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STATE OF CONNECTICUT *v.* THOMAS STEELE
(AC 37956)

Alvord, Sheldon and Norcott, Js.

Syllabus

Convicted of the crimes of robbery in the first degree, conspiracy to commit robbery in the first degree and conspiracy to commit larceny in the third degree in connection with his conduct in robbing a bank, the defendant appealed to this court. He challenged the sufficiency of the evidence to support his robbery conviction and also claimed, *inter alia*, that the trial court improperly admitted lay testimony from a detective, D, concerning historic cell site analysis, a certain process that utilizes cell phone records and cell site locations to identify the location of cell phones at a particular time. Specifically, he claimed that the court should have qualified D as an expert witness before permitting him to testify about how he used the defendant's cell phone records to determine his whereabouts before, during and after the bank robbery. *Held:*

1. There was sufficient evidence presented at trial to support the defendant's conviction of robbery in the first degree as a principal: the jury reasonably could have credited the testimony of M, the defendant's friend, that the defendant had told M that he robbed a bank but discredited M's testimony that she understood him to be joking, and the state presented a variety of direct and circumstantial evidence that created a connection between the physical attributes and possessions of the robber and the defendant, including, *inter alia*, surveillance footage of the robbery, eyewitness testimony describing what the robber was wearing, which matched other surveillance footage that depicted the defendant wearing similar clothing, and evidence of the defendant's purchase of a BB gun like the one used in the robbery; moreover, although the evidence was not inconsistent with the defendant being the getaway driver instead of the robber, a reasonable view of the evidence supported a finding that the defendant acted as a principal during the robbery, which was the only theory of liability the state pursued at trial and on which the court instructed the jury.
2. The trial court abused its discretion by not requiring D to be qualified as an expert witness before allowing him to testify regarding historic cell site analysis: although that analysis is not extremely difficult to understand, the analytical process involved therein is beyond the ken of the average juror, as call detail records can be used to determine the approximate location of a cell phone at the time of a particular communication by determining the geographical coverage area of the cell sector used to facilitate that communication, and that process of determining the coverage area requires scientific and technical knowledge, which would require a trial court, prior to admitting such testimony, to conduct a hearing to ensure that the testimony was based on a reliable scientific methodology, and contrary to the state's claim, D did not merely read from a document that was already in evidence, he explained how cell phones and cell sites operate and, thus, broached the realm of expert testimony; nevertheless, the admission of D's testimony was harmless beyond a reasonable doubt, as the state presented substantial evidence of the defendant's involvement in the bank robbery, including his admission to M that he robbed a bank, and D's testimony was largely cumulative of other direct and circumstantial evidence establishing the defendant's locations before, during and after the robbery.
3. The defendant's conviction of and sentences on the charges of conspiracy to commit robbery and conspiracy to commit larceny, having arisen out of a single agreement to rob the bank, violated his right against double jeopardy; accordingly, his conviction of both conspiracy charges could not stand.

Argued April 18—officially released August 29, 2017

Procedural History

Substitute information charging the defendant with

of the crimes of robbery in the first degree, conspiracy to commit robbery in the first degree and conspiracy to commit larceny in the third degree, brought to the Superior Court in the judicial district of Ansonia-Milford and tried to the jury before *Markle, J.*; verdict and judgment of guilty, from which the defendant appealed to this court. *Reversed in part; judgment directed.*

James B. Streeto, senior assistant public defender, with whom, on the brief, was *Maria V. Morse*, certified legal intern, for the appellant (defendant).

Rocco A. Chiarenza, assistant state's attorney, with whom, on the brief, were *Kevin D. Lawlor*, state's attorney, and *Amy L. Bepko*, assistant state's attorney, for the appellee (state).

Opinion

ALVORD, J. The defendant, Thomas Steele, appeals from the judgment of conviction, rendered after a jury trial, of robbery in the first degree in violation of General Statutes § 53a-134 (a) (4), conspiracy to commit robbery in the first degree in violation of General Statutes §§ 53a-48 (a) and 53a-134 (a) (4), and conspiracy to commit larceny in the third degree in violation of General Statutes §§ 53a-48 (a) and 53a-124 (a) (2). On appeal, the defendant claims that (1) there was insufficient evidence presented at trial to convict him of robbery in the first degree; (2) the trial court abused its discretion and violated his rights under the confrontation clause of the sixth and fourteenth amendments to the United States constitution when it permitted a detective to testify about historic cell site analysis without being qualified as an expert witness; and (3) his cumulative conviction and sentences for conspiracy to commit robbery and conspiracy to commit larceny violate the double jeopardy clause of the fifth and fourteenth amendments to the United States constitution. We agree with the defendant that his cumulative convictions and sentences for conspiracy to commit robbery and conspiracy to commit larceny violate the double jeopardy, but we reject the defendant's other claims. Accordingly, we reverse the judgment in part and affirm the judgment in part.

On the basis of the evidence presented at trial, the jury reasonably could have found the following facts. In the early morning hours of Saturday, February 16, 2013, the defendant checked into a Comfort Inn in Naugatuck and paid the required \$100 deposit in cash. Later that morning, at approximately 9:30 a.m., the defendant purchased a Beretta Airsoft BB gun (facsimile firearm), which looked like a Beretta style handgun, at a Walmart in Derby. Thereafter, the defendant returned to the Comfort Inn to check out. Caitlin Mitchell and an unidentified black male accompanied the defendant during the checkout process. When he was informed that he had to wait for housekeeping to check his room before his cash deposit would be refunded, the defendant became irate, insisting that he had to be somewhere and threatening to call the police if his deposit was not returned. Eventually, the hotel manager calmed the defendant down while the checkout process was completed. At approximately 11:30 a.m., after the hotel manager was informed that the defendant's room was in order, she placed the defendant's deposit on the counter beside her while she printed a receipt for the defendant. The defendant reached over the counter, grabbed the money, and left with Mitchell and the unidentified black male before the hotel manager could complete the checkout process. After exiting the hotel, all three individuals entered the defendant's green Cadillac Deville and left.¹

At 11:54 a.m., the defendant ran into the Webster Bank in Seymour while wearing dark blue jeans, a black ski mask, and grey gloves. He pointed his facsimile firearm at Tara Weiss, the assistant bank manager, and ordered everybody “[to] get to the fucking floor.” After the bank employees and customers complied with his order, the defendant jumped onto and then over the teller counter and aimed his facsimile firearm at Danielle George, a bank teller. He ordered her to open her cash drawer and place the money in the bag he provided. As George complied with his order, another teller behind the counter began to move. The defendant aimed his facsimile firearm at the other teller and told her “not to be a hero” The defendant returned his attention to George. George continued to put money in the defendant’s bag and managed to place a dye pack in the bag as well.² When George finished, the defendant took the bag and exited the bank.

On June 4, 2013, the defendant was arrested for his role in the bank robbery. In the operative information, the defendant was charged with robbery in the first degree, conspiracy to commit robbery in the first degree, and conspiracy to commit larceny in the third degree. After a trial, a jury found the defendant guilty of all counts. The defendant was sentenced to a total effective sentence of ten years of incarceration followed by four years of special parole.³ This appeal followed. Additional facts will be set forth as necessary.

I

We begin with the defendant’s claim that there was insufficient evidence presented at trial to convict him of robbery in the first degree as a principal, which was the only theory of liability the state pursued at trial and on which the court instructed the jury. The state responds that, when viewing the evidence in the light most favorable to sustaining the verdict, there was sufficient circumstantial evidence for a jury to reasonably conclude that the defendant acted as a principal during the robbery. We agree with the state.

The following additional facts are relevant to this claim. As the robber exited the bank, he ordered Weiss to count to 100. Weiss initially complied and began counting. Once the robber left the bank, however, she jumped up, ran to the doors, and locked them. Weiss then returned to her station, pressed the bank’s panic alarm, and called 911. After speaking with a 911 operator, Weiss reported the robbery to Webster Bank’s emergency hotline and to the branch manager, Jason Rodriguez, who was in New York. Rodriguez immediately began driving back to Connecticut from New York. State and federal law enforcement personnel arrived at the bank shortly thereafter and obtained, inter alia, surveillance footage of the robbery. Surveillance footage from inside the bank revealed that the robber wore

dark blue jeans, grey gloves, and a black ski mask. Surveillance footage from outside the bank revealed that a green vehicle, which was similar in appearance to the defendant's Cadillac, entered the bank parking lot shortly before the robbery and picked up an individual on Spruce Street shortly after the robbery.⁴

After leaving the bank, the robber and his companion(s) initially drove north on Route 8, stopping in Beacon Falls to dispose of the discharged dye pack and the cash that was burned when the dye pack discharged. Shortly thereafter, members of law enforcement, with the assistance of a pedestrian, recovered the dye pack and some of the burned and stained cash from an area near the Beacon Falls Police Department.

Later that day, at approximately 2 p.m., the defendant and an unidentified black male were traveling northbound on Route 8 when they stopped to dispose of a facsimile firearm by throwing it onto the embankment along the side of the highway. Unbeknownst to the defendant and his companion, Rodriguez, who was also traveling northbound on Route 8 on his way to the bank, observed this conduct. When he neared the defendant's Cadillac, he immediately noticed that it was being driven erratically. In response, he slowed down and watched as the Cadillac swerved into the breakdown lane, where he saw the driver throw an object over the roof of the Cadillac and onto the embankment. Because of the suspicious nature of this conduct and his knowledge of the recent robbery at his bank branch, Rodriguez used his cell phone to record his observations, including the vehicle's make, color, and license plate number and a brief physical description of the men in the driver's and front passenger's seats.⁵ He then reported the incident to the police. Shortly thereafter, officers recovered a black Beretta style facsimile firearm from the Route 8 embankment near the Bridgeport-Trumbull line. Notably, the tip of the recovered facsimile firearm was covered with black electrical tape.

Shortly after the incident along Route 8, the defendant purchased professional strength Goo Off and rubber cleaning gloves with cash at the Home Depot in Derby. He then proceeded to the Post Motor Inn in Milford where he rented a cabin in his own name and paid for it in cash. The following morning, February 17, 2013, the defendant checked into the Super 8 Motel in Milford with Mitchell, paying for the room with cash.

That evening, a patrol officer reported that she had located the Cadillac involved in the Webster Bank robbery in the Super 8 Motel parking lot. Shortly thereafter, officers investigating the bank robbery arrived. After speaking to the employees at the front desk of the motel and reviewing its surveillance footage, the officers determined that the defendant was associated with the Cadillac and that he was staying in room 206. After about fifteen minutes of knocking on the defendant's

door, the defendant came to the window of his room but refused to open the door. He denied ever being in Seymour or knowing anything about the Cadillac in the parking lot, claiming that a friend had dropped him off at the motel. When the detectives asked him whether he knew anything about a bank robbery, he stated that he did not, but added that "if [the officers] had enough information on him, [they] would be arresting him right now." Members of the Milford Police Department then detained the defendant and Mitchell in the lobby of the Super 8 Motel. When special agent Lisa C. McNamara of the Federal Bureau of Investigation arrived, she attempted to talk to Mitchell, but the defendant kept yelling at her: "Don't talk to them, you don't have to talk to them, your parents have to be present, you don't have to talk to them." As a result, McNamara brought Mitchell outside of the lobby and they sat in an unmarked police cruiser so that they could talk without the defendant hearing.

Officers subsequently seized several items from the Super 8 Motel. From the defendant and Mitchell's vacated room, they seized a hotel room key for the room that the defendant had rented at the Comfort Inn. From the hotel staff, they obtained surveillance footage, which showed the defendant arriving at the motel in his Cadillac and checking into his room. Notably, during the course of check-in, the defendant could be seen removing several folded bundles of cash from his pants pockets and using that cash to pay for his room. Because the defendant paid in cash, officers further seized from the Super 8 Motel seventy dollars that was stained with red dye, which they believed that the defendant used to pay for the room. Subsequent forensic tests confirmed the presence of chemicals used in bank dye packs on the stained cash.

In addition to retrieving several items from the Super 8 Motel staff, officers seized and searched the defendant's Cadillac. In the Cadillac, officers found five pairs of grey latex gloves, receipts from Walmart and Home Depot, and a roll of black electrical tape. The latex gloves that were recovered from the Cadillac's glove box were similar in appearance to the ones worn by the individual who had robbed the Webster Bank. The Walmart receipt helped the officers obtain surveillance footage from Walmart, which confirmed that on the morning of the robbery the defendant, who was wearing dark blue jeans, arrived at Walmart in his Cadillac and purchased a facsimile firearm of the same make and model as the one recovered from the embankment along Route 8. Subsequent forensic tests revealed that the electrical tape found in the defendant's Cadillac was indistinguishable from the electrical tape found on the facsimile firearm recovered from the embankment along Route 8.

Because the defendant appeared to lead a transient

lifestyle in which he frequently moved from motel to motel, officers checked with hotels and motels in the area to determine whether he had stayed in them after the robbery. When they arrived at the Post Motor Inn, they learned that the defendant had checked into a cabin at 2:51 p.m. on the day of the robbery. On his registration card, the defendant had listed two people in his party and had noted his vehicle's make and license plate number. The officers noticed that the sink in the defendant's cabin was tinted red and that the snow behind the cabin was stained red. They took samples of the stained snow. In the tree line near the cabin, the officers found a garbage bag, which contained, inter alia, rubber gloves similar to those the defendant had purchased at Home Depot, towels with red stains on them, and an empty bottle of soap. A Post Motor Inn employee also gave them a black ski mask that he had found in the snowbank approximately thirty feet from the defendant's cabin. Subsequent forensic tests confirmed that the gloves and towels retrieved from the garbage bag and the seized samples of stained snow contained traces of the chemicals used in bank dye packs.

Finally, at trial, Mitchell testified that on the weekend of the robbery she had seen the defendant in possession of "a substantial amount of money" and cleaning "red stuff" off his Cadillac. Mitchell also testified that the defendant had told her that he "robbed a bank" Mitchell maintained that when the defendant stated that he robbed a bank, he did so "jokingly" and, as a result, she did not take him seriously. She admitted, however, that the defendant was her friend and that "I don't want to be here with this," i.e., "to testify against someone that was close to me" After the parties rested and presented closing arguments, the court instructed the jury. With respect to the charge of robbery in the first degree, the court instructed the jury only on principal liability.

"The standard of review we apply to a claim of insufficient evidence is well established. In reviewing the sufficiency of the evidence to support a criminal conviction we apply a two-part test. First, we construe the evidence in the light most favorable to sustaining the verdict. Second, we determine whether upon the facts so construed and the inferences reasonably drawn therefrom the [finder of fact] reasonably could have concluded that the cumulative force of the evidence established guilt beyond a reasonable doubt. . . .

"We note that the jury must find every element proven beyond a reasonable doubt in order to find the defendant guilty of the charged offense, [but] each of the basic and inferred facts underlying those conclusions need not be proved beyond a reasonable doubt. . . . If it is reasonable and logical for the jury to conclude that a basic fact or an inferred fact is true, the jury is

permitted to consider the fact proven and may consider it in combination with other proven facts in determining whether the cumulative effect of all the evidence proves the defendant guilty of all the elements of the crime charged beyond a reasonable doubt. . . .

“Moreover, it does not diminish the probative force of the evidence that it consists, in whole or in part, of evidence that is circumstantial rather than direct. . . . It is not one fact, but the cumulative impact of a multitude of facts which establishes guilt in a case involving substantial circumstantial evidence. . . . In evaluating evidence, the [finder] of fact is not required to accept as dispositive those inferences that are consistent with the defendant’s innocence. . . . The [finder of fact] may draw whatever inferences from the evidence or facts established by the evidence it deems to be reasonable and logical. . . .

“Finally, [a]s we have often noted, proof beyond a reasonable doubt does not mean proof beyond all possible doubt . . . nor does proof beyond a reasonable doubt require acceptance of every hypothesis of innocence posed by the defendant that, had it been found credible by the [finder of fact], would have resulted in an acquittal. . . . On appeal, we do not ask whether there is a reasonable view of the evidence that would support a reasonable hypothesis of innocence. We ask, instead, whether there is a reasonable view of the evidence that supports the [finder of fact’s] verdict of guilty.” (Internal quotation marks omitted.) *State v. Crespo*, 317 Conn. 1, 16–17, 115 A.3d 447 (2015).

We conclude that there was sufficient evidence presented at trial to support the defendant’s conviction of robbery in the first degree. First, Mitchell testified that the defendant told her that he “robbed a bank” On the basis of this testimony, the jury could have concluded that when the defendant said that he “robbed a bank,” he meant that he personally had robbed a bank. The defendant, relying on the corpus delicti doctrine, argues that Mitchell’s testimony cannot support his conviction because his purported confession is uncorroborated. The purpose of the corpus delicti doctrine, however, is to protect against convictions for offenses that have not in fact occurred. *State v. Farnum*, 275 Conn. 26, 33–34, 878 A.2d 1095 (2005). The corpus delicti doctrine has no bearing on the present case because it is undisputed that the Webster Bank in Seymour was robbed on February 16, 2013; indeed, it is undisputed on appeal that the defendant was one of the individuals who conspired to rob the bank.

The defendant further suggests that Mitchell’s testimony cannot support his conviction because Mitchell testified that she did not take the defendant seriously when he said that he “robbed a bank” A jury may properly decide, however, “what—all, none, or some—of a witness’ testimony to accept or reject.”

(Internal quotation marks omitted.) *State v. Victor C.*, 145 Conn. App. 54, 61, 75 A.3d 48, cert. denied, 310 Conn. 933, 78 A.3d 859 (2013). The jury in this case very well could have credited Mitchell's testimony that the defendant told her that he robbed a bank but discredited her testimony that she understood him to be joking. Mitchell admitted that the defendant was her friend and that she did not want "to testify against someone that was close to [her]." The jury reasonably could have concluded, therefore, that Mitchell characterized the defendant's statement as a joke because of her desire to protect him.

The defendant's robbery conviction, however, is not supported solely by Mitchell's testimony. At trial, the state presented a variety of direct and circumstantial evidence creating a connection between the physical attributes and possessions of the robber and the defendant. The jury had before it surveillance footage of the robbery. When determining if the defendant was the robber, the jurors could have compared surveillance footage of the robber with other surveillance footage of the defendant and their own observations of the defendant in court to determine if there was a physical resemblance between the robber and the defendant. Additionally, the bank surveillance footage and eyewitness testimony established that the robber possessed a black firearm and was wearing dark blue jeans, grey gloves, and a black ski mask. Walmart surveillance footage depicted the defendant wearing dark blue jeans on the morning of the robbery. The receipt and surveillance footage from Walmart further established that while at Walmart the defendant personally purchased a black facsimile firearm, which was the same make and model as the facsimile firearm an individual driving a Cadillac disposed of later that afternoon by throwing it onto an embankment alongside of Route 8. Five pairs of grey latex gloves similar to those worn by the robber were recovered from the Cadillac's glove compartment, and a black ski mask similar to the one worn by the robber was recovered from a snowbank approximately thirty feet from the defendant's cabin at the Post Motor Inn.

Although it can be argued that this evidence is not inconsistent with the defendant being the getaway driver instead of the robber, "[i]n reviewing a sufficiency of the evidence claim . . . we do not ask whether there is a reasonable view of the evidence that would support a reasonable hypothesis of innocence. We ask, instead, whether there is a reasonable view of the evidence that supports the jury's verdict of guilty." (Internal quotation marks omitted.) *State v. Silva*, 285 Conn. 447, 459, 939 A.2d 581 (2008). Mindful that in determining the sufficiency of the evidence we consider its cumulative effect and construe the evidence in the light most favorable to sustaining the verdict, we determine that there was sufficient evidence presented at trial to support the defendant's conviction of robbery

in the first degree.

II

The defendant next claims that the court improperly admitted lay testimony concerning historic cell site analysis.⁶ Specifically, the defendant argues that the court should have qualified Detective Steven Ditria as an expert witness before permitting him to testify about how he used the defendant's cell phone records to determine his whereabouts before, during, and after the bank robbery. The defendant further contends that this evidentiary error obstructed his rights under the confrontation clause because Ditria's lack of training, education, or experience with cell phones, cellular networks, and cell site analysis prevented him from being meaningfully cross-examined on this evidence.⁷ The defendant seeks review of this unpreserved constitutional claim pursuant to *State v. Golding*, 213 Conn. 233, 567 A.2d 823 (1989); see also *In re Yasiel R.*, 317 Conn. 773, 781, 120 A.3d 1188 (2015) (modifying third condition of *Golding*).⁸ The state responds that Ditria merely read from a document that was already in evidence, i.e., the defendant's cell phone records and instructions from the cellular carrier on interpreting those records, and, thus, his testimony was factual, not opinion.⁹ Alternatively, the state argues that any error in the admission of this testimony was harmless beyond a reasonable doubt. We agree with the defendant that the court abused its discretion by not requiring Ditria to be qualified as an expert witness, but we agree with the state that this error was harmless beyond a reasonable doubt. Accordingly, the defendant's constitutional claim fails under the fourth prong of *Golding*. See *State v. Dixon*, 318 Conn. 495, 511, 122 A.3d 542 (2015).

A

To understand the significance of the trial court's decision to permit a lay witness to testify about historic cell site analysis, it is first necessary to understand the manner in which cell phones and cellular networks operate. Although the trial court did not have the benefit of such information when it made its evidentiary ruling, we share the view of our sister courts that such information is essential to understanding how historic cell site data is generated and what inferences that data supports concerning the locations of a cell phone, and by inference its user, during a communication. E.g., *State v. Payne*, 440 Md. 680, 690–98, 104 A.3d 142 (2014); *Collins v. State*, 172 So. 3d 724, 740–41 (Miss. 2015); *State v. Patton*, 419 S.W.3d 125, 130–31 (Mo. App. 2013); *State v. Johnson*, 797 S.E.2d 557, 561–62 (W. Va. 2017); see, e.g., *Commonwealth v. Augustine*, 467 Mass. 230, 236–39, 4 N.E.3d 846 (2014) (reviewing cell phone technology prior to determining whether police were required to obtain search warrant to obtain information from defendant's cell phone service provider); *State v. Earls*, 214 N.J. 564, 574–78, 70 A.3d 630 (2013) (same).

We will rely in this overview on information and materials relied on by our sister courts when discussing cellular network technology or cell site analysis.

Cell phones are essentially sophisticated two way radios that use cellular networks comprised of cell sites¹⁰ and radio frequency (RF) antennae to communicate with one another. *State v. Payne*, supra, 440 Md. 692; J. Beck et al., “The Use of Global Positioning (GPS) and Cell Tower Evidence to Establish a Person’s Location—Part II,” 49 Crim. L. Bull. Art. 8, 2 (2013). A cell site is the fixed location that provides cellular coverage using RF antennae, a base station, and other network equipment. J. Beck et al., supra, 3. The geographical coverage area of a cell site is called a cell sector.¹¹ See *United States v. Bohannon*, 824 F.3d 242, 256 (2d Cir. 2016), cert. denied, U.S. , 137 S. Ct. 628, 196 L. Ed. 2d 517 (2017). The shape and size of a cell sector is variable and depends on several external and internal factors. External factors include the surrounding environment and geography, e.g., the location of buildings, vehicles, vegetation, and land masses, which might prevent the RF signal from propagating in a uniform and uninterrupted manner. *State v. Payne*, supra, 693–94; A. Blank, “The Limitations and Admissibility of Using Historical Cellular Site Data to Track the Location of a Cellular Phone,” 18 Rich. J.L. & Tech. 3, 6–7 (2011); see generally T. Singal, *Wireless Communications* 35–65, 100 (2011) (discussing propagation patterns of radio frequency signals). Internal factors include the technical characteristics of the cell site and the RF antennae. *State v. Payne*, supra, 693; A. Blank, supra, 4–6.

There are four types of cell sites generally used by cellular companies: macrocells, microcells, picocells, and femtocells. M. Harris, *Unison, How Cell Towers Work* 2–3 (2011), available at www.unisonsite.com/pdf/resource-center/How%20Towers%20Work.pdf (last visited August 23, 2017) (hereinafter M. Harris, *How Cell Towers Work*); *Geolocation Privacy and Surveillance (GPS) Act: Hearing on H.R. 2168 before the Subcommittee on Crime, Terrorism, Homeland Security and Investigations of the House Committee on the Judiciary, 113th Cong. 45, 54–55 (2013)* (written testimony of Matthew Blaze, associate professor of computer and information science, University of Pennsylvania), available at <https://judiciary.house.gov/wp-content/uploads/2016/02/113-34-80542.pdf> (last visited August 23, 2017) (hereinafter Blaze testimony); see also *United States v. Davis*, 785 F.3d 498, 542 (11th Cir.), cert. denied, U.S. , 136 S. Ct. 479, 193 L. Ed. 2d 349 (2015).

Macrocells are prototypical “cell towers,” although they can be attached to a structure, and can cover an area often miles in diameter or more in rural areas where there is less signal interference. M. Harris, *How Cell Towers Work*, supra, 3; Blaze testimony, supra, 54; see also *Sprint Spectrum L.P. v. Zoning Board of Adjustment*, 21 F. Supp. 3d 381, 391 (D.N.J. 2014), aff’d, 606

Fed. Appx. 669 (3d Cir. 2015). Microcells typically are used in urban or suburban settings to cover an area that is less than one mile in diameter. M. Harris, *How Cell Towers Work*, supra, 3. A picocell is a small base station that acts like an extension cord, extending the macrocell's or microcell's signal through high traffic or obstructed areas and covering an area of less than 250 yards in diameter. Id.; M. Harris, *Unison, Think Small: Micro, Pico and Femto Cell Sites 2* (2011), available at <http://www.unisonsite.com/pdf/resource-center/Think-%20Small%20Unison-whitepaper-7D.pdf> (last visited August 23, 2017) (hereinafter M. Harris, *Think Small*). Finally, a femtocell is like a booster pack; it uses a broadband Internet connection to “backhaul” mobile calls and data traffic into a wireless carrier's existing cellular network. M. Harris, *Think Small*, supra, 2; see also *EON Corp IP Holdings LLC v. Cisco Systems, Inc.*, 36 F. Supp. 3d 912, 923 (N.D. Cal. 2014), aff'd, 595 Fed. Appx. 991 (Fed. Cir. 2015). The coverage range of these devices is similar to that of a cordless phone base. M. Harris, *How Cell Towers Work*, supra, 3; M. Harris, *Think Small*, supra, 2; Blaze testimony, supra, 55; see also *United States v. Davis*, supra, 503–504 n.7.

Each of the four types of cell sites contains, inter alia, a base station and at least one RF antenna. M. Harris, *How Cell Towers Work*, supra, 2, 6. An RF antenna can be omnidirectional or multidirectional. An omnidirectional antenna is intended to service the entire, 360 degree area around a cell site. T. Singal, supra, p. 100; M. Harris, *How Cell Towers Work*, supra, 5–6; see also *Ruckus Wireless, Inc. v. Netgear, Inc.*, Docket No. C 08-2310 PJH, 2013 WL 6627737, *1, *4 (N.D. Cal. December 16, 2013). The idealized cell sector of a cell site with an omnidirectional antenna is a hexagon with the cell site at the center.¹² E.g., T. Singal, supra, pp. 99–100; M. Harris, *How Cell Towers Work*, supra, 5. In contrast, directional antennae are intended to service only small portions of the area around a cell site. For example, a cellular carrier might use three directional antennae with beam widths set at 120 degrees in order to achieve 360 degrees of coverage around a cell site. *Collins v. State*, supra, 172 So. 3d 740; J. Beck et al., supra, 49 Crim. L. Bull. Art. 8, 3; see also T. O'Connor, “Provider Side Cell Phone Forensics,” 3 *Small Scale Digital Device Forensics J.* 1 (2009) (discussing and depicting typical cell site and antenna configurations), available at <http://ctfdatapro.com/pdf/celltower.pdf> (last visited August 23, 2017). With this configuration, the idealized cell sector is a wedge, with a center angle of 120 degrees, emanating out from the cell site. E.g., *State v. Payne*, supra, 440 Md. 724 (appendix C); T. O'Malley, “Using Historical Cell Site Analysis Evidence in Criminal Trials,” 59 *U.S. Atty. Bull.* 16, 19 (2011), available at <https://www.hsdl.org/?view&did=701377> (last visited August 23, 2017). The directional orientation of a directional antenna is called its “azi-

muth.”¹³ T. O’Connor, *supra*, 1; *United States v. Mack*, Docket No. 3:13-cr-00054 (MPS), 2014 WL 6474329, *2 (D. Conn. November 19, 2014).

Every seven seconds, regardless of whether it is being used, a cell phone will “register” with in-range cell sites.¹⁴ J. Beck et al., *supra*, 49 Crim. L. Bull. Art. 8, 3; A. Blank, *supra*, 18 Rich. J.L. & Tech. 5. When an individual places a call or sends a message, the cell phone communicates with the base station at the cell site with which it has the strongest, best quality signal. J. Beck et al., *supra*, 3–4; A. Blank, *supra*, 5; see also *United States v. Mack*, *supra*, 2014 WL 6474329, *3. Through various processes, the base station of that cell site helps the transmitting cell phone connect to the receiving cell phone, which will also use the cell site with the strongest, best quality signal to receive the call or message. See generally T. O’Malley, *supra*, 59 U.S. Atty. Bull. 20–21. Importantly, the cell site in closest proximity to these cell phones might not be the one producing the strongest, best quality signal for them. J. Beck et al., *supra*, 3; see A. Blank, *supra*, 5. The characteristics of the cell site, the RF antenna, and the cell phone as well as a variety of environmental and geographic factors influence which cell site has the strongest, best quality signal for a cell phone.¹⁵

In addition, it is possible that during a communication the cell site being used by either the transmitting or the receiving cell phone will cease to be the one with the strongest, best quality signal for that cell phone. In this circumstance, a “handoff,” or “handover,” will occur to ensure that the communication is not disrupted. A. Blank, *supra*, 18 Rich. J.L. & Tech. 5–6. Handoffs are broadly classified as being “hard” or “soft” depending on the cell phone system the cellular carrier uses. A hard, or “break before make,” handoff involves a definite decision by the cell phone to break its connection with its current cell site before, or as, it makes a connection with a new cell site. D. Wong & T. Lim, “Soft Handoffs in CDMA Mobile Systems,” *IEEE Personal Communications*, 6 (1997), available at <http://wireless.stanford.edu/papers/DWongsoftHandoff.pdf> (last visited August 23, 2017); L. Paul, “Handoff/Handover Mechanism for Mobility Improvement in Wireless Communication,” 13 *Glob. J. Res. Engineering Elec. & Elecs. Engineering* 6, 7 (2013), available at https://globaljournals.org/GJRE_Volume13/2-Handoff-Handover-Mechanism.pdf (last visited August 23, 2017).

Conversely, during a soft, or “make before break,” handoff a cell phone will simultaneously connect to multiple base stations until it determines which of the in-range cell sites is producing the strongest, best quality signal. D. Wong & T. Lim, *supra*, 6; L. Paul, *supra*, 8–9.

Every time a cell phone sends or receives a communication the base station at the cell site automatically generates a call detail record. *State v. Payne*, *supra*,

440 Md. 695–96 and 696 n.24; *In re United States for Historical Cell Site Data*, 724 F.3d 600, 611–12 (5th Cir. 2013); J. Beck et al., *supra*, 49 Crim. L. Bull. Art. 8, 4. The purpose of call detail records is to enable the cellular provider to bill a subscriber accurately for his or her cell phone usage and to help the carrier understand the calling patterns of their subscribers. J. Beck et al., *supra*, 4; see also *State v. Payne*, *supra*, 695; *In re United States for Historical Cell Site Data*, *supra*, 611–12. Call detail records can contain a variety of information depending on the cellular carrier, but these records ordinarily include some information about the cell site(s) used to make or receive the communication.¹⁶ *State v. Payne*, *supra*, 696; J. Beck et al., *supra*, 4; T. O'Malley, *supra*, 59 U.S. Atty. Bull. 23; Blaze testimony, *supra*, 57. The call detail records in the present case contain information about the cell sites in use when the cell phone initiated and terminated a communication.

One form of historic cell site analysis uses the cell site and antenna information contained in a call detail record to determine which cell sector a cell phone was using at the time of a certain communication and, thereby, the geographical area the cell phone, and by inference its user, was in at that time. The geographical coverage area of a specific cell sector can be determined by conducting a drive test or by estimating the cell sector.¹⁷ Drive testing involves the use of RF mapping equipment and software to map the actual cell sector generated by a particular cell site and antenna. E.g., T. O'Malley, *supra*, 59 U.S. Atty. Bull. 28; see also *id.*, 29 (depicting cell sector based on drive testing). This method was developed by cellular carriers to help them monitor and maintain the quality of their cellular networks, but it has also been used by law enforcement agencies to track suspects and fugitives and by attorneys at trial to establish a cell phone's, and by inference its user's, approximate locations at particular dates and times. See *T-Mobile Central, LLC v. Unified Government of Wyandotte County/Kansas City, Kan.*, 528 F. Supp. 2d 1128, 1140, 1150–52, 1166–67 (D. Kan. 2007), *aff'd in part*, 546 F.3d 1299 (10th Cir. 2008); T. O'Malley, *supra*, 28–29.

Although the precision of drive testing makes it the preferred method for determining the shape and size of a cell sector, performing a drive test is not always possible. *United States v. Mack*, *supra*, 2014 WL 6474329, *3. For example, the cell site might have been removed or its characteristics altered by the cellular carrier since the crime was committed. E.g., *id.* (federal agent testified that drive testing was not possible because cell site in question was no longer present at time of his investigation). In this circumstance, the approximate size and shape of a cell sector can be determined by drawing a pie-wedge diagram on a map. *Id.* The center angle of the pie-wedge corresponds to the antenna's beam width setting, e.g., 120 degrees, and

the outward boundary of the pie-wedge will extend 50 to 70 percent of the way into the opposing cell sector. *Id.*; *United States v. Machado-Erazo*, 950 F. Supp. 2d 49, 55–56 (D.D.C. 2013); *United States v. Davis*, Docket No. 11-60285-CR, 2013 WL 2156659, *5–6 (S.D. Fla. May 17, 2013); e.g., T. O’Malley, *supra*, 59 U.S. Atty. Bull. 28 (depicting estimated cell sector superimposed on map). Critically, the boundaries of an estimated cell sector are not fixed. Depending on a variety of factors, the actual cell sector can be smaller or larger than the estimated cell sector. T. Singal, *supra*, p. 100; A. Blank, *supra*, 18 Rich. J.L. & Tech. 5; see also T. O’Malley, *supra*, 28–29 (depicting idealized cell sector and actual cell sector).

B

Against the foregoing scientific and technical background, we turn to the defendant’s claims on appeal. As we previously stated, the threshold issue is whether the court improperly permitted lay testimony concerning historic cell site analysis. The following additional facts are relevant to our resolution of this claim. At the time of the robbery, the defendant owned a cell phone serviced by Sprint-Nextel (Sprint). During the course of his investigation, Ditria subpoenaed the defendant’s subscription information and call detail records from Sprint, and, at trial, the state entered the materials Sprint provided into evidence as exhibit 77.

Exhibit 77 includes, *inter alia*, the defendant’s call detail records, instructions on how to interpret those records, and a list of cell site locations. The call detail records are in the form of a ten column chart, which, in relevant part, has columns titled, “First Cell,” and, “Last Cell.” The “key” to the call detail records explains that “First Cell” and “Last Cell” refer to the specific cell site and “sector” through which the communication was initiated and terminated. “The first digit [of the cell site identification number] reflects the sector. The last 3-4 digits represent the [cell] site number. . . . For example, if the number in the [First Cell or Last Cell] column reads 2083, the cell site is 083 and the sector is 2.” (Emphasis omitted.) A separate, eighteen column chart provided by Sprint contains a variety of information about Sprint’s cell sites, including the address and azimuth of each cell site. Exhibit 77 does not define what a “sector” or “azimuth” is.¹⁸ Nor does it contain any general or specific information on cellular networks, the geographical coverage areas of Sprint’s cell sites, or the operation of cell phones and cell sites.

At trial, Ditria explained that learning the defendant’s cell phone number was “crucial” because he “wanted to learn the whereabouts of [the defendant] based on his phone records.” Once he knew the defendant’s cell phone number, Ditria testified, he subpoenaed the defendant’s cell phone records from Sprint. Ditria identified the documents provided by Sprint, which were

entered into evidence as exhibit 77 without objection. Ditria explained that although he understood the “[b]asic incoming and outgoing phone calls” when he received the call detail records, he needed help to understand the cell site information within them. He contacted a Sprint representative, whose job it was to assist law enforcement, “to learn about the communication of the cell phone and the cell tower”

When Ditria began to explain his current understanding of “the significance of a cell tower,” defense counsel objected on foundational grounds, stating: “I think he is giving opinion testimony here regarding, I think that’s where we’re going here.” The court asked the prosecutor for a response, to which she replied: “What he understands about cell phone records now after being educated.” The court overruled the objection. Thereafter, the following colloquy occurred:

“[The Prosecutor]: Okay. You were explaining what a cell phone tower is for.

“[Ditria]: In order for a phone call to be made, incoming or outgoing, you have to have a cell tower, and it dedicates the subscriber information, checking if it’s a legitimate phone number, and with that carrier.

“[The Prosecutor]: Can you make a phone call without a cell tower?

“[Ditria]: Absolutely not.

“[The Prosecutor]: And did you also learn how close a cell phone has to be to a tower in order to receive information from it?

“[Ditria]: Yes.

“[The Prosecutor]: And how far away can a phone be to bounce off the tower?

“[Ditria]: Anywhere from zero to thirty miles.

“[The Prosecutor]: A big radius?

“[Ditria]: Right.

“[The Prosecutor]: So, cell phone—at thirty miles or right next to the tower?

“[Ditria]: Correct.

“[The Prosecutor]: That’s the tower that’s it’s going to bounce off of?

“[Ditria]: Correct.

“[The Prosecutor]: And so, did he also teach you how to read these?

“[Ditria]: Yes.

“[The Prosecutor]: Okay. And so, I’m going to pick a random page, page number two of thirty. How can you determine from this page what cell tower you are looking for? What column are we looking at?”

Defense counsel objected, explaining: “I think we’re getting into the realm of expert testimony here, and I don’t think that the officer has been qualified as an expert. What we’re trying to do here is to educate the jury, and I think that’s wholly in the purview of an expert.” The prosecutor replied: “The officer has indicated that he did not know how to read the records, but now he does know how to read the records and has demonstrated to the jury that he has the information in front of him.” The court overruled the defendant’s objection, stating that it found that proper foundation had been laid for the admission of exhibit 77 into evidence and that “[i]t’s part of his investigation, he learned how to interpret the data. I’ll allow him now to testify from the document entered into evidence.

Direct examination of Ditria continued. The prosecutor asked Ditria, “[h]ow is this information helpful to your understanding of the case,” and Ditria explained that it “[b]asically, pinned down the whereabouts of [the defendant] before, during, and after the robbery of Webster Bank.” Thereafter, Ditria explained in detail how the defendant’s call detail records helped him to confirm the defendant’s presence near eight areas of interest: Walmart, the Comfort Inn, the Webster Bank, Beacon Falls, Bridgeport, Home Depot, the Post Motor Inn, and the Super 8 Motel. In particular, Ditria testified as to when the defendant or the bank robbery suspect was believed to be in the area of interest, when the communication in question was made, the address of one of the cell sites used by the defendant’s cell phone,¹⁹ and the distance from that cell site to the area of interest.²⁰ After reviewing these details, the prosecutor asked Ditria: “So, after learning the proximity of the cell tower locations to the places that you believe that [the defendant] was at, what does that do for your investigation?” Ditria responded: “It gives us a better understanding about the whereabouts of [the defendant] during those dates and times.”

On cross-examination, defense counsel attempted to explore Ditria’s understanding of cell site analysis through the following colloquy:

“[Defense Counsel]: And now, Sprint only operates a digital cell phone system; isn’t that right?”

“[Ditria]: I’m not sure.

“[Defense Counsel]: All right. Do you know if they operate an analog system?”

“[Ditria]: I’m not sure.

“[Defense Counsel]: And the phones that we use now are all digital, right?”

“[Ditria]: (Indicating yes.)

“[Defense Counsel]: And I think you were testifying that the cell phones connect to a particular tower, right?”

“[Ditria]: Yes.

“[Defense Counsel]: And didn’t they tell you that they actually connect to more than one tower simultaneously; isn’t that right?

“[Ditria]: They did not say that.

“[Defense Counsel]: They didn’t say that?

“[Ditria]: No. . . .

“[Defense Counsel]: Do you know that the cell phone is always looking for the strongest signal?

“[Ditria]: I don’t know if it’s looking for the strongest, no.

“[Defense Counsel]: Now, do you know that on a digital cell phone, they can connect to multiple cell sites; did you know that?

“[Ditria]: I did not know that.

“[Defense Counsel]: They didn’t tell you that?

“[Ditria]: (Indicating no.)

“[Defense Counsel]: And the representative at Sprint, did he tell you that there’s things that can get in the way of a signal from a cell tower?

“[Ditria]: He did not say that.

“[Defense Counsel]: Things like leaves, weather; did he say that?

“[Ditria]: He did not say that.

“[Defense Counsel]: That the wind could impact the coverage of a cell site; did he say that?

“[Ditria]: He did not.

“[Defense Counsel]: And that digital cell phones have this thing called a soft handoff; did he tell you what that is?

“[Ditria]: No.

“[Defense Counsel]: Have you ever heard of the term triangulation?

“[Ditria]: I have not.

“[Defense Counsel]: They didn’t tell you or explain that to you over the phone?

“[Ditria]: No.”

The defendant requested to make a motion outside the presence of the jury. After the jury was excused, the defendant moved to strike Ditria’s testimony regarding “the cell phone coverage” because he was not competent to testify on that topic. The court disagreed, explaining: “There was never any offer that he is an expert, and he did not offer any opinions. He is simply interpreting or translating the data that was given to him.” The state agreed, adding: “[I]t just goes to the

weight of his testimony.” The court overruled defense counsel’s objection, but it stated, in response to a question from defense counsel, that it was “perfectly fine” for defense counsel to explore the defendant’s education, or lack thereof, with respect to cell phones and cellular networks on cross-examination. Thereafter, defense counsel continued his cross-examination, during which he explored Ditria’s lack of education and training concerning cell phones and cellular networks.

After Ditria’s testimony, both parties rested and presented closing arguments. During her opening argument, the prosecutor referred to Ditria’s testimony concerning the location of the defendant’s cell phone, highlighting in particular the short distance between cell sites used by the defendant’s cell phone and the areas of interest. In response, defense counsel during his closing argument emphasized that Ditria “didn’t have any expertise as to how these things actually work.” During her rebuttal argument, the prosecutor made the following relevant remarks: “Ditria said that he had no formal education in cell phone tower mechanics, but he did have the wherewithal to call somebody who did, right? And we found out that a cell tower is in a fixed location and that cell phones are mobile, mobile phones, right? So, if you know where the cell tower is, and that’s in a fixed location, and a cell phone is mobile, but you know that there are these other things that are fixed locations, like Walmart; Walmart is not mobile, right? Walmart is where it is. Home Depot is where it is. The Super 8 is not moving without some significant effort, okay? So, if you have [the defendant] pinned down in those places, then you could also coordinate the fact that his cell phone is pinging off cell towers in a fixed location all within a mile. Does Ditria really need all that technological expertise to explain it to you, okay?”

“We review a trial court’s decision [regarding the admission of] expert testimony for an abuse of discretion. . . . If we determine that a court acted improperly with respect to the admissibility of expert testimony, we will reverse the trial court’s judgment and grant a new trial only if the impropriety was harmful to the appealing party.” (Internal quotation marks omitted.) *State v. Edwards*, 325 Conn. 97, 123, 124, 156 A.3d 506 (2017). A lay witness may not provide opinion testimony “unless the opinion is rationally based on the perception of the witness” Conn. Code Evid. § 7-1. In order for a witness to testify concerning “scientific, technical or other specialized knowledge,” the witness must be “qualified as an expert by knowledge, skill, experience, training, [or] education” Conn. Code Evid. § 7-2. “Expert testimony should be admitted when: (1) the witness has a special skill or knowledge directly applicable to a matter in issue, (2) that skill or knowledge is not common to the average person, and (3) the testimony would be helpful to the court or jury in

considering the issues. . . . [T]o render an expert opinion the witness must be qualified to do so and there must be a factual basis for the opinion.” (Internal quotation marks omitted.) *State v. Williams*, 317 Conn. 691, 702, 119 A.3d 1194 (2015).

Our analysis of the evidentiary issue presented by the defendant is informed by our Supreme Court’s recent decision in *State v. Edwards*, supra, 325 Conn. 97. In *Edwards*, the state sought to elicit testimony from Detective Christopher Morris concerning how he used the defendant’s call detail records to determine his location at certain points in time and to offer into evidence maps that Morris created showing the estimated cell sectors of the cell sites in question. *Id.*, 119–22. As part of the state’s offer of proof, Morris testified as to his training and experience conducting historic cell site analysis. *Id.*, 121. “The trial court then ruled that the state had met its burden of establishing the reliability of the proffered evidence and that Morris was qualified by his expertise to analyze cell phone data provided in Verizon records.” *Id.*, 122.

On appeal, our Supreme Court agreed with the defendant that “the trial court improperly admitted testimony and documentary evidence through Morris without qualifying him as an expert and conducting a *Porter* hearing²¹ in order to ensure that his testimony was based on [a] reliable scientific methodology.” (Footnote added.) *Id.*, 133. In reaching this conclusion, the court observed that it “has not had the opportunity to address whether a police officer needed to be qualified as an expert witness before he could be allowed to testify regarding cell phone data” *Id.*, 127. Relying on *State v. Payne*, supra, 440 Md. 680, the court concluded that Morris’ testimony concerning historic cell site analysis constituted expert testimony and, therefore, Morris should have been qualified as an expert witness. *State v. Edwards*, supra, 325 Conn. 128, 133. The court observed that “although Morris relied on data he obtained from Verizon to conduct his analysis [of the defendant’s call detail records], the process he used to arrive at his conclusions [concerning the approximate coverage areas of the cell sites in question] was beyond the ken of [an] average [person].” *Id.*, 128.

We conclude that *Edwards* is controlling as to this issue on appeal.²² Although historic cell site analysis is not extremely difficult to understand, we agree with the court in *Edwards* that this analytical process is beyond the ken of the average juror. As we discussed in part II A of this opinion, call detail records can be used to determine the approximate location of a cell phone at the time of a particular communication by determining the geographical coverage area of the cell sector used to facilitate that communication. This process of determining the actual or approximate geographical coverage area of a cell sector requires

scientific and technical knowledge. Specifically, it requires an understanding of how cell sites and RF antennae operate, and knowledge of all of the internal and external factors that influence the size and shape of a cell sector. Indeed, in recognition of the scientific underpinnings of historic cell site analysis, our Supreme Court in *Edwards* held that a court must conduct a *Porter* hearing prior to admitting testimonial or documentary evidence of historic cell site analysis. *Id.*, 132–33. For these reasons, we conclude that the court abused its discretion by not requiring Ditria to be qualified as an expert witness.

The state nonetheless urges that “when Ditria’s testimony is reviewed in relation to the cell phone records themselves, a document that was admitted as a full exhibit without objection, it is clear that the substance of his testimony, i.e., the particular cell tower that the defendant’s cell phone connected with at particular times, did not constitute ‘expert’ testimony at all, but was the equivalent of Ditria merely reading from a document that was already in evidence.” We disagree; Ditria did not merely read from exhibit 77. Ditria testified that in order to make a phone call, a cell phone must use a cell site. Ditria then explained that in order to use a cell site, a cell phone must be within thirty miles of it. Ditria further agreed with the prosecutor that, because of these principles, if a cell phone is “at thirty miles or right next to” a cell site, then that is the cell site that the cell phone is going to use to make or receive a call. None of this information is contained in Exhibit 77. By explaining to the jury how cell phones and cellular sites operate and the geographical coverage area of Sprint’s cell sites, Ditria broached the realm of expert testimony.

Having concluded that the court abused its discretion by not requiring Ditria to be qualified as an expert witness, we turn to the defendant’s confrontation clause claim. Because the defendant seeks *Golding* review of this unpreserved constitutional claim, we do not need to determine whether the court’s failure to qualify Ditria as an expert witness obstructed the defendant’s confrontation rights if this error was harmless beyond a reasonable doubt. See *State v. Dixon*, *supra*, 318 Conn. 511.

“[W]hether [an improper evidentiary ruling] is harmless in a particular case depends upon a number of factors, such as the importance of the witness’ testimony in the prosecution’s case, whether the testimony was cumulative, the presence or absence of evidence corroborating or contradicting the testimony of the witness on material points, the extent of cross-examination otherwise permitted, and, of course, the overall strength of the prosecution’s case. . . . Most importantly, we must examine the impact of the . . . evidence on the trier of fact and the result of the trial. . . . [T]he proper standard for determining whether an erroneous eviden-

tiary ruling is harmless should be whether the jury's verdict was substantially swayed by the error." (Internal quotation marks omitted.) *State v. Edwards*, supra, 325 Conn. 133; accord *State v. Santos*, 318 Conn. 412, 425, 121 A.3d 697 (2015). For the purposes of our analysis, we assume that this evidentiary error was of constitutional magnitude and, therefore, the burden is on the state to prove that this error was harmless beyond a reasonable doubt. See *State v. Santos*, supra, 425.

We conclude that the admission of Ditria's testimony was harmless beyond a reasonable doubt. As we discussed in part II of this opinion, the state presented substantial and varied evidence of the defendant's involvement in the bank robbery, including the defendant's admission to Mitchell that he robbed a bank. Moreover, Ditria's testimony was largely cumulative evidence of the defendant's location before, during, and after the robbery. Specifically, Ditria's testimony was used to corroborate the defendant's presence near eight areas of interest: Walmart, the Comfort Inn, the Webster Bank, Beacon Falls, Bridgeport, Home Depot, the Post Motor Inn, and the Super 8 Motel. The state established the defendant's presence at all of these locations through other direct and circumstantial evidence. For example, surveillance footage established the defendant's presence at Walmart and the Super 8 Motel as well as the presence of a vehicle similar in appearance to the defendant's Cadillac at the Webster Bank during the robbery. The Walmart and Home Depot receipts recovered from the defendant's Cadillac corroborated the defendant's presence at those stores. Rodriguez' testimony and the recovered facsimile firearm, which was the same make and model as the one the defendant purchased from Walmart, established the defendant's and his Cadillac's presence on Route 8 near the Bridgeport-Trumbull line. To establish the defendant's presence at various hotels, the state admitted into evidence registration forms, in the defendant's own name, for the Comfort Inn, the Post Motor Inn, and the Super 8 Motel and presented the testimony of employees from those hotels who confirmed that guests must present a driver's license when checking into those establishments. Finally, all of the direct and circumstantial evidence of the defendant's participation in the robbery corroborates his presence in Beacon Falls, where the dye pack associated with George's cash drawer was recovered shortly after the robbery.

As a result, even though we conclude that the court abused its discretion by not requiring Ditria to be qualified as an expert witness, we also conclude that this error was harmless beyond a reasonable doubt. Therefore, the defendant's constitutional claim fails under the fourth prong of *Golding*.

III

The defendant's final claim is that his cumulative

convictions and sentences for conspiracy to commit robbery and conspiracy to commit larceny violated his right against double jeopardy. The defendant seeks *Golding* review of this unpreserved constitutional claim. The defendant's claim is reviewable under *Golding* because the record is adequate to review the alleged claim of error and the claim is of constitutional magnitude alleging the violation of a fundamental right. See *State v. Dixon*, supra, 318 Conn. 511. As the state concedes, the defendant is further entitled to reversal of one of his conspiracy convictions under *Golding* because both convictions arose out of a single agreement to rob the Webster Bank in Seymour. See *State v. Wright*, 320 Conn. 781, 829, 135 A.3d 1 (2016) ("it is a double jeopardy violation to impose cumulative punishments for conspiracy offenses if they arise from a single agreement with multiple criminal objectives").

The appropriate remedy for this due process violation is to reverse the judgment of conviction as to both counts of conspiracy and to remand the case to the trial court with direction to vacate the defendant's conviction of conspiracy to commit larceny and to render judgment on the defendant's remaining conviction of conspiracy to commit robbery. See *id.*, 829–30; see also *State v. Lee*, 325 Conn. 339, 345, 157 A.3d 651 (2017); *State v. Padua*, 273 Conn. 138, 171–73, 869 A.2d 192 (2005). The defendant further requests that we direct the trial court to resentence him with respect to his remaining conviction of conspiracy to commit robbery. Cf. *State v. Wright*, supra, 320 Conn. 830. We cannot order the trial court to resentence the defendant, however, because vacatur of the defendant's conviction and sentence for conspiracy to commit larceny will not alter his total effective sentence. See *State v. Johnson*, 316 Conn. 34, 42–43, 111 A.3d 447 (2015); see footnote 3 of this opinion.

The judgment is reversed only with respect to the conviction of conspiracy to commit larceny in the third degree and the case is remanded with direction to vacate the judgment as to that conviction. The judgment is affirmed in all other respects.

In this opinion the other judges concurred.

¹ At trial, the defendant disputed possessing or operating the Cadillac, which was registered to and insured by Wardell Eaddy. The state presented substantial evidence, however, that although Eaddy registered the Cadillac in his own name as a favor to the defendant, the defendant possessed and operated the Cadillac at the time of the robbery.

² A "dye pack" is a bank security feature that is made up of a stack of actual currency with its center removed and a dye pack put in its place. The dye pack is designed to release red dye, tear gas, and smoke at a designated period of time after the device has been removed from the bank. When the dye pack explodes, it becomes very hot and can burn currency it comes in contact with it. The serial numbers of the devices and the bills used on the top and bottom of the stack are recorded to pair specific packets with specific teller stations inside a bank.

³ For both his conviction of robbery in the first degree and his conviction of conspiracy to commit robbery, the defendant was sentenced to ten years of incarceration followed by four years of special parole. For his conviction of conspiracy to commit larceny, the defendant was sentenced to five years of

incarceration. The court further ordered that the defendant's three sentences were to be served concurrently.

⁴ Raider, a canine trained and certified in tracking humans, tracked a scent from the front door of the Webster Bank where the robber was last seen to the corner of Garden Street and Spruce Street where he lost the trail. Raider's handler testified that he observed fresh tire tracks in the area where Raider lost the scent trail.

⁵ Rodriguez testified that the driver, who threw the object, had a thin mustache and that the passenger, whom he did not get a good look at, was wearing a hat. In surveillance footage from Walmart and a hotel the defendant stayed at the day after the robbery, the defendant is seen with a thin black mustache and a light grey beard.

⁶ Historic cell site analysis involves the use of cell phone records and cell site locations to determine, within some range of error, a cell phone's approximate location at a particular time. *United States v. Natal*, 849 F.3d 530, 534 (2d Cir. 2017).

⁷ It is unclear whether the defendant also claims that Ditria's testimony concerning what he learned from a Sprint representative about how cell phones and cellular networks operate was improper and constituted a confrontation violation under *Crawford v. Washington*, 541 U.S. 36, 124 S. Ct. 1354, 158 L. Ed. 2d 177 (2004). In the "legal standard" section of his opening appellate brief, the defendant briefly reviewed the principles of *Crawford* and, in one paragraph, argues why "the 'interpretations of the data' offered through Detective Ditria constituted testimonial hearsay" in violation of *Crawford*. The defendant did not thereafter advance, in his briefs or at oral argument before this court, a claim that a *Crawford* violation occurred. Indeed, the defendant's briefs and oral argument focused principally on his claim that Ditria should have been qualified as an expert witness and that the court's failure to do so obstructed his confrontation rights. As a result, we conclude that, to the extent the defendant alleges a *Crawford* violation, this claim is inadequately briefed. See *State v. Buhl*, 321 Conn. 688, 724, 138 A.3d 868 (2016).

⁸ "Under *Golding*, a defendant can prevail on a claim of constitutional error not preserved at trial only if all of the following conditions are met: (1) the record is adequate to review the alleged claim of error; (2) the claim is of constitutional magnitude alleging the violation of a fundamental right; (3) the alleged constitutional violation . . . exists and . . . deprived the defendant of a fair trial; and (4) if subject to harmless error analysis, the state has failed to demonstrate harmlessness of the alleged constitutional violation beyond a reasonable doubt. In the absence of any one of these conditions, the defendant's claim will fail." (Internal quotation marks omitted.) *State v. Dixon*, 318 Conn. 495, 511, 122 A.3d 542 (2015). "The first two steps in the *Golding* analysis address the reviewability of the claim, while the last two steps involve the merits of the claim." (Internal quotation marks omitted.) *State v. Britton*, 283 Conn. 598, 615, 929 A.2d 312 (2007). "The appellate tribunal is free, therefore, to respond to the defendant's claim by focusing on whichever condition is most relevant in the particular circumstances." (Internal quotation marks omitted.) *State v. Dixon*, supra, 511.

⁹ The state further argues that the defendant has abandoned or, alternatively, inadequately briefed any evidentiary claim because he "appears to limit his appellate claims to his assertion that his constitutional right to confrontation was violated." The state is correct that the defendant framed this issue in his statement of the issues as "whether the defendant's sixth amendment right to confrontation was violated when Detective Ditria testified without specialized knowledge regarding the whereabouts of the defendant based upon his interpretation of cell phone records." In advancing this claim, however, the defendant has consistently argued that the violation of his confrontation rights stems from the court's evidentiary error in permitting Ditria to interpret his cell phone records without qualifying him as an expert witness. The defendant has thoroughly briefed why testimony concerning cell site analysis should be admitted only through an expert witness. Accordingly, we conclude that the defendant has not abandoned or inadequately briefed this threshold evidentiary claim.

¹⁰ "Cell sites" are often referred to as "cell towers." We believe that the term cell site is more precise. The primary purpose of a cell site "is to elevate antennas that transmit and receive radio-frequency (RF) signals from" cell phones. M. Harris, Unison, How Cell Towers Work (2011), available at www.unison.com/pdf/resource-center/How%20Towers%20Work.pdf (last visited August 23, 2017). This purpose can be accomplished by building an independent tower or by placing the cell site in common

structures such as buildings, water towers, bridges, tunnels, streetlights, traffic lights, stadium lights, and billboards. Id.

¹¹ This geographical coverage area is also known as a “cell,” “sector,” and “footprint.” See *T-Mobile USA, Inc. v. City of Anacortes*, 572 F.3d 987, 997 n.11 (9th Cir. 2009) (“‘coverage footprint’”); *State v. Payne*, supra, 440 Md. 692 (“cell”); *United States v. Mack*, Docket No. 3:13-cr-00054 (MPS), 2014 WL 6474329, *3 (D. Conn. November 19, 2014) (“sector”); *United States v. Davis*, Docket No. 11-60285-CR, 2013 WL 2156659, *5 (S.D. Fla. May 17, 2013) (“footprints of the sectors”); T. Singal, *Wireless Communications* 99 (2011) (“cell” or “footprint”).

¹² “Cells [or cell sectors] are always drawn as hexagons because it makes it simpler and easier to show adjacent cells without any overlap. In reality, the cell shape is closer to a circle but it may be affected by surrounding buildings and other geographic features.” T. Singal, supra, p. 101.

¹³ “Commonly a cell [site] will have the first of the three antennas centered on due North or 0 degrees. This antenna has a nominal area 120 degrees wide which [covers] 60 degrees each side of due north. This antenna’s nominal field [extends] from 300 degrees (-60 degrees) to 60 degrees and is called either the north facing antenna or the Alpha antenna. The second antenna is centered at 120 degrees and has a nominal coverage area [that extends] from 60 degrees to 180 degrees, this antenna is referred to as the southeast facing antenna or the Beta antenna. The third antenna nominally covers the remaining area of the field; it is centered on 240 degrees and nominally [extends] from 180 degrees to 300 degrees, this antenna is called either the southwest facing antenna or the gamma antenna.” T. O’Connor, supra, 3 *Small Scale Digital Device Forensics* J. 1; see also id., 1, 3 (depicting different antenna orientation models).

¹⁴ The only way to prevent registration is by turning the cell phone off, by putting it in “Airplane Mode,” or by placing it in a shielded container, such as a Faraday bag. J. Beck et al., supra, 49 *Crim. L. Bull. Art. 8*, 3.

¹⁵ Cell site characteristics include whether maintenance or repairs are being performed on a given cell site, the range of coverage, the wattage output, the call capacity of a cell site, and the number and closeness of neighboring cell sites that will be competing with the cell site in question to produce the strongest, best quality signal in the area. A. Blank, supra, 18 *Rich. J.L. & Tech.* 6; J. Beck et al., supra, 49 *Crim. L. Bull. Art. 8*, 5–6. Antenna characteristics include the number of antenna on the cell site, the antenna’s height, the direction and angle of the antenna, and the call volume of the antenna at any given time. A. Blank, supra, 4. Cell phone specific characteristics include the wattage output and the generation of the cell phone’s broadband capability. Id. Last, environmental and geographical factors include the weather, topography (e.g., height above sea level), and density of physical structures in the area. Id., 6–7; J. Beck et al., supra, 5–6.

¹⁶ The information contained in call detail records is sometimes referred to as cellular site location information, or CSLI. E.g., *State v. Smith*, 156 Conn. App. 537, 540, 554 n.4, 113 A.3d 103, cert. denied, 317 Conn. 910, 115 A.3d 1106 (2015); see also *Commonwealth v. Estabrook*, 472 Mass. 852, 853 n.2, 38 N.E.3d 231 (2015).

¹⁷ The methodology of estimating the shape and size of a cell sector is sometimes referred to as “cell identification”; *Collins v. State*, supra, 172 So. 3d 740; or “mapping”; e.g., *State v. Edwards*, 325 Conn. 97, 121, 156 A.3d 506 (2017); *United States v. Mack*, supra, 2014 WL 6474329, *3; *United States v. Machado-Eraza*, 950 F. Supp. 2d 49, 55–56 (D.D.C. 2013).

¹⁸ It appears that “sector” in these instructions refers to the RF antenna, and thereby the cell sector, used. The instructional page titled “Sector Layout” explains that “Sprint . . . cell sites can be set-up in a variety of ways. . . . [N]ot every cell site has three sectors. Some may have two sectors or may be omni sites. . . . The direction that the sector faces depends on the need for coverage in a particular area.” The instructions further explain Sprint’s labeling schemes for determining the directional orientation of the azimuth’s face, which are designated as being an alpha sector, beta sector, or gamma sector. None of the information provided by Sprint explains the nautical directions associated with a particular sector type (e.g., north, south, east, or west). Cf. T. O’Connor, supra, 3 *Small Scale Digital Device Forensics* J. 1; footnote 14 of this opinion.

¹⁹ We observe that of the eight phone calls analyzed by Ditria, five had different cell sites listed for the initiation and termination of the call. For four of these calls, Ditria provided the address of only the first cell site, and for one of these calls Ditria provided the address of only the last cell site. Ditria did not explain to the jury that a cell phone might use multiple

cell sites or antennae during the course of a call or that he was, in some instances, providing them with the address of only one of the cell sites used.

²⁰ First, Ditria testified that around the time indicated on the Walmart receipt the defendant's cell phone "was hitting off the South Cliff Street tower approximately one mile from the Walmart in Derby located in Ansonia." Second, Ditria testified that around the time that the defendant checked into the Comfort Inn, the defendant's cell phone used a cell site located "on 280 Elm Street in Naugatuck, approximately point six miles from the Comfort Inn motel." Third, Ditria testified that around the time of the robbery, the defendant's cell phone used a cell site located on "Rimmon Street in Seymour . . . approximately point eight miles from the Webster Bank." Fourth, Ditria testified that at 12:20 p.m. on the day of the robbery, the defendant's cell phone used a cell site at "236 Pent Road in Beacon Falls," which was "[a]pproximately 1000 feet, under a quarter of a mile" from the Beacon Falls Police Department. Fifth, Ditria testified that at approximately 1 p.m. on the day of the robbery, the defendant's cell phone used a cell site at "1875 Noble Avenue in Bridgeport," which was "[a]pproximately a quarter mile." Ditria did not explain what this cell site was a quarter mile from, but it appears he was alluding to the area where the facsimile firearm was recovered. Sixth, Ditria testified that around the time indicated on the Home Depot receipt, the defendant's cell phone used a cell site at "134 Roosevelt Drive in Derby . . . approximately point six miles from the Home Depot in Derby." Seventh, Ditria testified that around the time that the defendant checked into the Post Motor Inn, the defendant's cell phone used a cell site at "28 Orange Road in Orange," which was "[a]pproximately point eight miles from the Post Motor Inn." Finally, Ditria testified that around the time the defendant checked into the Super 8 Motel the defendant's cell phone was using a cell site located at "160 Wampus Lane in Milford," which was "[a]pproximately one mile" from the Super 8 Motel.

²¹ See *State v. Porter*, 241 Conn. 57, 698 A.2d 739 (1997), cert. denied, 523 U.S. 1058, 118 S. Ct. 1384, 140 L. Ed. 2d 645 (1998).

"A *Porter* analysis involves a two part inquiry that assesses the reliability and relevance of the witness' methods. . . . First, the party offering the expert testimony must show that the expert's methods for reaching his conclusion are reliable. . . . Second, the proposed scientific testimony must be demonstrably relevant to the facts of the particular case in which it is offered, and not simply be valid in the abstract. . . . Put another way, the proponent of scientific evidence must establish that the specific scientific testimony at issue is, in fact, derived from and based [on] . . . [scientifically reliable] methodology." (Internal quotation marks omitted.) *State v. Edwards*, supra, 325 Conn. 124.

²² We recognize that in *Edwards* "the state [did] not assert that Morris did not provide expert testimony"; *State v. Edwards*, supra, 325 Conn. 118; and the court elsewhere concluded that "the trial court admitted Morris' testimony as an expert witness . . ." *Id.*, 128. Indeed, the court initially framed the issue presented on appeal only as whether the trial court improperly admitted Morris' testimony and maps "without determining that the evidence was based on reliable scientific principles under *State v. Porter*, 241 Conn. 57, 80–90, 698 A.2d 739 (1997), cert. denied, 523 U.S. 1058, 118 S. Ct. 1384, 140 L. Ed. 2d 645 (1998)." *State v. Edwards*, supra, 118.

Nevertheless, our Supreme Court's holding does not appear to be dicta because this discussion was not "merely [a] passing commentary" that went "beyond the facts at issue" and was "unnecessary to the holding in the case." (Internal quotation marks omitted.) *Voris v. Molinaro*, 302 Conn. 791, 797 n.6, 31 A.3d 363 (2011). Instead, the court was intentionally taking up, discussing, and deciding a question germane to, though not necessarily decisive of the controversy before it, i.e., whether historic cell site analysis is the kind of scientific evidence that requires expert testimony and a *Porter* hearing to ensure the reliability of the scientific principles underlying it. See *id.* Moreover, even if our Supreme Court's statements concerning the need to qualify a witness as an expert before permitting him to testify about historic cell site analysis was dicta, we conclude that it is persuasive precedent. See *id.*
