial. Additionally, the defendant argues admission of the maps violated the rule against

hearsay. Because this issue was not raised at trial, we review for a substantial risk of a miscarriage of justice. See Commonwealth v. AdonSoto, 475 Mass. 497, 504 (2016). We conclude it does not create such a risk.

At trial, the Commonwealth introduced maps showing the defendant's latitude and longitude points reported from the ET1 from 10:25 A.M. to 10:32 A.M. Buck testified that the maps were created by BI collecting the latitudes and longitudes of GPS points over time and sending them to a third-party mapping company. The mapping company would then produce a map encompassing all the points.²⁰ Finally, BI would plot the points onto the map. Although the record is not entirely clear how the points are plotted on the map, it appears they are generated by a computer.²¹

²⁰ Specifically, Buck stated at voir dire: "What we do is if you're looking to provide a map we can do it for [twenty-four] hours, or [fifteen] minutes, whatever you want. What we do is we take the specifics of the request, we gather those latitude[s] [and] longitudes, we send them off to a mapping company, such as Google, and then they render back the maps that would be containing those latitude[s] [and] longitude[s] and then we take and we put dots on the map representing the latitude[s] [and] longitude[s] for display"

²¹ At voir dire in response to a question asking how BI ensures the points on the maps are accurate, Buck testified: "Because nobody can get to them, nobody can do anything with them. When they get into the SQL database they're encrypted so that nobody can actually change the data within the database."

"Hearsay requires a 'statement,' i.e., 'an oral or written assertion or . . . nonverbal conduct of a person, if it is intended by the party as an assertion.'" Commonwealth v. Thissell, 74 Mass. App. Ct. 773, 776-777 (2009), S.C., Thissell II, 457 Mass. 191, quoting Commonwealth v. Whitlock, 74 Mass. App. Ct. 320, 326 (2009). See Mass. G. Evid. § 801(a). Whether a computer record contains a statement depends on whether the record is "computer-generated," "computer-stored," or a hybrid of both. Thissell II, supra at 197 n.13. Computer-generated records are created solely by the mechanical operation of a computer and do not require human participation. Commonwealth v. Royal, 89 Mass. App. Ct. 168, 171-172 (2016). For this reason, they cannot be hearsay.

With the exception of the defendant's name, all of the information included in the maps was computer-generated. The latitude, longitude, and speed points in the text boxes were generated by the GPS technology. The maps themselves were rendered by a computer at the third-party mapping company. And the dots on the map were rendered by BI's computer system. Thus, because the maps -- with the exception of the defendant's name -- were computer generated, they do not contain a statement and are not hearsay. Further, because the maps were not hearsay, they did not violate the confrontation clause. See

Pytou Heang, 458 Mass. at 854, citing Commonwealth v. Hurley, 455 Mass. 53, 65 n.12 (2009).

b. Authentication of the surveillance video. The Commonwealth introduced a cell phone video of surveillance video that allegedly depicted the shooting. The defendant objected at trial, arguing that the underlying surveillance video had not been authenticated. He renews this argument on appeal.²² Because defense counsel preserved this argument at trial, we review "to determine whether the judge abused [his] discretion and, if so, whether the error resulted in prejudice to the defendant." Commonwealth v. Connolly, 91 Mass. App. Ct. 580, 586 n.6 (2017). We hold that the judge did not abuse his discretion in admitting the surveillance video.

"To satisfy the requirement of authenticating or identifying an item of evidence, the proponent must produce evidence sufficient to support a finding that the item is what the proponent claims it is." Mass. G. Evid. § 901(a). See Mass. G. Evid. § 104(b). See also Commonwealth v. Purdy, 459 Mass. 442, 448-449 (2011). Authenticating a surveillance video is "typically . . . done through one of two means -- having an eyewitness testify that the video is a fair and accurate

²² The defendant does not argue that Carty's cell phone video was not authenticated. His argument both at trial and on appeal pertains to the underlying surveillance video.

representation of what he saw on the day in question, or having someone testify about the surveillance procedures and the methods used to store and reproduce the video material."

Connolly, 91 Mass. App. Ct. at 586.

These are not, however, the exclusive ways a video can be authenticated. In addition, "[e]vidence may be authenticated by circumstantial evidence alone, including its '[a]pppearance, contents, substance, internal patterns, or other distinctive characteristics.'" Commonwealth v. Siny Van Tran, 460 Mass. 535, 546 (2011), quoting Mass. G. Evid. § 901(b)(4). See Purdy, 459 Mass. at 448-449 ("A judge making a determination concerning the authenticity of a communication sought to be introduced in evidence may look to 'confirming circumstances' that would allow a reasonable jury to conclude that this evidence is what its proponent claims it to be"); Commonwealth v. Nardi, 452 Mass. 379, 396 (2008), quoting Commonwealth v. LaCorte, 373 Mass. 700, 704 (1977) (proof of authenticity may take form of testimony "that circumstances exist which imply that the thing is what its proponent represents it to be").

The defendant relies on Connolly, 91 Mass. App. Ct. at 586-588, for the proposition that where secondary evidence is introduced regarding the contents of a video, the underlying video must also be authenticated. This is true. "Of course, had the video been available at trial, the Commonwealth would

have had to authenticate it before it could be admitted." Id. at 586. A proponent is not exempt from our rules of authentication if he or she introduces a video of a video, instead of introducing the underlying video itself.

Here, however, the underlying video was authenticated through plentiful circumstantial evidence indicating a jury could find that it was what it purported to be. Carty testified that he saw a car, with its driver's side door open, that had crashed into a pole at the intersection of Quincy Street and Baker Avenue. Across the street from where the car was crashed, Carty found seven shell casings and several bullet fragments. In addition, Carty said multiple still photographs were fair and accurate representations of the scene of the shooting and the crash. Among these photographs were multiple of a blue sedan -- the same color and body style as that of the car in the cell phone video of the surveillance video -- that had crashed into a light pole bearing signs designating Quincy Street and Baker Avenue. At least one of the photographs depicted a sign in front of the crashed car; the sign advertised a church and was black and white with red lettering. In the cell phone video, the same sign is visible in front of the car.

In addition, Carty viewed the surveillance video in the immediate aftermath of the shooting after he personally approached the resident to whom the surveillance system

belonged. That mitigates concerns that the video could have been manipulated. Compare Connolly, 91 Mass. App. Ct. at 588 (fact that officer did not obtain surveillance video until month after incident and did not testify about circumstances that led him to view video raised concern that video could have been manipulated). Finally, Rock's testimony that she heard a sound like a car backfiring or gunshots, and then saw a Black man with braids, wearing a red shirt, and with his hands in his pockets, provides further circumstantial evidence to authenticate the video. Thus, the circumstantial evidence was sufficient to enable a reasonable jury to find that the video was what it purported to be. The judge did not abuse his discretion in admitting it.²³

c. Commonwealth's argument that jurors could identify the defendant from a video. Finally, the defendant argues that it was improper for the Commonwealth to urge the jury to identify

²³ The defendant argues that the video's time stamp raises questions about its authenticity. For most of the cell phone video of the surveillance video, the time stamp in the upper-right corner is not visible. However, sixteen seconds into the cell phone video, the surveillance video time stamp appears to show "9/15/2015 11:33." The defendant argues that even if we assume that the time stamp is off by an hour, 10:33 A.M. would not match up with the supposed time of the shooting, according to the defendant's GPS data points. It is true that an accurate and more visible time stamp could have helped to authenticate the video. See Connolly, 91 Mass. App. Ct. at 588. Yet, given the substantial other circumstantial evidence, a time stamp was not necessary to authenticate the video.

him as the shooter based on grainy video of someone who only matched his generic description. This issue is unpreserved, and thus we review for a substantial risk of a miscarriage of justice. See AdonSoto, 475 Mass. at 504.

In the Commonwealth's opening, the prosecutor twice urged the jury to identify the defendant based on the video. The prosecutor stated, "You are going to be able to see who the person is on that video and you are going to be able to compare it to the person sitting in [the defendant's] chair. I submit to you . . . , you will be able to tell that it's Mr. Davis."²⁴ In closing, the prosecutor did not explicitly suggest that the jury could identify the defendant based on the video. He only stated that the video, in conjunction with the other evidence, showed that the defendant had committed the crimes.²⁵

²⁴ Later, the prosecutor stated, "You are going to see the video There was someone that looks incredibly similar to Mr. Davis raising his hand letting off seven rounds at a car"

²⁵ For example, the prosecutor stated, "[T]here are numerous pieces of evidence which will allow you to find beyond a reasonable doubt that Mr. Davis is the person depicted in that video."

The closest the prosecutor came in the closing to asking the jury to identify the defendant based on the video was commenting that the defendant "[h]appens to look like the shooter." We discern no error with this statement because unlike the opening, the prosecutor did not state that the jury could identify the defendant based on the video alone. Instead, he merely stated that the defendant's appearance was consistent with the shooter's.

The defendant and amici liken the prosecutor's comments to a single-suspect showup identification without any of the procedural protections required for such an identification. See Commonwealth v. German, 483 Mass. 553, 563 (2019), quoting Supreme Judicial Court Study Group on Eyewitness Evidence: Report and Recommendations to the Justices 92 (July 25, 2013) ("most significant of pre-identification warnings is that 'the offender may or may not be in the photo array or lineup, or the person being shown in a showup'"); Commonwealth v. Forte, 469 Mass. 469, 477 (2014) ("An identification stemming from a videotape containing only one individual is analogous to a one-on-one identification, which is considered inherently suggestive"). Further, the defendant and amici argue that the general characteristics of being a Black man with long braids or dreadlocks are not enough to support reasonable suspicion, let alone the inference that one could identify the defendant based on the video. See Commonwealth v. Warren, 475 Mass. 530, 535-536 (2016) (general description of three Black males, two with dark clothing and one with red "hoodie" not sufficient for reasonable suspicion); Commonwealth v. Cheek, 413 Mass. 492, 496 (1992) (description of "black male with a black 3/4 length goose [jacket]" not enough for reasonable suspicion because it "could have fit a large number of men who reside in . . . a predominately black neighborhood of the city"). Moreover, amici

argue that the characterization of a Black man with braids is a prime trigger for implicit bias, due to stereotypical associations about criminality based on this description.

"The proper function of an opening is to outline in a general way the nature of the case which the counsel expects to be able to prove or support by evidence" (citation omitted). Commonwealth v. Sylvia, 456 Mass. 182, 188 (2010). "The prosecutor's expectation must be 'reasonable and grounded in good faith.'" Id., quoting Commonwealth v. Fazio, 375 Mass. 451, 456 (1978). "Absent a showing of bad faith or prejudice . . . the fact that certain evidence fails to materialize is not a ground for reversal" (citation omitted). Id. "[A] claim of improper [opening statement] by the prosecutor must be judged in light of the entire [statement], the judge's instructions to the jury, and the evidence actually introduced at trial" (citation omitted). Commonwealth v. Barbosa, 477 Mass. 658, 669 (2017).

We agree with the defendant that the Commonwealth's suggestions that the jury could identify the defendant based on the video were unreasonable. The video is not high enough resolution and is taken from too far away to be able to discern any features of the shooter's face. Cf. Commonwealth v. Vasquez, 482 Mass. 850, 861 (2019) (eyewitness unfamiliar with suspect would likely be unable to make identification based on poor quality video). All one can see is that the shooter is a

Black man with long hair in braids or dreadlocks that extend down to his midback.²⁶ As amici point out, braided hairstyles are not uncommon among Black people. Given the shooter's common hairstyle and the inability to see any of his facial features, it was unreasonable for the Commonwealth to ask the jury to identify the defendant as the shooter in the video. See Sylvia, 456 Mass. at 188 (prosecutor's statements in opening must be based on reasonable expectation of what evidence will show). Because we reverse the defendant's convictions on other grounds, we need not determine whether these improper statements gave rise to a substantial risk of a miscarriage of justice.

Conclusion. The judgments against the defendant are reversed, the verdicts are set aside, and the case is remanded to the Superior Court for a new trial and further proceedings consistent with this opinion.

So ordered.

²⁶ At trial, to show what the defendant looked like around the time of the shooting, the Commonwealth introduced a photograph of him taken the following day. The photograph depicts the defendant's face and shows that his hair is in what appear to be thin dreadlocks. However, because the dreadlocks extend behind the defendant's shoulders, a viewer can only tell that they are longer than shoulder length and not whether they are as long as the shooter's, which extend to about midback. Even if the length of the defendant's hair was similar to that of the perpetrator in the video, such evidence still would have fallen short of evidence from which the jury could have identified the defendant as the perpetrator depicted in the video.