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STATE OF CONNECTICUT v. ALFRED SWINTON
(SC 16548)

Sullivan, C. J., and Borden, Katz, Palmer and Vertefeuille, Js.

Argued September 26, 2003—officially released May 11, 2004

James B. Streeto, assistant public defender, for the appellant (defendant).

Christopher T. Godialis, assistant state's attorney, with whom were *John M. Massameno*, senior assistant state's attorney, and, on the brief, *Christopher L. Morano*, chief state's attorney, *John M. Bailey*, former chief state's attorney, and *Carolyn K. Longstreth*, former senior assistant state's attorney, for the appellee (state).

Opinion

KATZ, J. The defendant, Alfred Swinton, appeals¹ from the judgment of conviction, rendered after a jury trial, of one count of murder in violation of General Statutes § 53a-54a.² The defendant claims on appeal that the trial court improperly: (1) admitted into evidence computer enhanced photographs and computer gener-

ated exhibits without a proper foundation; (2) refused to mark a file as a court exhibit for appellate review; (3) failed fully to disclose all relevant material for cross-examination following its in camera review of a witness' out-of-court statements; (4) failed to sequester members of the victim's family who were scheduled to testify as witnesses at trial; and (5) failed to grant the defendant's motion to suppress certain statements that he had made to a fellow inmate while the defendant was incarcerated during trial. In addition, the defendant claims that the state's attorney committed prosecutorial misconduct in his argument to the jury. We reject the defendant's claims and, accordingly, we affirm the judgment of the trial court.

The jury reasonably could have found the following facts. On January 12, 1991, the twenty-eight year old victim, Carla Terry, left her residence for an evening out. She was dressed in a black brassiere, white underwear, a blue shirt, jeans, socks, boots, a white hat, and multiple jackets. The victim's sister, Laverne Terry, had helped the victim adjust the size of the black bra by inserting two safety pins into the right side of the garment. Later that night, the victim encountered Hector Freeman, her neighbor, at the Oakland Terrace Cafe in Hartford. The two proceeded to the Keney Park Cafe, arriving there after 1 a.m. on January 13, 1991. Once inside, Freeman and the victim separated. At some point during the evening, the defendant was seen speaking with the victim. At approximately 2 a.m., Freeman and the victim left the bar together. The defendant left moments thereafter. Freeman gave the victim a ride home. The victim's sister, Rhonda Terry, heard the victim arrive outside of her apartment "[a] little after two" in the morning and, through a window, watched the victim get out of Freeman's car. The victim called out to her sister that she would return shortly and that she was going to stay with her sister that night. She then walked across the street and out of view.

At approximately 4:45 a.m. on January 13, 1991, Officer Michael Matthews of the Hartford police department found the victim's body in a snow bank near the University of Hartford—an area identified as being near one of the defendant's previous addresses. The victim was partially dressed, her undergarments had been removed, and she was wrapped in a brown plastic garbage bag. Paramedics arrived, and after an unsuccessful attempt to revive her, they took the victim to the hospital, where she was pronounced dead.

Edward McDonough, deputy chief medical examiner for the state, conducted an autopsy and concluded that the cause of death was asphyxia by manual strangulation. Taking into account the twenty-seven degree temperature of that evening and early morning, he estimated the time of death as approximately two or three hours before the victim's body arrived at the hos-

pital. McDonough noted bruising on the victim's scalp consistent with blows to the head, as well as abrasions on the victim's neck, and bruising on her face and elsewhere on her body. In particular, McDonough observed and photographed crescent shaped bruises on each of the victim's breasts that he identified as being consistent with bite marks. The bite marks had been inflicted at or near the time of death. McDonough consulted with Lester Luntz, a forensic odontologist,³ regarding the bruises on the victim's breasts. Ultimately, Luntz identified the bruises as bite marks.

On January 19, 1991, following an initial investigation that revealed that the defendant had been in the Keney Park Cafe the night of the victim's murder, Detectives James Rovella and Stephen Kumnick of the Hartford police department interviewed the defendant at his residence in Stafford Springs. The police conducted a second interview approximately one week later at the police station. During interviews with the police, the defendant repeatedly mentioned an altercation that he had had with his former wife and that, even though the police report memorializing the incident stated that he had "choked" her, the defendant claimed that he actually had restrained her instead. Following the second interview, the police sought and obtained several search warrants for the defendant's residence. On March 5, 1991, the police executed a warrant for the defendant's residence, and the common areas of the building were searched with the consent of the building owner. During the course of the search of the common basement area to which the defendant had access, the police found a cardboard box containing a black bra that had holes in the cloth that could have been made by safety pins. Laverne Terry, the victim's sister, who had helped the victim adjust her bra before she went out for the evening, identified it as the same bra the victim had worn on the night of her murder. The police also found brown plastic garbage bags located in a shed behind the defendant's residence, and safety pins in the defendant's van. In addition, the police found a newspaper in the defendant's apartment dated the day of the victim's death, but found no other editions of the newspaper.

Also pursuant to a warrant, Luntz made molds,⁴ or models, of the defendant's teeth. Following Luntz' death, the molds of the defendant's teeth were retrieved from Luntz' house by the police. These molds were examined later by another forensic odontologist, Constantine Karazulas, who concluded that the defendant had inflicted the bite marks on the victim's body.

Over the next several years,⁵ the defendant made several incriminating statements. While being transported to get molds of his teeth made, the defendant made comments to Lieutenant Jose Lopez of the Hartford police department that women "bore the seed of . . . evil." The defendant stated that women were

always looking for favors and that sex was the only thing women had to offer in exchange for such favors. The defendant told Lopez that someone like the victim had used him for money and for rides, and that women like that “get what they deserve.” The defendant labeled these women prostitutes and included the victim in this class. He seemed angry that women had used him in this manner. In June, 1992, the defendant arrived at Benton Auto Body, a towing company and auto body shop that worked in conjunction with the Hartford police department, in order to pick up his van that was to be released to him after a “police hold.” The defendant told Ann Fraczek, the manager of the towing company, that he had been accused of biting a woman on the breast and then murdering her. He admitted that he had dated the victim and that she had been in his van. The defendant also stated that the police had “fouled the whole investigation up” and had done a “lousy job.” As he was leaving, he told Fraczek that the police had “screwed up so bad they will never catch me now”

The defendant also made certain incriminating statements during a 1993 interview with Karon Haller, a freelance writer working with Connecticut Magazine.⁶ The interview took place over dinner and several drinks, and the defendant spoke with Haller concerning the victim’s murder, hoping to enlist her help in proving that he was innocent of that crime. During the discussion, the defendant ruminated vaguely over who might have committed the crime, and why. His rumination was interspersed with frequent, and often incoherent, digressions concerning prostitution, sex and drug use, and its peculiar effect on a person’s sense of reality. The defendant suggested that the victim was a drug user and a prostitute, and that she might have taken money from the killer and then not fulfilled her promise of sex. He theorized that she probably had offered sex in exchange for money, but then had tried to “skip out” with the money. The defendant’s most incriminating remarks came at a particular point in the interview at which he pleaded with Haller for help in his investigation into who murdered the victim, and he offered her all the information that he previously had gathered on the subject. In response, Haller asked whether the killer was going to “do it again.” The defendant responded: “Summer’s long, and summer’s hot.” Haller asked: “Why? Why doesn’t he just stop?” The defendant answered: “If I knew that, I can stop tomorrow. If I knew that, I would stop tomorrow. . . . So somebody could live.”

In addition, on more than one occasion, the defendant declared to various acquaintances that he had “gotten away” with murder. For example, Mary Alice Mills, an admitted drug addict who stole and engaged in prostitution to support her addiction, stated that, in the summer of 1991, while drinking and doing drugs with a group

of people, the defendant said he had “got away with killing” the victim, and that he had killed her because “[h]e didn’t like women anymore.”⁷ In addition, Cynthia Stallings, also a drug user, stated that the defendant had made derogatory remarks about women in her presence. Shortly after the initial murder charge against the defendant was dismissed; see footnote 5 of this opinion; Stallings and a group of people, including the defendant, sat in her mother’s bedroom drinking. Someone in the group had mentioned the victim’s name, and the defendant started laughing. Somebody told the defendant that he should not laugh, even if he was innocent of the charge, because the victim was dead. The defendant replied, smirking, that he was not innocent, and that the police “had [him] for the teeth marks on her [breast],” but that the authorities had made mistakes.

On another occasion, Stallings and a friend, Sonia Faye Henderson, were out at a bar when they saw the defendant. Despite Stallings’ warnings to Henderson that the defendant had been charged with murder, Henderson sat drinking and smoking with the defendant. When the bar closed, Henderson left and got into the defendant’s car with him. Stallings rode in a car that traveled immediately in front of the defendant’s car. At some point, Stallings noticed the defendant’s car weaving, and saw that the defendant and Henderson were struggling with each other inside the defendant’s car. Stallings got out of the car she was in and approached the defendant’s car. When she opened the passenger car door, she saw that the defendant had his hands on Henderson’s neck and Henderson was struggling to get out of the car. Henderson was yelling for the defendant to let her go, and the defendant was yelling that he had spent money on her and expected a sexual favor in return. Henderson appeared to be hysterical, as she was hollering and crying. Stallings grabbed Henderson and yanked her from the defendant’s grip, eventually pulling her out of the car. The defendant laughed and drove away. After the incident, Henderson’s neck looked red, scratched and swollen.

The defendant’s coworkers also recounted incriminating behavior by the defendant. Andrew Brescia met the defendant while working as a remodeler and general contractor at a property in Stafford Springs. After he became aware that the defendant was a suspect in a murder investigation, he would make teasing remarks toward the defendant, including calling him “choking Al.” On one particular occasion, he asked the defendant what it was like to strangle a woman. In response, the defendant said, “ ‘You want to know what it feels like? I’ll show you,’ ” and grabbed Brescia from behind and started to choke him. The defendant applied a lot of pressure to Brescia’s neck, in what Brescia described as a “grip of steel.” According to Brescia, the defendant did not appear to be joking. Edward Manner, the defendant’s landlord, who employed both the defendant and

Brescia, witnessed this incident. Manner also stated that once, over lunch, he had asked the defendant what it was like to rape and kill a woman, and that the defendant merely grinned and laughed in response.

In February, 1991, the defendant made incriminating statements to his brother, Larry Swinton, while they were in the presence of James Arnold, an acquaintance of the defendant and an admitted heroin addict. According to Arnold, Larry Swinton called the defendant stupid for beating up and biting the victim, and the defendant responded that, although he had done these things to the victim, she was alive when he left her. Arnold recounted other conversations relating to the victim, in which the defendant had explained that she had made him angry by calling him stupid and other names, and that he was tired of women playing games with him. According to Arnold, the defendant was very angry at women who would take his money or who would allow him to buy them drinks or drugs, and then not follow through on their promises of sex. The defendant also told Arnold that he had “just lost it” and regretted what he had done, but that he had not killed the victim. During another conversation with Arnold, the defendant discussed having had rough sex with the victim and stated that the victim had gotten angry with him over something pertaining to the sex act.⁸

Following his arrest in 1998; see footnote 5 of this opinion; the defendant also made several incriminating statements to a fellow inmate, Michael Scalise, while the defendant was imprisoned during his trial.⁹ In particular, on January 31, 2001, after his trial had begun, the defendant told Scalise that he was going to have his son kill two witnesses who had testified against him, including one of the victim’s sisters. Scalise reported this information to a correction officer on or about February 7, 2001. On February 13, 2001, Scalise reported that he had more information beyond the threats the defendant had made. As a consequence, on February 16, 2001, Scalise met with Detective Rovella and Eric Daigle, a state police trooper, to divulge a number of incriminating statements made by the defendant about which Scalise later testified. Specifically, the defendant confessed to Scalise that he had killed the victim, wrapped her in a plastic bag, and left her in a snow bank near a college. The defendant also revealed to Scalise that he had bitten the victim during sexual intercourse prior to killing her. The defendant demonstrated to Scalise how he had strangled the victim with his hands. He bragged to Scalise that he “got her good.” The defendant revealed that he had redressed the victim, and had put her jackets back on, to keep her warm. He also admitted to keeping the victim’s bra and panties for “mementos.”

The defendant also stated to Scalise that the state would not be able to prove its case after ten years had

passed. He believed that the state would not be able to match his teeth to the bite marks on the victim's body, and he showed Scalise prints of his teeth and a letter from a forensic analyst in support of his contention. The defendant told Scalise that he was having some of his teeth pulled, so that if the state took more molds of his teeth, the new molds would not match up with the bite marks on the victim. The defendant also kept his head shaved while in jail because he believed it would prevent the police from obtaining any further hair samples from him. The defendant revealed to Scalise that the police had found the same type of plastic bag at his house, but that he thought he had a solid defense because the bag was a common household item. The defendant admitted to meeting the victim at a bar, and stated that, even though he had committed the crime, the police should not have singled him out because there were many other people at the bar the night she was killed. He further stated his belief that the victim's sister could not remember the bra the victim had worn ten years earlier.

Scalise met with Rovella and Daigle again on February 22, 2001, at which point he disclosed additional incriminating information about the defendant and memorialized his disclosures in written statements. The defendant had explained to Scalise that, on the night of the victim's murder, he had gone to the bar alone, and the victim had arrived with another man. The victim had left the bar that night with the other man, but the defendant had met up with the victim later that night, whereupon he had sex with her, killed her, "bagged" her, and then "dumped" her body in a snow bank near the University of Hartford. The defendant also revealed that he had been angry and jealous because the man the victim had been seen with earlier was married, and the defendant had believed that the man had "no business spending time" with the victim. The defendant told Scalise that he had bitten the victim on her breast while having sex with her, had beaten her in the face, and had strangled her. He also admitted to having had sex with the victim on previous occasions in exchange for drugs. The defendant stated that, after he had killed the victim, he took her bra and underwear, and that a safety pin had been attached to the bra. He told Scalise that he had taken the pin off the bra and used it in his van to pierce his radiator.

The defendant was convicted of murder and sentenced to a term of sixty years imprisonment. This appeal followed. Additional facts will be set forth as necessary.

I

The defendant first claims that the trial court improperly admitted into evidence computer enhanced photographs¹⁰ and computer generated exhibits without an adequate foundation. Specifically, the defendant chal-

lenges the admissibility of two separate, but related, pieces of evidence: first, photographs of a bite mark¹¹ on the victim's body that were enhanced using a computer software program known as Lucis, and second, images of the defendant's teeth overlaid, or superimposed, upon photographs of the bite mark that were made through the use of Adobe Photoshop, another computer software program. The defendant contends that the state did not present foundation testimony on the adequacy of these two programs for the task of matching the defendant's dentition with the victim's bite mark because the computer enhanced and computer generated exhibits were introduced through experts with no more than an elementary familiarity with the programs. Therefore, the defendant argues, the admission of this evidence violated his constitutional right to confrontation. The state responds that the exhibits were merely photographic or illustrative evidence, not scientific evidence, and therefore did not require the testimony of a witness who could explain the inner workings of the equipment that produced it in order to provide an adequate foundation. We conclude that the trial court properly admitted into evidence the computer enhanced photographs, but improperly admitted the superimposed images created by Adobe Photoshop.

According to the defendant, the law governing the admissibility of scientific evidence is applicable to the question of admissibility of computer enhanced and computer generated evidence. The dominant standard for determining the admissibility of scientific evidence is *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786, 125 L. Ed. 2d 469 (1993). In *Daubert*, the United States Supreme Court concluded that a two part inquiry should govern the admissibility of scientific evidence: "whether the reasoning or methodology underlying the testimony is scientifically valid and . . . whether that reasoning or methodology properly can be applied to the facts in issue." *Id.*, 592-93. We adopted this standard in *State v. Porter*, 241 Conn. 57, 68, 698 A.2d 739 (1997), cert. denied, 523 U.S. 1058, 118 S. Ct. 1384, 140 L. Ed. 2d 645 (1998).¹² The standard in *Daubert*, however, does not resolve the issue in the present case.¹³ "*Daubert* is only a threshold inquiry into the admissibility of scientific evidence and other evidentiary rules must also be satisfied. . . . See [*State v. Porter*, supra, 90]." C. Cwik & J. North, *Scientific Evidence Review: Admissibility and Use of Expert Evidence in the Courtroom* (2003) p. 88. The question presented here goes to the requirement that evidence be reliable so as to satisfy the requirements of the confrontation clause.¹⁴ See *State v. Rawls*, 198 Conn. 111, 118, 502 A.2d 374 (1985) ("necessary assurances of reliability" required to satisfy confrontation clause); *Bray v. Bi-State Development Corp.*, 949 S.W.2d 93, 97 (Mo. App. 1997) (adequate foundation to authenticate computer generated evidence needed to establish its relia-

bility). The questions regarding the reliability of the evidence in issue in this case look beyond the reliability of the underlying information to whether the evidence had been generated by someone and something that gives the court confidence that the defendant's confrontation rights have been honored. What exactly is required in the context of computer enhanced and computer generated evidence, other than business records, presents an issue of first impression in Connecticut.

We begin our analysis with the following well established principles. In determining the relevancy and admissibility of evidence, trial courts have broad discretion. *Bovat v. Waterbury*, 258 Conn. 574, 594, 783 A.2d 1001 (2001). "Our standard of review of an evidentiary ruling is dependent on whether the claim is of constitutional magnitude. If the claim is of constitutional magnitude, the state has the burden of proving the constitutional error was harmless beyond a reasonable doubt. *State v. Dehaney*, 261 Conn. 336, 355 n.12, 803 A.2d 267 (2002), cert. denied, 537 U.S. 1217, 123 S. Ct. 1318, 154 L. Ed. 2d 1070 (2003); *State v. Ramos*, 261 Conn. 156, 176, 801 A.2d 788 (2002). Otherwise, in order to establish reversible error on an evidentiary impropriety, the defendant must prove both an abuse of discretion and a harm that resulted from such abuse. *State v. Young*, 258 Conn. 79, 94-95, 779 A.2d 112 (2001); *State v. Hamilton*, 228 Conn. 234, 244, 636 A.2d 760 (1994)." *State v. Kirsch*, 263 Conn. 390, 412, 820 A.2d 236 (2003).

In the present case, the defendant claims that the admission of this evidence without a proper foundation obstructed his constitutional right to confrontation. "The sixth amendment to the constitution of the United States guarantees the right of an accused in a criminal prosecution to be confronted with the witnesses against him. This right is secured for defendants in state criminal proceedings. *Pointer v. Texas*, 380 U.S. 400, 85 S. Ct. 1065, 13 L. Ed. 2d 923 (1965). A similar right is embodied in article first, § 8, of the Connecticut constitution. *State v. Hackett*, 182 Conn. 511, 517, 438 A.2d 726 (1980). . . . [T]he primary interest secured by confrontation is the right of cross-examination. *Davis v. Alaska*, 415 U.S. 308, 315, 94 S. Ct. 1105, 39 L. Ed. 2d 347 (1974)." (Internal quotation marks omitted.) *State v. Esposito*, 192 Conn. 166, 178, 471 A.2d 949 (1984). Keeping these principles in mind, we address each type of evidence in turn.

A

We first address the admissibility of the computer enhanced photographs of the bite mark. The following additional facts are relevant to our disposition of this issue. At trial, the state presented several images of the bite marks that were computer enhancements of a photograph taken at the victim's autopsy. The enhancements were created through the use of a software pro-

gram called Lucis. The state introduced the enhancements through Major Timothy Palmbach, overseer of the division of scientific services in the state department of public safety. Palmbach has a master's degree in forensic science, and extensive experience in the forensic field. Palmbach had obtained the original photographs for the purpose of enhancement from Karazulas. Because the state police did not possess the equipment necessary to generate the digitally enhanced photographs, Palmbach produced the computer enhanced photographs at Lucis' manufacturer's offices in New Britain, a company called Image Content Technologies. Palmbach explained that Lucis was developed in 1994 specifically for "scientific applications," but that experts had used it in forensic settings.

During his testimony, Palmbach explained how the Lucis program works: "Simply put, what the program will do is it allows us to see image detail that we normally couldn't see otherwise. How it effectively works is it takes advantage . . . of the fact that a normal photograph . . . has many layers of contrast in it. Your average photograph is going to have around 255 layers of contrast in it. At best our eyes are only capable of perceiving 32 layers of contrast. . . . So the net result is our eyes see very, very little of actually what's present inside of the image itself. Now, what our eye tends to perceive as far as contrast differences are . . . the major contrast differences. We don't have the ability with our own eyes to see the minor contrast differences. . . . So what this program's intent is . . . to allow us to make a selection of a particular range of contrast. . . . And by . . . narrowing [the] band of contrast layers down, we increase the image detail. So we reduce the amount of layers that we're looking at. We're not getting rid of them. We're just saying we only want to look at some of these layers at a particular time. . . . [T]he result is the picture's got tremendous detail. . . . At times we end up creating too much detail. We'll get background noise. And it depends upon what it's on. And skin would be a good example. Because if you imagined . . . magnifying [and] looking at all the fine detail on your skin—the hairs, the pores, the wrinkles . . . it might actually be very noisy looking. So then . . . we'll tell the computer to . . . stop showing us quite so much detail."

With the use of a laptop computer, Palmbach demonstrated to the jury exactly how the original bite mark photograph had been enhanced—first by scanning a photograph of the bite mark into the computer,¹⁵ then by selecting a particular part of the image to be enhanced, and lastly by defining "contrast ranges" through the manipulation of a "big cursor" that allows the user to "[diminish] layers" in order to enhance the image's detail, and also through the manipulation of a "small cursor" that allows the user to "reduc[e] the ultrafine detail" in order to dissipate the "noisy effect"

of too much detail. Once the cursors are set on certain values, the computer performs an algorithm that engages in a “pixel-to-pixel comparison” in order to enhance the selected image.¹⁶ The enhancement produced an image in “one-to-one” format.¹⁷ Palmbach testified several times that nothing was added to or removed from the photograph by the enhancement process. Palmbach described how he and Karazulas had “tested” the accuracy of Lucis’ enhancement process by taking a photograph of a bite mark that Karazulas had produced on his own arm, enhancing that photograph, and then comparing the enhancement with the original photograph.

Although much of Palmbach’s testimony concerned how the Lucis program worked, he was not qualified as an expert in computer programs, generally, or in Lucis specifically, nor was he qualified as a programmer. Palmbach testified that he was not aware of how the computer makes the distinction as to how many layers there are in an image, or what the algorithm is, or how the algorithm actually sorts the layers. Although he testified that error rates are a cause for concern within the scientific field, he had not seen any published error rates concerning the Lucis program. Additionally, Palmbach testified that Lucis did not create any artifacts in its enhancement process.¹⁸

The defendant objected to the admission of the enhanced photographs, arguing that Palmbach’s testimony laid an inadequate foundation. The trial court overruled that objection. On appeal, the defendant argues that the evidence at issue resembles composite photographs, and therefore, should be governed under a similar standard. With respect to composite photographs, “[t]he moving party must present witnesses with firsthand knowledge of how the composite was prepared and of how accurately it portrays that which it is intended to depict.” *State v. Weidenhof*, 205 Conn. 262, 275, 533 A.2d 545 (1987).¹⁹ The defendant also claims that because this evidence actually was created by and through the use of a computer, it is computer generated evidence, and thus entails additional foundational requirements.

The state argues, to the contrary, that the Lucis enhanced photographs are mere “reproductions” of the photograph of the bite mark, and that their admissibility therefore should be governed by the foundational standard for photographs. Under that standard, all that is required is that a photograph be introduced through a witness competent to verify it as a fair and accurate representation of what it depicts.²⁰ See *State v. DeForge*, 194 Conn. 392, 397, 480 A.2d 547 (1984); *Cagianello v. Hartford*, 135 Conn. 473, 475, 66 A.2d 83 (1948). The state argues that the enhancements met this burden because the authenticity of the original photographs was never questioned and the testimony at trial was

that the enhancements accurately reflected the content of the originals. The state further argues that a photographer's in-court testimony is not required for the admission of a photograph; see *McGar v. Bristol*, 71 Conn. 652, 655, 42 A. 1000 (1899); and therefore, the computer programmer's testimony is not required in this instance.

We note first that there is some question as to whether what is at issue here is actually computer generated evidence. Currently, there is no universal definition of that term; many commentators, however, and some courts, divide computer generated evidence into two distinct categories of evidence: simulations and animations. "In a simulation, data is entered into a computer which is programmed to analyze the information and perform calculations by applying mathematical models, laws of physics and other scientific principles in order to draw conclusions and recreate an incident. . . . In contrast, an animation does not develop any opinions or perform any scientific calculations and, to the contrary, is nothing more than a graphic depiction or illustration of the previously formed opinion of an expert." (Citations omitted.) *Commonwealth v. Serge*, 58 Pa. D. & C.4th 52, 68–69 (2001). The evidence at issue in the present case does not fall cleanly within either category,²¹ but we determine it to be more than the mere "enlargement"²² of a photograph, as the state argues. Enlargement simply involves making the details of an image larger, whereas the enhancement process in this case "reveals" parts of an image that previously were unviewable.²³

Our research reveals that, of the few cases that actually discuss the admission of computer enhanced evidence, none explicitly qualifies such evidence as "computer generated." See, e.g., *United States v. Calderin-Rodriguez*, 244 F.3d 977, 986 (8th Cir. 2001) (digitally enhanced sound recordings); *Nooner v. State*, 322 Ark. 87, 103–104, 907 S.W.2d 677 (1995) (digitally enhanced videotape), cert. denied, 517 U.S. 1143, 116 S. Ct. 1436, 134 L. Ed. 2d 558 (1996); *Dolan v. State*, 743 So. 2d 544, 545–46 (Fla. App. 1999) (same); *English v. State*, 205 Ga. App. 599, 599–600, 422 S.E.2d 924 (1992) (same); *State v. Hayden*, 90 Wash. App. 100, 103, 950 P.2d 1024 (1998) (digitally enhanced fingerprint). We note, however, that the appearance of computer generated evidence in our courts is becoming more common. Not only can we not anticipate what forms this evidence will take, but also common sense dictates that the line between one type of computer generated evidence and another will not always be obvious.

Therefore, because in the present case, we cannot be sure to what extent the difference between *presenting* evidence and *creating* evidence was blurred, we let caution guide our decision. We do not agree with the state's proposition that the enhanced photographs in the present case are like any other photographs admit-

ted into evidence,²⁴ and we determine that, to the extent that a computer was both the process and the tool used to enable the enhanced photographs to be admitted as evidence, we consider these exhibits, for the purposes of this analysis, to be computer generated.

The appearance of computer generated evidence in Connecticut cases is limited. For the most part, cases in Connecticut that give rise to the question of the admissibility of computer generated evidence involve the admissibility of computerized business records. *American Oil Co. v. Valenti*, 179 Conn. 349, 360, 426 A.2d 305 (1979); *Midstates Resources Corp. v. Dobrindt*, 70 Conn. App. 420, 426, 798 A.2d 494 (2002); *Ninth RMA Partners, L.P. v. Krass*, 57 Conn. App. 1, 9–11, 746 A.2d 826, cert. denied, 253 Conn. 918, 755 A.2d 215 (2000); *Federal Deposit Ins. Corp. v. Carabetta*, 55 Conn. App. 369, 376–77, 739 A.2d 301, cert. denied, 251 Conn. 927, 742 A.2d 362 (1999); *State v. Dumas*, 54 Conn. App. 780, 797–98, 739 A.2d 1251, cert. denied, 252 Conn. 903, 743 A.2d 616 (1999); *Farmers & Mechanics Bank v. Krupa*, 52 Conn. App. 493, 495, 727 A.2d 252 (1999); *Webster Bank v. Flanagan*, 51 Conn. App. 733, 744–48, 725 A.2d 975 (1999); *SKW Real Estate Ltd. Partnership v. Gallicchio*, 49 Conn. App. 563, 575–78, 716 A.2d 903, cert. denied, 247 Conn. 926, 719 A.2d 1169 (1998); *Berkeley Federal Bank & Trust, FSB v. Ogalin*, 48 Conn. App. 205, 207–11, 708 A.2d 620, cert. denied, 244 Conn. 933, 711 A.2d 726 (1998); *State v. Caprilozzi*, 45 Conn. App. 455, 458–61, 696 A.2d 380, cert. denied, 243 Conn. 937, 702 A.2d 644 (1997); *Shadhali, Inc. v. Hintlian*, 41 Conn. App. 225, 227–29, 675 A.2d 3, cert. denied, 237 Conn. 926, 677 A.2d 948 (1996); *Shawmut Bank Connecticut, N.A. v. Connecticut Limousine Service, Inc.*, 40 Conn. App. 268, 275–77, 670 A.2d 880, cert. denied, 236 Conn. 915, 673 A.2d 1143 (1996); *Babiarz v. Hartford Special, Inc.*, 2 Conn. App. 388, 397–98, 480 A.2d 561 (1984); c.f. *State v. Polanco*, 69 Conn. App. 169, 184, 797 A.2d 523 (2002) (computer generated map admitted under testimony by geographic information systems technician verifying accuracy of program and result); *State v. Wright*, 58 Conn. App. 136, 148–49, 752 A.2d 1147, cert. denied, 254 Conn. 907, 755 A.2d 884 (2000) (same).

In the seminal case of *American Oil Co. v. Valenti*, supra, 179 Conn. 359, wherein this court first addressed the standard to be used in admitting computer generated evidence, the court adopted a general rule, requiring “testimony by a person with some degree of computer expertise, who has sufficient knowledge to be examined and cross-examined about the functioning of the computer.” In that case, the court cautioned, “[c]omputer machinery may make errors because of malfunctioning of the hardware, the computer’s mechanical apparatus. Computers may also, and more frequently, make errors that arise out of defects in the software, the input procedures, the data base, and the

processing program. . . . In view of the complex nature of the operation of computers and general lay unfamiliarity with their operation, courts have been cautioned to take special care to be certain that the foundation is sufficient to warrant a finding of trustworthiness and that the opposing party has full opportunity to inquire into the process by which information is fed into the computer.” (Citations omitted; internal quotation marks omitted.) *Id.*, 358–59.

In *American Oil Co.*, the court did not require the computer programmer, or even the person who had entered the information into the computer, to testify, because the reliability of the records was extrinsically established. *Id.*, 360–61. “Routinely prepared records . . . are well recognized exceptions to the hearsay rule, because their regular use in the business of the company insures a high degree of accuracy. Proof of day-to-day business reliance upon computerized records should therefore make less onerous the burden of laying a proper foundation for their admission.” *Perma Research & Development Co. v. Singer Co.*, 542 F.2d 111, 125 (2d Cir.) (Van Graafeiland, J., dissenting), cert. denied, 429 U.S. 987, 97 S. Ct. 507, 50 L. Ed. 2d 598 (1976). In the case before us, such reliability has not been extrinsically established, and therefore, the standard in *American Oil Co.*, although a good starting place, provides only limited guidance. We therefore find it necessary to look outside our jurisdiction to further refine the appropriate foundational requirements for computer generated or computer enhanced evidence that does not constitute business records.

Although computer enhanced photographs, and the like, have surfaced as evidence in recent cases, both in Connecticut and elsewhere, their admissibility apparently has not been challenged on a basic foundational issue such as in the present case.²⁵ See, e.g., *State v. Asherman*, 193 Conn. 695, 717, 478 A.2d 227 (1984) (odontologist used life-sized enlargements and creation of “mirror image” photograph of defendant’s teeth by photographing defendant’s teeth and taking special scan photographs inside defendant’s mouth), cert. denied, 470 U.S. 1050, 105 S. Ct. 1749, 84 L. Ed. 2d 814 (1985); *Bundy v. State*, 455 So. 2d 330, 336–37 (Fla. 1984) (one forensic dental expert used enlarged photographs, another used computer enhanced photographs). We note, however, that similar computer enhancement has been discussed in the context of other types of evidence. For example, images from videotapes have been enhanced for evidentiary purposes. Those jurisdictions addressing the issue of enhancement in the context of videotape have permitted such enhancements as evidence, and we find these cases instructive.²⁶

In *Nooner v. State*, supra, 322 Ark. 104, the Arkansas Supreme Court upheld a ruling in a pretrial hearing that “so long as the process leading to the duplicate

videotape and enhanced photographs was explained to the jury,” they could be introduced as evidence. Stating that “[r]eliability must be the watchword in determining the admissibility of enhanced videotapes and photographs, whether by computer or otherwise,” the court allowed the enhancements because their reliability was attested to by multiple witnesses who all “meticulously described their role in the enhancement process.” *Id.* Witnesses in *Nooner* included the person who “slowed” down the videotape enough to make still photographs from it; the person who took a still photograph from the videotape, transferred it to his computer, softened the pixels to remove graininess, and then placed the resulting image on a computer disk; and the person who took the computer disk and printed still photographs, including a photograph in which he had “multiplied the pixels per square inch to improve the contrast and adjusted the brightness in one of the still photographs.” *Id.* Additionally, the court noted that there was no evidence of distortion in the enhancements, nor was there any evidence to indicate that the enhancement somehow had changed a face, features, or physique, or had been altered to include someone or something not present on the videotape. *Id.*

Similarly, in *English v. State*, supra, 205 Ga. App. 599, the Georgia Court of Appeals, analogizing the admissibility of a computer enhanced videotape to photographic enlargements,²⁷ admitted the videotape when the technician who performed the enhancement testified to the process and further testified that the photographic copy, as enhanced, was a “‘fair and accurate’” representation of what appeared in the frozen frames of the videotape copy. In *Dolan v. State*, supra, 743 So. 2d 546, the Florida District Court of Appeal allowed the admission of enhanced still prints wherein it was established that the original videotape from which they were taken accurately reflected the store in which a sexual battery occurred when “there [was] testimony as to the nature of the store’s video security system, the placement of the film in the camera, [and] how the camera worked,” and a forensic analyst “explain[ed] the computer enhancement process and establish[ed] that the images were not altered or edited”

What is consistent, in all three cases, is that the technician or analyst who testified was the person who had engaged in the enhancement process and was capable of testifying in specific detail as to the process. See *Nooner v. State*, supra, 322 Ark. 104; *Dolan v. State*, supra, 743 So. 2d 546; *English v. State*, supra, 205 Ga. App. 599. This is consistent with this court’s ruling in *American Oil Co.* that, in order for computer generated evidence to be admitted, there must be “testimony by a person with some degree of computer expertise, who has sufficient knowledge to be examined and cross-examined about the functioning of the computer.” *American Oil Co. v. Valenti*, supra, 179 Conn. 359.

Contrary to the defendant's assertions in the present case, however, this standard does not dictate that the *only* person capable of such expertise is the programmer of the software.

As we have in the past, we look to the federal rules for further guidance on this issue. See, e.g., *State v. Weinberg*, 215 Conn. 231, 242–43, 575 A.2d 1003 (relying on rule 601 of Federal Rules of Evidence), cert. denied, 498 U.S. 967, 111 S. Ct. 430, 112 L. Ed. 2d 413 (1990); *Mac's Car City, Inc. v. American National Bank*, 205 Conn. 255, 260–61, 532 A.2d 1302 (1987) (relying on rules 54 [b] and 56 [f] of Federal Rules of Civil Procedure); *State v. Nardini*, 187 Conn. 513, 526, 447 A.2d 396 (1982) (relying on rule 609 [b] of Federal Rules of Evidence). Rule 901 (b) (9) of the Federal Rules of Evidence provides that authentication or identification of a process or system requires “[e]vidence describing a process or system used to produce a result and showing that the process or system produces an accurate result.” The advisory committee notes to rule 901 (b) (9)²⁸ provide that the rule “is designed for situations in which the accuracy of a result is dependent upon a process or system which produces it.” The notes also suggest that the rule is particularly adapted to such “recent developments” as the computer. Therefore, the federal rule dictates that the inquiry into basic foundational admissibility requires sufficient evidence to authenticate both the accuracy of the image *and* the reliability of the machine producing the image.

Several factors that establish authentication under rule 901 of the Federal Rules of Evidence have been identified. “This standard can generally be satisfied by evidence that (1) the computer equipment is accepted in the field as standard and competent and was in good working order, (2) qualified computer operators were employed, (3) proper procedures were followed in connection with the input and output of information, (4) a reliable software program was utilized, (5) the equipment was programmed and operated correctly, and (6) the exhibit is properly identified as the output in question.” C. Mueller & L. Kirkpatrick, *Evidence: Practice Under the Rules* (2d Ed. 1999) § 9.16, p. 1442 (citing other commentators); E. Weinreb, “‘Counselor, Proceed With Caution’: The Use of Integrated Evidence Presentation Systems and Computer-Generated Evidence in the Courtroom,” 23 *Cardozo L. Rev.* 393, 410 (2001) (citing same factors); see *Commercial Union Ins. Co. v. Boston Edison Co.*, 412 Mass. 545, 549, 591 N.E.2d 165 (1992) (conditioning admissibility on sufficient showing that: “[1] the computer is functioning properly; [2] the input and underlying equations are sufficiently complete and accurate [and disclosed to the opposing party, so that they may challenge them]; and [3] the program is generally accepted by the appropriate community of scientists”); *Kudlacek v. Fiat S.p.A.*, 244 Neb. 822, 843, 509 N.W.2d 603 (1994) (same);

State v. Clark, 101 Ohio App. 3d 389, 416, 655 N.E.2d 795 (1995) (same), aff'd, 75 Ohio St. 3d 412, 662 N.E.2d 362 (1996); *Clark v. Cantrell*, 339 S.C. 369, 384, 529 S.E.2d 528 (2000) (holding computer generated evidence admissible where it is [1] authentic under state equivalent to federal rule 901 [b] [9], [2] relevant under state evidence rules, [3] a “fair and accurate representation of the evidence to which it relates” and [4] its probative value substantially outweighs dangers of its admission); see also *Bray v. Bi-State Development Corp.*, supra, 949 S.W.2d 97–100 (noting that three guidelines for admissibility established in *Commercial Union Ins. Co.* as well as rule 901 [b] [9] of Federal Rules of Evidence provide “helpful starting point” but not adopting strict formula or set of guidelines).

We agree that “[r]eliability must be the watchword” in determining the admissibility of computer generated evidence; *Nooner v. State*, supra, 322 Ark. 104; and we conclude that these six factors adequately refine our requirement enunciated in *American Oil Co.* that, in order to lay a proper foundation for computer generated evidence, there must be “testimony by a person with some degree of computer expertise, who has sufficient knowledge to be examined and cross-examined about the functioning of the computer.” *American Oil Co. v. Valenti*, supra, 179 Conn. 359. In addition to the reliability of the evidence itself, what must be established is the reliability of the procedures involved, as defense counsel must have the opportunity to cross-examine the witness as to the methods used. We note that “[r]eliability problems may arise through or in: (1) the underlying information itself; (2) entering the information into the computer; (3) the computer hardware; (4) the computer software (the programs or instructions that tell the computer what to do); (5) the execution of the instructions, which transforms the information in some way—for example, by calculating numbers, sorting names, or storing information and retrieving it later; (6) the output (the information as produced by the computer in a useful form, such as a printout of tax return information, a transcript of a recorded conversation, or an animated graphics simulation); (7) the security system that is used to control access to the computer; and (8) user errors, which may arise at any stage.” R. Garcia, “‘Garbage In, Gospel Out’: Criminal Discovery, Computer Reliability, and the Constitution,” 38 UCLA L. Rev. 1043, 1073 (1991); see also K. Butera, “Seeing is Believing: A Practitioner’s Guide to the Admissibility of Demonstrative Computer Evidence,” 46 Clev. St. L. Rev. 511, 525 (1998) (proper authentication requires that reliability of computer process and accuracy of results be subject to scrutiny).

We believe that these factors effectively address a witness’ familiarity with the type of evidence and with the method used to create it, and appropriately require that the witness be acquainted with the technology

involved in the computer program that was used to generate the evidence. These factors also ensure that the hardware and software used to generate the evidence were adequate for that purpose and that the technology was reliable. As in our decision in *Porter*, we stress that these factors represent an approach to the admissibility of computer generated evidence, and not a mechanical, clearly defined test with a finite list of factors to consider. See *State v. Porter*, supra, 241 Conn. 79. “Trial courts must have considerable latitude in determining the admissibility of evidence in this area as in others.” *American Oil Co. v. Valenti*, supra, 179 Conn. 360. Although a trial court should weigh and balance these factors and decide whether they ultimately support the admissibility of the evidence, we offer these factors to serve as guideposts, and do not suggest that these factors necessarily are to be held in equipoise. See *Bray v. Bi-State Development Corp.*, supra, 949 S.W.2d 99 (“Few jurisdictions have attempted to enunciate a formula or fixed set of guidelines to govern the establishment of a foundation for computer-generated evidence other than business records. However, there is a developing consensus . . . which agrees on how the accuracy of computer-generated evidence can be established and gives a trial court sufficient parameters to exercise its discretion in this area without the need for a precise formula.”).

Applying these factors to the facts of the present case, we conclude that the state laid an adequate foundation for the Lucis enhancements of the bite mark photograph. First, Palmbach testified that the computer equipment is accepted as standard equipment in the field.²⁹ He testified that the Lucis program was relied upon by experts in the field of pattern analysis in a forensic setting. He further testified that the program had been used in “fingerprint pattern identification, bloodstain pattern identification, footwear and tire impression identification, and in bite mark identification.” Second, it was established that a qualified computer operator produced the enhancement. Palmbach’s testimony clearly demonstrated that he was well versed in the Lucis program. He was a well trained and highly experienced forensic analyst, and he testified to his qualifications as an expert in the analysis of pattern evidence and the enhancement of that evidence. Palmbach testified on cross-examination that he previously had created digitally enhanced images of footprints and tire prints, and that on two occasions, he had created digitally enhanced images of dental imprints on breasts. Additionally, Karazulas, an odontological expert, was with Palmbach throughout the process and was able to aid him in determining when the image was appropriately enhanced for forensic comparison. Contrary to the defendant’s assertion, there is no evidence in the record that Barbara Williams, the president and chief executive officer of the company that manufactured the

Lucis program; see footnote 29 of this opinion; actually participated in the enhancement, or that Palmbach relied on her expertise to produce a properly enhanced image. Rather, the record reveals that Palmbach and Williams merely had “discussions.” As the trial court stated in overruling the defendant’s objection to the admissibility of the evidence, “[t]he process at all times was under the control of [Palmbach].”

Third, the state presented evidence that proper procedures were followed in connection with the input and output of information. During direct examination, Palmbach testified accurately, clearly, and consistently regarding the process of the digitization of the image—wherein a photograph is transformed into pixels; see footnote 15 of this opinion;—and how Palmbach then had used the Lucis software to select comparable points of contrast and array them into layers. He also testified as to how the Lucis program then diminished certain layers in order to heighten the visual appearance of the bite mark. During voir dire and cross-examination, Palmbach further explained and clarified this process. In fact, he even demonstrated the enhancement process to the jury using a laptop demonstration. Importantly, Palmbach compared the enhanced photographs with the unenhanced photographs in front of the jury. When asked whether there was anything in the enhanced image that was not present in the original image, Palmbach testified: “No . . . there’s not. One of the features of Lucis is that it does not remove any pixels. It is only selecting to show you the range that you’ve asked for. Every one of those pictures and every bit of that contrast is still present in the enhanced portion It’s just that we’re diminishing some and bringing others forward . . . just for viewing purposes. But every bit of that information is still present. We have not selected out or deleted some of these pixels or any of the pixels.”

Fourth, the state adequately demonstrated that Lucis is a reliable software program. Palmbach testified that, in a forensic setting, the “primary concern is accuracy. . . . [W]e can’t choose a program in which it will delete, alter, or change that material in any form or fashion. If it does, it’s not suitable for this type of analysis.” He further testified that the Lucis program, unlike other computer programs such as Adobe Photoshop, does not even have image editing features and was not designed to edit the images it enhances. Therefore, the defendant’s concern that the computer edited or distorted the image is misplaced. Although Palmbach testified that he was not aware of the error rates regarding the Lucis program, he stated that he was aware of Lucis’ marketing papers and an article that had been written concerning Lucis, both of which claimed that the program was artifact free, which would contribute greatly to a low error rate. Additionally, Palmbach personally tested Lucis’ accuracy by making a known exemplar using a bite mark made by Karazulas on his own arm

and then subjecting it to enhancement.

Our review of the record through the lens of the previously enunciated factors reveals that the state presented testimony that sufficiently established the reliability of the evidence and the processes that produced it. Although Palmbach admitted that the algorithm itself was programmed by someone who “knows a lot more about computers” than he did, our review of the record reveals that Palmbach had sufficient knowledge of the processes involved in the enhancement to lay a proper foundation.

As we previously have mentioned, some commentators and courts divide computer generated evidence into separate categories of animation and simulation. It has been suggested that these categories determine which evidentiary foundation should govern the admissibility of the evidence. See *Commonwealth v. Serge*, supra, 58 Pa. D. & C.4th 71 (citing cases and commentary).³⁰ We repeat, however, that, at least in the present case, we do not find these categories to be helpful.³¹ Nor do we agree with commentary that suggests that application of the same standard to all types of computer generated evidence, without differentiation, will cause mischief. See F. Galves, “Where the Not-So-Wild Things Are: Computers in the Courtroom, the Federal Rules of Evidence, and the Need for Institutional Reform and More Judicial Acceptance,” 13 Harv. J.L. & Tech. 161, 256 (2000) (stressing importance of applying different standards of admissibility to animations and simulations because animations are illustrative evidence and thus should have lower threshold for admissibility than simulations admitted as substantive evidence). Instead, we see no harm in applying a single standard, one that is fairly stringent and uses reliability as its touchstone. As the presence and use of computer generated evidence in courtrooms increases, so will our understanding of its attendant processes. The drafters of rule 901 of the Federal Rules of Evidence recognized this potential familiarity with what today seems like nascent technology. The advisory committee notes to rule 901 provide that: “[r]ule 901 (b) (9) does not, of course, foreclose taking judicial notice of the accuracy of the process or system.” We believe that there is no harm in requiring the courts of this state to take the time to ensure that basic foundational requirements are met, particularly because the potential mischief³² caused by a standard that is too lax would be great.³³

Our research reveals that such an approach has echoes in distant jurisprudence. In the earliest cases that admitted sound recordings, video recordings, and even photographs, courts had strict admissibility requirements, but later relaxed these requirements as the technology involved gained greater acceptance with its consistent use. See J. Witkowski, “Can Juries Really Believe What They See? New Foundational Require-

ments for the Authentication of Digital Images,” 10 Wash. U. J.L. & Policy 267, 276–80 (2002) (citing cases); see also *Cunningham v. Fair Haven & Westville R. Co.*, 72 Conn. 244, 250, 43 A. 1047 (1899) (“[i]t is common knowledge that as to such matters, either through want of skill on the part of the artist, or inadequate instruments or materials, or through intentional and skillful manipulation, a photograph may be not only inaccurate but dangerously misleading”); *Dyson v. New York & New England R.R. Co.*, 57 Conn. 9, 24, 17 A. 137 (1888) (offer of photographs accompanied by testimony of photographer who took them as to their accuracy, and of surveyor who identified points of view). Like the photograph, even the most advanced technologies today will seem commonplace tomorrow. Importantly, the factors we enunciate in this opinion provide for both circumstances. Moreover, we note that, because the domain of computer generated evidence expands on a nearly daily basis, by the time we could make a ruling regarding one particular program or application, that program would become obsolete and a new one would take its place. We do not wish to enunciate a standard that is applicable today and useless tomorrow.

B

We next address the admissibility of the exhibits created with Adobe Photoshop. The following additional facts are relevant to the disposition of this issue. Through Karazulas, the state offered overlays, created with the use of Adobe Photoshop, which superimposed images of the defendant’s dentition over photographs of the bite mark.³⁴ Karazulas had extensive training and experience in the study of bite mark identification, and was admitted as an expert in the field of forensic odontology. He testified that bite mark identification is based upon the recognition of unique characteristics of the person whose teeth had left that mark. He further testified that different teeth leave varying marks; for example, incisors leave rectangular marks while cuspids leave pointed or triangular marks.

In the process of coming to the conclusion that the defendant was the biter, Karazulas employed a number of comparative techniques. First, Karazulas examined the molds made from the defendant’s teeth. He testified that, from these molds, he could discern several unique characteristics. In the upper left side of the mouth, the left upper cuspid was rotated instead of being flush to the other teeth, and the cuspid on the other side was also rotated. The upper left central and lateral incisors also were tipped forward. On the lower jaw, Karazulas pointed out that there were spaces behind several teeth—on the lower left between the cuspid and bicuspid, on the lower right between the cuspid and the lateral incisor, and between the right cuspid and the first bicuspid. He further pointed out that, “[a]s you look at the arch, it slants up to the right. All the teeth

move upward and to the right.”

Next, Karazulas examined unenhanced photographs of the bite mark. Looking at these, Karazulas could tell by their orientation that the marks had been inflicted by someone standing directly in front of the victim and approaching her breast in a head-on position. By the shape, circumference, size and individual characteristics of the bite marks, he could tell that the marks above the nipple had been made by the upper jaw, or maxillary teeth, and the marks under the nipple had been made by the mandibular teeth. With regard to the photographs, Karazulas stated that their quality was “excellent,” and that he could see the circumference of the arch, the individual characteristics of many teeth, the diastema, or spacing between the teeth, as well as “drag marks” where the tissue slid between the biter’s jaws.

Karazulas then compared the models made of the defendant’s teeth with the various photographs of the bite mark. He testified that any unique or identifiable characteristics of the defendant’s dentition depicted in the models appeared to have a corresponding mark on the victim’s breast, and likewise, that the markings on the breast of the victim contained a corresponding mark for every unique characteristic of the defendant’s dentition.

Lastly, Karazulas engaged in a series of steps that eventually led to the creation of the Adobe Photoshop overlays at issue in this case. First, he made a wax impression using the plaster molds taken of the defendant’s teeth.³⁵ Karazulas then placed the upper and lower molds of the defendant’s teeth onto a copy machine and printed out an image from these molds. Next, placing paper over that image, and holding it over a lighted surface, he manually traced out the biting edges of the teeth. That tracing was then photocopied³⁶ onto a clear piece of acetate, producing a transparent overlay depicting the edges of the defendant’s dentition.³⁷

Karazulas then had both enhanced and unenhanced photographs of the bite mark, as well as tracings of the defendant’s dentition, scanned into a computer. Because he was not familiar with Adobe Photoshop, and was using the program for the first time for an odontological match, Karazulas secured the assistance of Gary Weddle, a Fairfield University chemistry professor, to scan these images and create the overlays by using the computer program to superimpose the defendant’s dentition over the bite mark.³⁸ Karazulas relied on Weddle because he lacked the ability to do the superimpositions himself. Over the course of two days, Karazulas spent approximately seven to eight hours watching Weddle create the overlays. Karazulas testified that he instructed Weddle not to alter the original images in creating the overlays.

Using the Adobe Photoshop program, Karazulas testified that Weddle created a number of overlays. These overlays can be categorized into two types. First, there are overlays, such as state's exhibits 117 and 166, that are composed of tracings of the defendant's dentition superimposed over cropped photographs of the bite mark, both enhanced and unenhanced. Second, there are overlays composed of images of the defendant's actual teeth superimposed over photographs of the bite mark. This type of overlay, as depicted in state's exhibits 118 through 121, as well as state's exhibit 164, was created by: scanning portions of the molds taken of the defendant's teeth to create state's exhibit 115;³⁹ directing the computer software to isolate the upper layers of the occlusal edges of the molds from the images contained in state's exhibit 115; applying a process to the images of the teeth whereby the teeth became less opaque and more transparent; and lastly, superimposing the image of the translucent teeth over various photographs of the bite mark. On the basis of these processes, Karazulas concluded that the defendant had bitten the victim's breasts.

Referring to state's exhibit 119, an Adobe Photoshop overlay composed of an image of the defendant's translucent upper teeth superimposed over an unenhanced photograph of the bite mark, Karazulas testified as follows: "I observed that the shape of the bite mark on the breast and the arch that the teeth edges made were very consistent. And very pointedly the left central incisor, the tipping forward matched the discoloration of the bite mark area on the breast, and there is a noticeable gap without a mark where the cuspid on the upper left side is rotated. And the marks above the teeth to the left are pretty consistent with the shape of those incisal edges." Commenting on state's exhibit 117, an Adobe Photoshop overlay composed of tracings of the defendant's upper dentition superimposed over an unenhanced photograph of the bite mark, Karazulas testified: "It gives me the shape of the arch. A match of the arch is consistent with the mark above it. The upper front central incisor, left one, protrudes beyond the line or curvature matching the markings in the bite mark. And there are other marks of each of these two above that correspond to the circumference." Karazulas also testified with regard to state's exhibit 120, an Adobe Photoshop overlay composed of an image of the defendant's translucent upper teeth superimposed over a Lucis-enhanced photograph of the bite mark, stating: "We can see where each individual tooth falls into line with the discolorations on the breast and all the particular nuances, the upper left central incisor and the lateral, the arch bulges out. And the corresponding marks of the other teeth seem to fall right into the arch very well." He also stated, noting state's exhibit 121: "There's a very good relationship between the marks on the breast and each of the individual teeth in the lower jaw.

Each tooth seems to fit into the pattern very well.”

The defendant objected to the admission of these overlays for lack of foundation.⁴⁰ The state argued that a proper foundation had been laid because Karazulas could testify that the scanned photographs appearing in the overlays were fair and accurate renditions of the original photographs of the bite mark, and that the scanned tracings or scanned dental molds appearing in the overlays were fair and accurate renditions of original acetate tracings or original dental molds of the defendant’s dentition and, therefore, through authentication of the component parts, or individual layers, of the exhibits, the overlays themselves were authenticated. In essence, the state argued that Karazulas’ lack of knowledge about *how* the computer generated the evidence was irrelevant, reasoning that, because two pieces of reliable evidence had gone into the computer, what came out of the computer therefore necessarily had to be reliable.

The defendant argued that the reliability of what had come out of the computer was the issue, and that he could not test that reliability by questioning a person who merely had sat next to the machine. The defendant referred to the issue at hand as a “black-box phenomenon,” whereby the jury was being asked to trust the computer. The defendant further argued that, although two separate images that could be authenticated were “fed” into a computer, there was no way for Karazulas to authenticate independently the result of the two images being superimposed other than by saying that the resulting product was a fair and accurate representation of what “came out” of the computer. The defendant pointed out that the reliability of what had gone into the computer does not ensure that the evidence coming out of the computer is also reliable, and that a witness who had spent almost eight hours merely watching another person create the superimposition was “uniquely disqualified” to testify regarding the inner machinations of the computer that had produced the evidence. The defendant argued that it was impossible for him to test the reliability of the machine itself or the process used with a witness who could attest, based on the naked eye, only to the fact that the exhibit produced at trial was a fair and accurate representation of what came out of the machine. As the defendant pointed out: “[T]here were two steps. There was a scan. There was transmission of one form of data into another form. There are questions about the accuracy of the transmission. Then that went in somewhere and was translated into . . . the digital impulses that are computers. Then they were sorted by some process and they were superimposed one upon the other. It’s not enough to say . . . A looks like A, B looks like B, and look what the computer did.”

The trial court admitted the Adobe Photoshop

images. The court reasoned that Karazulas' expertise was the important factor in determining whether the images should be introduced into evidence because it was his expertise that could judge whether the finished product accurately represented subjects or items or the juxtaposition of subjects and items about which he is an expert, not the computer expert who may have facilitated the creation of the exhibits.

On appeal, the state resurrects its argument that, because the exhibits used to create the overlay—the photographs of the bite mark and the tracings or molds of the defendant's teeth—were authenticated properly, the overlay itself, as a product of the two, was authenticated as well.⁴¹ In addition, the state claims that the overlays created by Adobe Photoshop are the equivalent of what could be seen if a tracing of the defendant's teeth manually were placed over a photograph of the bite mark.

The defendant claims on appeal that, “[i]n this case, the computer was used to *create* a picture which did not exist before,” and that “[a] dramatic new technique was used to *create* the single most important piece of evidence offered” (Emphasis in original.) Unfortunately, we find ourselves incapable of evaluating just how true these assertions are and that inability underscores the problem at issue here.⁴² Unlike Palmbach's ability to testify regarding the Lucis enhancement process, Karazulas was not able to testify in accordance with the standard set forth in part I A of this opinion; specifically, he could not testify as to whether the computer processes that were used to create the overlays were accepted in the field of odontology as standard and competent,⁴³ whether proper procedures were followed in connection with the input and output of information,⁴⁴ whether Adobe Photoshop was reliable for this sort of forensic application,⁴⁵ or whether the equipment was programmed and operated correctly. Nor was Karazulas capable of testifying that a qualified computer operator was employed; he could testify only that, because he did not know enough to perform the process himself, he had someone else do it. In fact, when asked how the computer actually superimposed the tracing of the biting edges of the defendant's teeth over the photograph, Karazulas merely stated that “Weddle . . . moved them together.” Moreover, we note that Palmbach testified that, unlike the Lucis program, the Adobe Photoshop program was capable of actually altering photographs.⁴⁶

Karazulas, a highly qualified odontologist, recognized his own limitations as a witness with respect to the Adobe Photoshop evidence. He admitted that he had “no skill or experience” with Adobe Photoshop. When asked whether the computer bent the image in some respects in order to account for the curvature of a three-dimensional object, such as a breast, when the

computer is actually superimposing one two-dimensional flat image onto another, Karazulas responded that he did not think that the computer could do so, but stated: “I’m not an expert in it, but I think we [can] get somebody who knows computers, they can explain that.”

Karazulas also testified that the images of the defendant’s teeth, which had been produced by scanning the molds of his teeth, had also been subjected to a process whereby Adobe Photoshop “cut layers” in order to make the images of the teeth less opaque for purposes of the superimposition. This “layering” effect allows the program user to adjust the opacity of an object in order to see other images *through* the object—in other words, to make one object nearly transparent. When asked about Adobe Photoshop’s capability to create this see-through effect, Karazulas had trouble describing it. “We’d have to ask an Adobe [Photoshop] expert, I guess, or a technician what that means, but when you see it done on the screen, it makes sense.” Later, in response to direct questioning from the trial court concerning this same process, Karazulas stated: “Judge, you got me,” “I don’t know how they do it, but they do it,” and “I think we really need an engineer.”

A witness must be able to testify, adequately and truthfully, as to exactly what the jury is looking at, and the defendant has a right to cross-examine the witness concerning the evidence.⁴⁷ Without a witness who satisfactorily can explain or analyze the data and the program, the effectiveness of cross-examination can be seriously undermined, particularly in light of the extent to which the evidence in the present case had been “created.” Karazulas lacked the computer expertise to provide the defendant with this opportunity.⁴⁸ For example, in response to a question asked by defense counsel regarding the superimposition of the image of the defendant’s teeth over the bite mark, Karazulas responded: “I see [Weddle] do it with the mouse and I see him clicking things; but, I mean, you have to be very experienced.” Later in the cross-examination, Karazulas explained the software this way: “Adobe [Photoshop] can put a picture on your screen, and then you could take a model and scan that into the photograph and you can make matches.” In particular, Karazulas also could not articulate sufficiently how the visual effect of the defendant’s translucent teeth superimposed over the bite mark was produced.⁴⁹ The defendant should have had the opportunity to question someone who could testify accurately as to the reliability of the evidence and the processes used to generate it. In this case, one possible candidate was the person who “created” the overlay—Weddle, the Fairfield University professor whom Karazulas had used to craft the superimposition of the defendant’s dentition over the images of the bite mark.⁵⁰ We conclude that, based on the standards discussed in part I A of this opinion, the

trial court improperly admitted the Adobe Photoshop overlays.⁵¹

In light of this conclusion, we next must consider whether the admission of the Adobe Photoshop overlays violated the defendant's constitutional rights, or whether the error was merely evidentiary in nature. See *State v. Morales*, 78 Conn. App. 25, 38, 826 A.2d 217 (“[w]e begin our analysis by considering whether the defendant has actually raised a claim of constitutional magnitude or whether he is robbing a garden variety evidentiary claim in the majestic garb of constitutional claims”), cert. denied, 266 Conn. 901, 832 A.2d 67 (2003). The defendant claims that the admission of this evidence without a proper foundation obstructed his constitutional right to confrontation. “The right to confrontation is fundamental to a fair trial under both the federal and state constitutions. *Pointer v. Texas*, [supra, 380 U.S. 403]; *State v. Jarzbek*, 204 Conn. 683, 707, 529 A.2d 1245 (1987), [cert. denied, 484 U.S. 1061, 108 S. Ct. 1017, 98 L. Ed. 2d 982 (1988)] It is expressly protected by the sixth and fourteenth amendments to the United States constitution;⁵² *Davis v. Alaska*, [supra, 415 U.S. 315]; *Pointer v. Texas*, supra [403]; and by article first, § 8, of the Connecticut constitution. *State v. Torello*, 103 Conn. 511, 513, 131 A. 429 (1925).” (Citation omitted.) *State v. Hufford*, 205 Conn. 386, 400–401, 533 A.2d 866 (1987).

“Our analysis of the defendant's claim is guided by the familiar constitutional guidelines relevant to cross-examination by the defendant in a criminal trial. It is axiomatic that the defendant is entitled fairly and fully to confront and to cross-examine the witnesses against him.” (Internal quotation marks omitted.) *State v. Reynolds*, 264 Conn. 1, 58, 824 A.2d 611 (2003). “The confrontation clause . . . requires that the defendant be accorded some irreducible minimum of cross-examination into matters affecting the reliability and credibility of the state's witnesses.” *State v. Ortiz*, 198 Conn. 220, 224, 502 A.2d 400 (1985). “The defendant's right to cross-examine a witness, however, is not absolute.” (Internal quotation marks omitted.) *State v. Francis*, 267 Conn. 162, 181, 836 A.2d 1191 (2003). “We have observed that a defendant's right [to cross-examination] is not infringed if the defendant fails to pursue a line of inquiry open to him. . . . The test is whether the opportunity to cross-examine existed, not whether full use of such opportunity was made.” (Internal quotation marks omitted.) *State v. Delgado*, 261 Conn. 708, 720, 805 A.2d 705 (2002). “In order to comport with the constitutional standards embodied in the confrontation clause, the trial court must allow a defendant to expose to the jury facts from which the jurors, as the sole triers of fact and credibility, could appropriately draw inferences relating to the reliability of the witness. . . . In determining whether a defendant's right of cross-examination has been unduly restricted, we consider the nature of the

excluded inquiry, whether the field of inquiry was adequately covered by other questions that were allowed, and the overall quality of the cross-examination viewed in relation to the issues actually litigated at trial.” (Internal quotation marks omitted.) *State v. Sandoval*, 263 Conn. 524, 535, 821 A.2d 247 (2003).

We recognize that foundational questions are generally of an evidentiary nature, and, in most instances, a mere evidentiary error will not rise to the level of a constitutional error. *State v. Vitale*, 197 Conn. 396, 403, 497 A.2d 956 (1985) (“[e]very evidentiary ruling which denies a defendant a line of inquiry to which he thinks he is entitled is not constitutional error”). The present case, however, is somewhat unique, based on the nature of the evidence, its significance to the case and the witness’ inability to attest to its trustworthiness. We therefore inquire whether the court’s ruling that the evidence had a satisfactory foundation, and the subsequent omission of testimony from Weddle, or any other person knowledgeable about the processes that created the evidence in this case, infringed on the defendant’s right to confrontation.

The relevant scope of inquiry in the present case is whether the defendant was given an adequate opportunity to cross-examine Karazulas concerning his identification of the defendant as the biter. To that end, we observe that Karazulas’ conclusion that the defendant’s dentition matched the bite mark on the victim’s breast involved several admissible building blocks, including molds of the defendant’s teeth, a wax impression taken from the molds, acetate tracings of the biting edges of the defendant’s teeth, and enhanced and unenhanced photographs of the bite mark. The defendant had the opportunity to cross-examine Karazulas freely regarding all of these exhibits and how they informed his conclusion. Any failure to take full advantage of such an opportunity does not render the improper admission of the Adobe Photoshop overlays, just one part of the evidentiary whole, a confrontation issue.

Moreover, we note that the defendant had his own expert use the Adobe Photoshop overlays to support his conclusion that the defendant was not the biter. Neal Riesner, a forensic dentist, testified on behalf of the defendant that, to a reasonable medical certainty, the state’s exhibits, including the overlays, did not reflect a match between the defendant’s dentition and the bite mark. For example, regarding state’s exhibit 121, an Adobe Photoshop overlay of an image of the defendant’s translucent lower teeth over a Lucis enhanced photograph of the bite mark, Riesner specifically pointed out that there was a tooth with no corresponding mark and that the overlay revealed no individual characteristics of the teeth. Riesner testified that state’s exhibit 119, an Adobe Photoshop overlay composed of an image of the defendant’s translucent

upper teeth superimposed over an unenhanced photograph of the bite mark, and state's exhibit 117, an Adobe Photoshop overlay composed of tracings of the defendant's upper dentition superimposed over an unenhanced photograph of the bite mark, depict the bite mark as having a wider arch than the defendant's teeth. According to Riesner, state's exhibit 118, an Adobe Photoshop overlay of an image of the defendant's translucent lower teeth over an unenhanced photograph of the bite mark, revealed a tooth that was wider than its corresponding mark, teeth with no corresponding marking, and a crack between two teeth with no corresponding mark. Additionally, state's exhibit 120, an Adobe Photoshop overlay composed of an image of the defendant's translucent upper teeth over a Lucis enhanced photograph of the bite mark, revealed a rotated maxillary right cuspid with no corresponding mark. Riesner testified that there were no visible concordant points between the defendant's dentition and the bite mark that were visible from viewing state's exhibits 117, 118, 119 or 121.

In addition to pointing out defects in the component exhibits Karazulas used to create the overlays, Riesner complained about the quality of the Adobe Photoshop overlays themselves. He insisted that the images were too cloudy or blurry to allow a positive match. He also testified that the computer generated overlays were problematic because they entailed the "arbitrary select[ion]" of "levels" of the images, thus falsely increasing the appearance of a match between the defendant's dentition and the bite mark.⁵³ He also pointed out that the computer generated overlays relied on flattened images of a curved surface. In addition, Riesner stated that he could not tell if anything in the images that appeared in the overlay had been "corrected." He disagreed that computer generated overlays were the "gold standard" compared to other methods of generating overlays, and further disagreed that computer generated overlays provided "the most reproducible and accurate exemplars."

Riesner's ability to testify from the Adobe Photoshop overlays that there was no match between the defendant's dentition and the bite mark, even considering his criticism of the overlays, undermines the significance of the defendant's inability to question Weddle, or anyone else, regarding how those exhibits were actually created. As Riesner's testimony makes clear, the defendant was given an opportunity to reveal adequately the infirmities of Karazulas' conclusion. Riesner's testimony actually highlighted the potential lack of reliability of the evidence for the jury, and so, his ability to testify from the overlays closed any gaps concerning those things on which the defendant was unable to cross-examine Karazulas directly.

Therefore, we determine that the trial court's ruling

did not, under all of the circumstances in this particular case, have the effect of violating the defendant's right of confrontation. See *State v. George*, 194 Conn. 361, 366, 481 A.2d 1068 (1984) (trial court's "isolated ruling does not in the context of the whole case amount to a deprivation of the opportunity to reveal the facts from which the jury could appropriately draw inferences relating to the reliability of the witness" [internal quotation marks omitted]), cert. denied, 469 U.S. 1191, 105 S. Ct. 963, 83 L. Ed. 2d 968 (1985). In satisfaction of his right to confrontation, the defendant had a meaningful opportunity to probe the reliability of Karazulas' identification testimony. Thus, the error was evidentiary in nature and not constitutional.

Accordingly, we shall examine whether the evidentiary impropriety was harmless. In order to establish reversible error on an evidentiary impropriety, the defendant must "demonstrate that it is more probable than not that the erroneous action of the court affected the result. . . . *State v. Meehan*, 260 Conn. 372, 397, 796 A.2d 1191 (2002)." (Internal quotation marks omitted.) *State v. Kirsch*, supra, 263 Conn. 412.⁵⁴

The defendant claims that the admission of the computer generated evidence was harmful in light of Karazulas' reliance on the improperly admitted exhibits, as well as the absence of other compelling evidence connecting him to the crime. Specifically, the defendant points to the fact that the bite mark match critically depended on the Adobe Photoshop software. First, the defendant argues that, solely on the basis of the molds and tracings of the defendant's teeth and the photographs of the bite mark, Karazulas testified generally about a few characteristics common to both. On the basis of his review of all the exhibits, specifically the Adobe Photoshop overlays, however, Karazulas testified regarding fifteen unique characteristics. Second, the defendant refers us to several points in Karazulas' testimony demonstrating his reliance on the Adobe Photoshop overlays to conclude that the defendant was the biter. In sum, the defendant asserts that, when testifying to the match visible in the Adobe Photoshop exhibits, Karazulas described the bite marks as being "very consistent" and having a "very good relationship" with the defendant's dentition. In contrast, regarding the original match made before the use of the Adobe Photoshop software, Karazulas stated that he "saw a match there from the old technique we used." The defendant also refers us to several places in the transcript wherein Karazulas describes the impact of the Adobe Photoshop software on his ability to be confident in the match as proof that the inadmissible overlays were an indispensable part of Karazulas' conclusion. Therefore, in light of the perceived objectivity of the evidence because it was computer generated, and the strong visual impact that such evidence could have had on the jury, the defendant claims that the harm suffered was over-

whelming.

In addition, the defendant points out that the harm from the overlays is not eliminated merely because the jury could have compared them with properly admitted exhibits, because jurors are not qualified to engage in odontological matching. More important, the defendant argues, because an odontological match requires pinpoint accuracy, visual inspection by laypersons is not an adequate substitute for testimony establishing the accuracy of an exhibit. The defendant also contends that jurors tend to give considerable weight to “scientific” evidence, and that the possibilities that a “juror would ignore the opinion of an expert based upon the juror’s own visual inspection are quite remote.” Specifically, after Karazulas’ testimony characterizing the computer match as “scientific” and incapable of error, and after the exhibits were admitted into evidence, according to the defendant there was no reason for the jury to “recreate” the overlays themselves in order to examine them and determine the extent to which they matched their corresponding individual parts.

Lastly, the defendant claims that the bite marks were the only physical evidence connecting him to the victim. Without the match of his teeth to the bite mark, the defendant argues, the state’s case consisted of nothing more than a nondescript bra, common household objects—safety pins and garbage bags—and admissions made by the defendant to individuals involved with drugs and crime. The defendant contends that no jury would have convicted him on such “flimsy” evidence.⁵⁵

In response, the state first relies on its incorrect assertion that, because the overlays only served to “illustrate” Karazulas’ conclusion; see footnotes 20 and 41 of this opinion; instead of serving as actual evidence that resulted in identification of the defendant as the biter, the admission of the overlays was harmless. Second, the state asserts that any harm caused by the overlay was ameliorated by the jury’s ability to test the accuracy of what the computer had generated by taking the original exhibits and manually laying one over the other to see if it could replicate the computer’s results.⁵⁶ Finally, the state relies on the other evidence produced at trial to prove harmlessness. Specifically, the state points to the existence of the victim’s bra and the brown trash bags, discovered in and around the defendant’s apartment building, the safety pins found in the defendant’s van, and the various confessions and incriminating statements the defendant made to Arnold, Scalise, and others. After a careful review of the record, we agree with the state that the evidence produced at trial mitigates any harm that resulted from the improper admission of the overlays.

Karazulas’ conclusion, following his examination of the overlays, that the defendant was the biter was definitive and to the highest degree of certainty. Karazulas

stated: "I believe that with reasonable medical certainty without any reservation that these marks were created by [the defendant's] teeth." Importantly, however, Karazulas testified that he also had rendered an opinion in this case in 1998, prior to the use of the Lucis and Adobe Photoshop software programs, and that his opinion in 1998 also involved a conclusion "to a reasonable degree of medical certainty," the highest certainty in the field. We note that Karazulas testified that, throughout his career, he had examined approximately 5000 different bite marks. In addition, he testified that there were numerous situations in which he was asked to render an opinion as to bite mark evidence, but that, unlike the present case, he frequently determined that such evidence was inadequate from which to draw a conclusion. This testimony informs the level of certainty he displayed regarding his pre-Adobe Photoshop identification of the biter. Therefore, although it may be true that, as the defendant contends, the majority of Karazulas' testimony regarding his conclusion that the defendant was the biter centered around the match that was visible from the Adobe Photoshop exhibits, that does not mean that Karazulas relied on those exhibits, before trial, to establish such a match. In fact, the testimony reveals otherwise. When asked whether he was "just as certain prior to the use of the computer," Karazulas answered in the affirmative, but subsequently added that "if anything, [his conclusion had] gotten stronger" due to the availability of Adobe Photoshop.

As we previously have discussed, Karazulas testified that the molds of the defendant's dentition demonstrated several unique characteristics, including two rotated cuspids, two tipped incisors and a slanted arch. A wax impression taken from the molds revealed some of the same characteristics, as well as diastema, and the uneven length of some of the defendant's teeth. Karazulas further testified that acetate tracings also illustrated these unique characteristics. In addition, Karazulas was able to compare all of these exhibits, which represented the defendant's dentition, with photographs of the bite mark. Karazulas testified that the quality of the bite mark was "excellent," and that from it he could "see the circumference of the arch and . . . [the] individual characteristics of many teeth."

Notably, at one point in the testimony, in an attempt to recreate the experiments that Karazulas employed to establish the time of the bite in relation to the victim's death, defense counsel used the molds of the defendant's teeth to put a "bite mark" on his own arm. Karazulas used this opportunity to point out to the jury the unique marks the molds left on defense counsel's skin. Addressing the jury, Karazulas stated: "I'm going to show them what a diastema looks like. Now, look. See that space? That's because the cuspid is turned. Now, look at this left cuspid sticking up. Exactly like the photograph. You did wonderful. Let's show the rest of

the jury. Because that cuspid is turned, the point is in a different place, there's a diastema. There's the central. And it's above this central. These two come up. Beautiful. Show these people. The photograph in my eyes looks just like what we have here. There's the diastema because of the rotated cuspid. Here's the central incisor above the plane of the lateral. Here's the diastema on the other side." It is clear, then, from our review of the record, that Karazulas' ultimate conclusion that the defendant was the biter did not rely upon the Adobe Photoshop overlays, but instead depended on Karazulas' studied comparison of properly admitted exhibits, such as the molds of the defendant's teeth, a wax impression taken from the molds, tracings of the defendant's dentition, and the enhanced and unenhanced photographs of the bite mark, as well as a persuasive impromptu demonstration in front of the jury. The Adobe Photoshop overlays served merely to augment the certainty of his conclusion.

We conclude that Karazulas' properly admitted testimony regarding exhibits other than those created using Adobe Photoshop goes a long way in rendering harmless the improperly admitted evidence. In the next stage of this inquiry, we turn to the other evidence that was before the jury. The physical evidence in this case included a black bra, identified as the one the victim wore on the night of her murder, and trash bags, like the one wrapped around the victim's body, found in and around the defendant's apartment building in Stafford Springs, as well as safety pins found in his van. In addition to these items, there was considerable testimony regarding the numerous confessions and other incriminating statements the defendant had made to several different witnesses, including a police lieutenant, a journalist, a shop manager, a coworker and his landlord.

Specifically, the defendant revealed his anger toward women and prostitutes to many different witnesses, stating that women like the victim "get what they deserve." The defendant also made incriminating remarks during an interview with a journalist. In response to being asked why the killer could not stop murdering women, he stated, "If I knew that, I would stop tomorrow. . . . So somebody could live." Moreover, the defendant told several acquaintances that he had "gotten away" with murder. When his landlord asked the defendant what it was like to rape and kill a woman, he grinned and laughed aloud. When one of the defendant's coworkers asked him what it felt like to strangle a woman, the defendant responded by violently choking the man. Lastly, Scalise, a fellow inmate at the time of the defendant's trial, testified to numerous conversations in which the defendant offered detailed accounts of the victim's murder. The defendant confessed to Scalise that he had bitten the victim on the breast while having sex with her, had beaten her in the

face, and had strangled her. He admitted to Scalise how, after he had killed the victim, he had taken her bra and underwear, “bagged” her, and then “dumped” her body in a snow bank near a university. The defendant admitted to removing the safety pin from the victim’s bra and later using it to repair his van. There is no indication in the record that Scalise became aware of such accurate details of the crime from any source but the defendant.

The defendant argues that most of the witness’ testimony against him was impugnable. Specifically, he draws our attention to the fact that Arnold, Mills and Stallings were all addicted to and under the influence of drugs at various times before, during and after the defendant made statements to them. In addition, the defendant points out that both Arnold and Scalise were incarcerated at the time they shared with the police information concerning the defendant, and suggests that their incarceration gave them a motive to cooperate with the state. Lastly, the defendant asserts that some of the witnesses had personal reasons for testifying against him. Specifically, Mills admitted that she testified, in part, because her sister was the victim of a homicide, and Arnold testified that he had strong “personal feelings” for the victim. Regardless of these possible infirmities, however, the jury *could* have credited the testimony of these witnesses and we continually have held to the rule that we will not judge the credibility of witnesses nor substitute our judgment for that of the trier of fact. See *PSE Consulting, Inc. v. Frank Mercede & Sons, Inc.*, 267 Conn. 279, 312, 838 A.2d 135 (2004) (“[i]ssues of credibility are uniquely within the province of the jury”); *State v. Francis*, supra, 267 Conn. 187 (jailhouse witnesses no less reliable than other witnesses).

Therefore, in light of the numerous confessions and other incriminating statements the defendant made to several people, as well as the aforementioned physical evidence, in combination with Karazulas’ testimony regarding properly admitted exhibits that tied the defendant inextricably to the bite mark, we conclude that the improper admission of the Adobe Photoshop overlays was harmless.

II

We next turn to the defendant’s claim that the trial court improperly declined to mark as an exhibit certain documents that were not offered into evidence. Specifically, Rovella, the lead investigator in this case, referred to some of his numerous police reports dating back to 1991 in order to refresh his recollection during direct examination. No attempt was made to have those items marked for identification nor was there any objection to their use. During cross-examination, the defendant asked Rovella whether earlier, during his direct examination, he had refreshed his memory by referring to

documents that were inside an “envelope.” Rovella acknowledged that he had. Rovella also acknowledged that the envelope contained other documents that he had not relied on. The defendant then asked to have all of the documents inside the envelope marked for identification. The state objected and the court ruled that the defendant could examine only those documents that Rovella had used to refresh his recollection. The defendant then asked Rovella to remove from the envelope those documents that he had used to refresh his memory. In an effort to comply, Rovella removed from the envelope all of the documents that he had authored. Although Rovella was able to identify one document that he had used to refresh his memory, he was not able to identify a second document that he had used.

On appeal, the defendant claims that the trial court improperly denied his request to mark for identification Rovella’s envelope and everything contained therein. Specifically, he contends that the trial court’s failure to mark those items deprived him of the opportunity to preserve for appellate review the documents used to refresh the witness’ recollection in violation of his statutory right to appellate review and his constitutional right to due process.

The state does not contest the fact that the defendant is entitled to see whatever Rovella used to refresh his recollection. Rather, the state first claims that it was the defendant’s responsibility to voice his interest in a timely manner and that his failure to do so left the witness unable to identify definitively which reports of the many that he had prepared helped to refresh his recollection. Next, the state argues that the reason a trial court must allow an item to be marked for identification is to allow a reviewing court to assess the propriety of the trial court’s ruling denying its admission into evidence. According to the state, because no attempt to offer evidence was made herein, the purpose behind the rule is not served and hence the rule is not applicable.

We need not address the propriety of the trial court’s denial of the defendant’s request, nor the policy behind marking documents for identification. On the basis of the record in this case, we conclude that the defendant was not harmed by the trial court’s ruling. Rovella could not state with specificity which other document he had used to refresh his recollection. He could state, however, that it was a police report that he personally had authored. There has been no claim that any of Rovella’s statements had not been disclosed pursuant to Practice Book § 40-13 (a) (1).⁵⁷ Indeed, as the defendant stated at trial: “[D]uring the course of trial . . . [the state’s attorney] had offered me an opportunity to look at all the reports and he has permitted me to review the contents of his folder with regards to . . . Rovella” Accordingly, all of Rovella’s reports previously

had been disclosed to the defendant, thereby allowing him to preserve *any* claim in connection thereto for appellate review.

III

The defendant next requests that the court examine two letters written by Arnold, an acquaintance of the defendant who testified against him at trial, in order to determine whether any additional material in the letters should have been disclosed. The defendant claims, essentially, that the trial court improperly declined to provide him with *unredacted* versions of the two letters.

The record reveals the following facts pertinent to this claim. After Arnold testified, the state moved for a protective order, pursuant to Practice Book § 40-41 (3),⁵⁸ to limit the required disclosure of two statements the witness had provided, one letter dated July 4, 2000, and another dated June 7, 2000,⁵⁹ both addressed to an inspector in the state's attorney's office. The state argued that, because only certain portions of the letters pertained to Arnold's direct testimony, and the remaining portions related to other pending criminal investigations, the state should not have to disclose the letters in their entirety. The defendant argued that a prohibition on viewing the unredacted letters deprived him of the right effectively to cross-examine Arnold. Pursuant to Practice Book § 40-13 (c),⁶⁰ the state provided the court with the two letters under seal, which the court marked as court exhibits 5 and 6, and the redacted versions, exhibits 5A and 6A, were disclosed to the defendant. In accordance with Practice Book § 40-42,⁶¹ the trial court examined the letters and concluded that they "relat[ed] to the ongoing investigation of other crimes" and were thus protected from disclosure. We agree with the trial court's determination.

The issue is whether the trial court properly determined that the excised material in the letters did not relate to the subject matter of Arnold's testimony or that redacting certain portions of the statements was necessary for "[t]he maintenance of secrecy regarding informants as required for effective investigation of criminal activity" Practice Book § 40-41 (3). We analyze the sealed undisclosed portion of the letters to determine whether the court abused its discretion. See *State v. Harris*, 227 Conn. 751, 762-63, 631 A.2d 309 (1993) (appellate review of confidential personnel file to determine whether trial court's failure to disclose was proper). After our own in camera review, and keeping in mind the parameters of the pertinent Practice Book provisions, we conclude that the court properly relied on both grounds in refusing to turn over limited portions of the statements and, therefore, did not abuse its discretion.

IV

The defendant next claims that the trial court impro-

erly refused to sequester members of the victim's family who were scheduled to testify as witnesses at trial. Specifically, he claims that the failure to sequester Laverne Terry, the victim's sister, allowed her to witness and, thereafter, testify to prejudicial events that occurred in the courtroom.

The record reveals the following facts and procedural history. At the start of voir dire, the defendant sought a sequestration of "[a]ny and all potential witnesses" pursuant to General Statutes § 54-85a.⁶² A second request was made at the start of evidence. The state objected both times, raising the rights of victims to be present in court under General Statutes § 54-85f⁶³ and article first, § 8, of the state constitution, as amended by article twenty-nine of the amendments.⁶⁴ The court thereupon balanced the rights of all involved and made the following remarks: "[I]t is my intention to make sure that this trial is fair to everybody concerned. And in particular the defendant and in particular the family members of the deceased. In order to do that the defendant, of course, has an absolute constitutional right to be present at every stage of the trial. The family members of the victim in this case have a right to be present which is limited. It is not an absolute right under the constitution of the state of Connecticut, under the laws of the state of Connecticut or under the constitution of the United States. But I will allow them to be present notwithstanding that they are going to be testifying.

"However, it may be that I'm going to exclude one or all of them during some of the testimony. And the reason that I would do that is to avoid any possible danger that their testimony might be influenced by what they hear in the courtroom before they testify. . . . [S]ometimes . . . people can be influenced by things they hear even unconsciously and unintentionally. But the requirement that this trial be fair to everybody and that the jury hear witnesses who are testifying accurately based on their own recollection of events, uninfluenced by what they hear in the courtroom, requires that in some cases it may be that I'm going to have to exclude one or more of the family members while some witness or another is testifying. *And I'm going to ask the attorneys to be particularly vigilant in this regard so that when a witness is called, whether it be by the prosecution or by the defendant, that they alert me . . . if there is a belief that the testimony of the witness who is about to testify would materially affect the testimony of any of these family members. So I can make a ruling on a witness-by-witness basis.*" (Emphasis added.)

Following the testimony of Laverne Terry on January 23, 2001, the trial court instructed her not to "discuss what you've said here with anybody until the case is over." No request to sequester her, however, was made at that time. When she was recalled on February 26,

2001, to give additional testimony that had required a foundation set by other state's witnesses in the interim, the state sought to elicit Laverne Terry's testimony regarding an incident in the courtroom that she had witnessed. In specific, when Arnold testified regarding an incriminating conversation he had overheard between the defendant and his brother, Larry Swinton, the defendant turned toward his brother, who was seated in court behind him, and made some gestures that Laverne Terry witnessed. She described the defendant's reaction as "[u]gly." The defendant objected to the testimony and resurrected his sequestration claim. The court overruled the objection, noting that the defendant had failed to renew the sequestration claim prior to or during Arnold's testimony despite the court's earlier pronouncement that it would consider sequestration requests concerning the victim's family members on a piecemeal basis.

The defendant claims that the trial court, in reliance on article first, § 8, of the Connecticut constitution as amended; see footnote 64 of this opinion; improperly declined to sequester the members of the victim's family. Essentially, the defendant argues that the trial court improperly elevated the victims' rights amendment over his right to sequester witnesses under § 54-85a. See footnote 62 of this opinion. He further argues that the state should bear the burden of demonstrating that he was not prejudiced by Laverne Terry's testimony regarding the exchange between the defendant and his brother. The state argues, inter alia, that, because the defendant had not moved to exclude Laverne Terry, in particular, from the courtroom at any relevant time, his claim that the *trial court* had failed to act properly is unfounded. We agree with the state.⁶⁵ The trial court expressly indicated a willingness to consider any additional motions for sequestration and encouraged the state and the defendant to be "vigilant" about making such requests. It was the defendant's failure to renew his motion that allowed Laverne Terry to remain in the courtroom to witness the defendant's conduct.⁶⁶ Accordingly, the defendant's claim must fail.

V

The defendant also argues that the trial court improperly allowed Scalise, imprisoned at the Hartford correctional center at the same time as the defendant, to testify regarding statements that the defendant had made to him. Specifically, the defendant claims that Scalise, a private citizen, was acting as an agent of the police when he engaged the defendant in conversations during which the defendant made incriminatory statements. The defendant maintains that the trial court's admission of these statements violated his constitutional right to counsel. See U.S. Const., amend. VI; Conn. Const., art. I, § 8.

The following facts and procedural history are perti-

ment to this claim. When the state attempted to call Scalise as a witness, the defendant objected to his testimony, claiming that Scalise had acted as an agent of the police and that the defendant's statements had been taken in violation of his right to counsel under the state and federal constitutions. A hearing was held during which Scalise testified regarding the circumstances under which the defendant had made incriminating statements.

Thereafter, the trial court made the following specific findings. In October, 2000, Scalise had been in contact with the state police concerning a case unrelated to the defendant and had furnished a six page statement about that case. Scalise's involvement in that case thereafter was terminated. In November, 2000, Scalise again furnished information to the state police on another unrelated case. While that case was still active, Scalise overheard the defendant in the present case make death threats against some of the witnesses against him. The statements at issue were made during conversations between Scalise and the defendant, which occasionally took the form of question and answer. On January 31, 2001, Scalise attempted to notify the police but was unable to make contact until February 7, when he informed an official of the Hartford correctional center about the threats the defendant had made. On February 16, 2001, Scalise met with Trooper Daigle of the state police and Rovella, who was then an inspector with the chief state's attorney's office,⁶⁷ at which time Scalise related the defendant's statements to them. Prior to the February 16 meeting, the police had not instructed Scalise to gather information about this case, or any other, nor had they indicated to Scalise that he would be rewarded in any way for his information. Therefore, the trial court concluded that prior to that meeting, Scalise had not been acting as an agent of the police in connection with the defendant.

Scalise subsequently met with Daigle and Rovella on February 22, 2001, at which time he disclosed additional incriminating information the defendant had divulged to him. With regard to those particular statements, the trial court found that, following the February 16 interview with the police, Scalise had become an agent of the police when he signed an agreement to that effect and was returned to the prison population "with the knowledge of the state that he was to essentially be a listening post." Although Scalise had become an agent of the police, the trial court nevertheless concluded that, based on the instructions from the police merely to listen and not to question the defendant about the murder in the present case, Scalise "was no more than a passive listener and did not deliberately elicit any information." Accordingly, the trial court denied the defendant's motion to suppress Scalise's testimony about the defendant's statements made prior to February 22, 2001.⁶⁸

On appeal, the defendant claims that the trial court improperly failed to suppress Scalise's testimony regarding the defendant's statements. As the defendant recognizes, a necessary predicate to this constitutional claim is a determination that the incriminating statements that he seeks to suppress were in fact elicited from him as a result of interrogation by Scalise acting as an agent of the police. See *State v. Alexander*, 197 Conn. 180, 183, 496 A.2d 486 (1985). The defendant contends that Scalise was acting as an agent throughout his interaction with the defendant because, based on his ongoing relationship with the state police, Scalise had gathered information for the state "in the hope and expectation of obtaining release from prison" and thus, the state "created a situation in which incriminating statements were likely to be made." We disagree.

A

We begin with the basic principles of law that guide the resolution of this issue. It is well settled that once the right to counsel has attached, "[t]he Sixth Amendment . . . imposes on the [s]tate an affirmative obligation to respect and preserve the accused's choice to seek [the] assistance [of counsel]." *Maine v. Moulton*, 474 U.S. 159, 171, 106 S. Ct. 477, 88 L. Ed. 2d 481 (1985). In a line of cases extending from *Massiah v. United States*, 377 U.S. 201, 84 S. Ct. 1199, 12 L. Ed. 2d 246 (1964), through *United States v. Henry*, 447 U.S. 264, 100 S. Ct. 2183, 65 L. Ed. 2d 115 (1980), to *Maine v. Moulton*, supra, 159, the United States Supreme Court has held that a state violates the sixth amendment when, acting through an undisclosed agent, it "deliberately elicit[s]" incriminating statements from an accused "after he ha[s] been indicted" and his right to counsel has attached. *Massiah v. United States*, supra, 206; see also *Kuhlmann v. Wilson*, 477 U.S. 436, 459, 106 S. Ct. 2616, 91 L. Ed. 2d 364 (1986); *Maine v. Moulton*, supra, 176–77; *United States v. Henry*, supra, 270. A violation can arise even if it is the accused who initiates the conversation with the undisclosed state agent. See, e.g., *Maine v. Moulton*, supra, 174–76; *Mealer v. Jones*, 741 F.2d 1451, 1454 (2d Cir. 1984), cert. denied, 471 U.S. 1006, 105 S. Ct. 1871, 85 L. Ed. 2d 164 (1985). As the Supreme Court has emphasized, the "knowing exploitation by the [s]tate of an opportunity to confront the accused without counsel being present is as much a breach of the [s]tate's obligation not to circumvent the right to the assistance of counsel as is the intentional creation of such an opportunity." *Maine v. Moulton*, supra, 176.

Therefore, the resolution of this claim turns on two findings of fact by the trial court, to which we generally afford great deference. "When, however, a defendant raises a question of this nature that is vitally affected by trial court factfinding, in a setting in which the credibility of the witnesses is not the primary issue, our

customary deference to the trial court is tempered by the necessity for a scrupulous examination of the record to ascertain whether such a factual finding is supported by substantial evidence.” (Internal quotation marks omitted.) *State v. Alexander*, supra, 197 Conn. 185.

The first issue of fact is whether Scalise, prior to February 16, 2001, acted as an agent of the police. “The existence of an agency relationship . . . turns upon a number of factual inquiries into the extent of police involvement with the informant. Those inquiries include the following: whether the police have promised the informant a reward for his cooperation or whether he is self-motivated . . . whether the police have asked the informant to obtain incriminating evidence and placed him in a position to receive it . . . and whether the information is secured as part of a government initiated, pre-existing plan.” (Citations omitted.) *Id.*, 184–85. The second issue of fact is whether Scalise “deliberately elicited” the defendant’s statements. See *Massiah v. United States*, supra, 377 U.S. 206. Again, there is no bright line test by which this determination is made. Rather, we scrutinize the record to determine whether the exchanges between the defendant and Scalise “‘look’ like government interrogations.” *United States v. Stevens*, 83 F.3d 60, 64 (2d Cir.), cert. denied, 519 U.S. 902, 117 S. Ct. 255, 136 L. Ed. 2d 181 (1996).

B

The trial court in the present case found that the defendant had failed to establish a sixth amendment violation in connection with Scalise’s testimony regarding the conversations that had transpired both before and after February 16, 2001. We treat these determinations in sequence.

First, the court concluded that Scalise was not acting as an agent of the police when he met with the defendant prior to February 16. Although he had been cooperating with the police in connection with a separate unrelated investigation and already had provided information with regard to that other investigation, this conduct did not transform him into an agent. He had not been acting in an “ombudsman” type capacity. See *United States v. York*, 933 F.2d 1343, 1348 (7th Cir.) (previous government informant was acting as state agent because law enforcement had instructed him “to collect information”), cert. denied, 502 U.S. 916, 112 S. Ct. 321, 116 L. Ed. 2d 262 (1991), overruled in part on other grounds, *Wilson v. Williams*, 182 F.3d 562, 565 (7th Cir. 1999). As the trial court found, “there is no evidence whatsoever that the police had instructed Scalise to gather information about this case, about crimes in general, or about any other case in particular, nor is there any evidence that the police had indicated to Scalise that he would be rewarded in any way by providing information about crimes in general or about any other case in particular or about this case.”

Two United States Supreme Court cases involving situations in which the government had introduced at trial statements made by defendants to “jailhouse informants” are particularly instructive in terms of contrast. In *United States v. Henry*, supra, 447 U.S. 266, an agent of the Federal Bureau of Investigation told a long-standing informant, whom it paid whenever he produced useful information and who was incarcerated with the defendant, “to be alert to any statements made by the federal prisoners, but not to initiate any conversation with or question” an accused about his crime. The defendant in *Henry* was one of a handful of federal prisoners incarcerated at the city jail in Norfolk County, Virginia. *Id.* The government informant ignored his instructions and struck up a friendship with the defendant, who made incriminating statements during the course of their conversations. *Id.*, 271. The court held that the informant was a government agent and had, through his conversations with the defendant, deliberately elicited the statements in violation of the defendant’s sixth amendment rights. *Id.*, 274.

In *Kuhlmann v. Wilson*, supra, 477 U.S. 439, the police intentionally placed the defendant in a cell with a prisoner who had agreed to act as an informant, in an attempt to discover the identities of the defendant’s accomplices. The police told the informant not to question the defendant about his crimes but simply to listen and report any information that the defendant volunteered. *Id.* The defendant ultimately confessed to the informant, and the government introduced those statements at the defendant’s trial. *Id.*, 440. The court held that while the informant was a government agent, he had acted only as a listening post and had done nothing to elicit the statements from the defendant and, therefore, the defendant’s sixth amendment rights had not been violated. *Id.*, 459–60.

In both *Henry* and *Kuhlmann*, although the court concluded without discussion that the informants were agents, the record reflects that the government officials in each case had identified specific prisoners from whom they wanted information and found informants to retrieve that information. By contrast, in the present case, the court found that no such directive existed. Although Scalise had been a government informant for some time when he came into contact with the defendant, and had some expectation that he would benefit from providing information to the government agent with whom he maintained contact, there was no evidence that the government had directed or steered the informant toward the defendant. The trial court found that “Scalise had no instructions whatsoever from the state police that he was to gather information about crimes in general or about any crime in particular or that he would be rewarded if he provided any such information.” Under these circumstances, a trial court

properly may determine that an informant “was not so much a government agent . . . as he was an entrepreneur who hoped to sell information to the government.” *United States v. York*, supra, 933 F.2d 1356; id., 1357 (“[t]hat inmates realize there is a market for information about crime does not make each inmate who enters the market a government agent”). Accordingly, we conclude that the trial court properly determined that Scalise had not been an agent for the police prior to February 16, 2001.

The trial court next determined that, as of February 16, Scalise’s status changed. The determination that Scalise became an agent as of that date was predicated on the court’s findings that Scalise had “signed an agreement to that effect and he was sent back into the prison population with the knowledge of the state that he was to essentially be a listening post.” Consequently, the next question the court considered was whether Scalise had intended to elicit the incriminating statements from the defendant.

“When the accused is in the company of a fellow inmate who is acting by prearrangement as a [g]overnment agent . . . [c]onversation stimulated in such circumstances may elicit information that an accused would not intentionally reveal to persons known to be [g]overnment agents. Indeed, the *Massiah* Court noted that if the Sixth Amendment is to have any efficacy it must apply to indirect and surreptitious interrogations as well as those conducted in the jailhouse.” (Internal quotation marks omitted.) *United States v. Henry*, supra, 447 U.S. 273.

A defendant does not, however, make out a constitutional violation “simply by showing that an informant, either through prior arrangement or voluntarily, reported [the defendant’s] incriminating statements to the police.” *Kuhlmann v. Wilson*, supra, 477 U.S. 459. Although “the government [has] an affirmative obligation not to solicit incriminating statements from the defendant in the absence of his counsel,” there is no constitutional violation when a government informant merely listens and reports. *United States v. Rosa*, 11 F.3d 315, 329 (2d Cir. 1993), cert. denied, 511 U.S. 1042, 114 S. Ct. 1565, 128 L. Ed. 2d 211 (1994). In the present case, the trial court properly concluded that Scalise had not elicited the defendant’s statements deliberately based upon its findings that “although Scalise was an agent of the police he was no more than a passive listener” Accordingly, we conclude that the trial court properly allowed Scalise to testify.

VI

In his last claim on appeal, the defendant argues that the state committed prosecutorial misconduct throughout its closing argument to the jury. The state responds that the few remarks the defendant identifies specifi-

cally either were not improper or are being taken out of context. We agree with the state.

Our law in regard to claims of prosecutorial misconduct is well settled. “To prove prosecutorial misconduct, the defendant must demonstrate substantial prejudice. . . . In order to demonstrate this, the defendant must establish that the trial as a whole was fundamentally unfair and that the misconduct so infected the trial with unfairness as to make the conviction a denial of due process.” (Citations omitted.) *State v. Alexander*, 254 Conn. 290, 303, 755 A.2d 868 (2000).

“[P]rosecutorial misconduct of constitutional proportions may arise during the course of closing argument, thereby implicating the fundamental fairness of the trial itself” (Internal quotation marks omitted.) *State v. Burton*, 258 Conn. 153, 165, 778 A.2d 955 (2001). “In determining whether prosecutorial misconduct was so serious as to amount to a denial of due process, this court, in conformity with courts in other jurisdictions, has focused on several factors. . . . Included among those factors are the extent to which the misconduct was invited by defense conduct or argument; *State v. Falcone*, 191 Conn. 12, 23, 463 A.2d 558 (1983); the severity of the misconduct; see *United States v. Modica*, 663 F.2d 1173, 1181 (2d Cir. 1981), cert. denied, 456 U.S. 989, 102 S. Ct. 2269, 73 L. Ed. 2d 1284 (1982); the frequency of the misconduct; *State v. Couture*, 194 Conn. 530, 562–63, 482 A.2d 300 (1984), cert. denied, 469 U.S. 1192, 105 S. Ct. 967, 83 L. Ed. 2d 971 (1985) . . . the centrality of the misconduct to the critical issues in the case; *Hawthorne v. United States*, 476 A.2d 164, 172 (D.C. App. 1984); the strength of the curative measures adopted; *United States v. Modica*, supra, 1181 . . . and the strength of the state’s case. See [id.] *State v. Whipper*, 258 Conn. 229, 262–63, 780 A.2d 53 (2001).

“As is evident upon review of these factors, it is not the prosecutor’s conduct alone that guides our inquiry, but, rather, the fairness of the trial as a whole. *Smith v. Phillips*, 455 U.S. 209, 219, 102 S. Ct. 940, 71 L. Ed. 2d 78 (1982); *State v. Alexander*, supra, 254 Conn. 303. We are mindful throughout this inquiry, however, of the unique responsibilities of the prosecutor in our judicial system. A prosecutor is not only an officer of the court, like every other attorney, but is also a high public officer, representing the people of the State, who seek impartial justice for the guilty as much as for the innocent. . . . By reason of his [or her] office, [the prosecutor] usually exercises great influence upon jurors. [The prosecutor’s] conduct and language in the trial of cases in which human life or liberty are at stake should be forceful, but fair, because he [or she] represents the public interest, which demands no victim and asks no conviction through the aid of passion, prejudice or resentment. If the accused be guilty, he [or she] should

none the less be convicted only after a fair trial, conducted strictly according to the sound and well-established rules which the laws prescribe. While the privilege of counsel in addressing the jury should not be too closely narrowed or unduly hampered, it must never be used as a license to state, or to comment upon, or to suggest an inference from, facts not in evidence, or to present matters which the jury have no right to consider.” (Internal quotation marks omitted.) *State v. Singh*, 259 Conn. 693, 700–702, 793 A.2d 226 (2002).

The defendant’s claims of prosecutorial misconduct do not fall neatly into specific categories of proscribed conduct. Rather, the defendant launches into a wholesale attack, taking remarks in isolation, separated from their factual moorings, providing little explanation as to why these remarks were improper. We conclude that he has not been deprived of a fair trial.⁶⁹

Of the few claims we are able to decipher, only three merit brief discussion. In the first, the defendant points to the state’s assertion that the trial was “a case about a vicious murder of a young woman, the mother of two young children, who was lured into a sinister trap, beaten, stripped, sexually assaulted and violently strangled until the breath of life was gone.” The state disputes the impropriety of this comment, relying on the fact that this was precisely what this case involved. We agree.

Next, the defendant claims that the state attacked him by making the following remark: “[W]e’ve seen tactics in this courtroom that have gone from plants in the courtroom to demonstrations by counsel where the results are hidden.” The state again contests the impropriety of these remarks, calling this court’s attention to a series of events that apparently included the defendant’s failed attempt to impeach Karazulas regarding a conversation he had during a recess and an equally unsuccessful bite that defense counsel inflicted upon his own arm, the result of which he thereafter refused to show to the jury upon the state’s request. Thus the state’s remarks were supported by the record and were not improper.

Third, the defendant claims that the state improperly vouched for the strength of its case and its witnesses. Specifically, the defendant points to the state’s assertion that “there’s no way that the truth is going to be hidden, not by me in a criminal trial.” A review of the transcript reveals that this remark was in connection with the state’s discussion of the victim’s lifestyle, which the state did not attempt to hide, and that in context, it was not improper.

Finally, in a shotgun approach, the defendant, pointing to a few isolated remarks and taking them out of context, argues that the state improperly suggested that the defendant still clung to a conspiracy theory despite his attorney’s express rejection of such a defense and

injected passion by referring to the victim's bra as the defendant's trophy. We do not see the impropriety of these remaining remarks, but, rather, consider them to have been a fair summary of the defendant's case and his conduct.⁷⁰ Therefore, the defendant's claim of prosecutorial misconduct fails.

The judgment is affirmed.

In this opinion the other justices concurred.

¹ The defendant appealed directly to this court pursuant to General Statutes § 51-199 (b), which provides in relevant part: "The following matters shall be taken directly to the Supreme Court . . . (3) an appeal in any criminal action involving a conviction for a capital felony, class A felony, or other felony, including any persistent offender status, for which the maximum sentence which may be imposed exceeds twenty years"

² General Statutes § 53a-54a (a) provides in relevant part: "A person is guilty of murder when, with intent to cause the death of another person, he causes the death of such person"

³ Forensic odontology is the application of the law to the field of dentistry. It includes the analysis of dentition and bite marks for purposes of identification.

⁴ To create these molds, Luntz first took impressions of the defendant's teeth in a silicone material. A form of plaster known as "dental stone" then was poured into the impression and left to harden into molds.

⁵ Although the defendant originally was charged with murder in June, 1991, that charge was dismissed following a finding of no probable cause. It was not until October, 1998, that the defendant was rearrested for the homicide.

⁶ Haller's interview was introduced as evidence in redacted form because the defendant was a suspect in other uncharged murders, and the interview referred both to the charged murder and uncharged crimes as well.

⁷ Mills said that the defendant had been one of her "customers." She also admitted to having "taken advantage" of him on several occasions.

⁸ Arnold also told police that between 1989 and 1992, the defendant would often carry with him a brown valise that he closely guarded. He carried the valise everywhere he went, including into the bathroom. One evening, when the defendant fell asleep, Arnold and another individual opened the valise and viewed its contents. The valise was filled with women's undergarments and lingerie of various styles and colors, as well as magazines containing explicit and violent sexual material.

⁹ Although Scalise acknowledged that some of his trial testimony was more detailed than the written statements that memorialized his conversations with the police, Scalise testified that he had not learned of any details of the crime from the media's reporting of the defendant's trial and that his only source of information concerning the homicide was the defendant.

¹⁰ The state contends that the defendant's objection concerning the Lucis enhanced photographs was unpreserved. On the basis of our review of the record, including the trial court's express ruling on the defendant's objection to the photographs, we conclude that this claim was raised at trial and therefore properly was preserved for appellate review.

¹¹ The photograph of the victim's left breast actually revealed two separate bite marks; for identification and comparative purposes, however, only the bite mark closest to the nipple was used. See footnote 34 of this opinion.

¹² "In [*Porter*] . . . we adopted the test for determining the admissibility of scientific evidence set forth in *Daubert* We noted therein two requirements established under *Daubert*. First, that the subject of the testimony must be scientifically valid, meaning that it is scientific knowledge rooted in the methods and procedures of science . . . and is more than subjective belief or unsupported speculation. . . . This requirement establishes a standard of evidentiary reliability . . . as, [i]n a case involving scientific evidence, *evidentiary reliability* will be based upon *scientific validity*. . . . Second, the scientific evidence must fit the case in which it is presented. . . . In other words, 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." (Citations omitted; emphasis in original; internal quotation marks omitted.) *State v. Kirsch*, 263 Conn. 390, 398, 820 A.2d 236 (2003).

¹³ We note that the defendant had filed two motions regarding the bite

mark testimony pursuant to *State v. Porter*, supra, 241 Conn. 57, but withdrew them for “legal and strategic reasons.” Thus, those aspects of the defendant’s appeal concerning the extent to which the evidence should be considered novel “scientific” evidence, and thus subject to the standard enunciated under *Porter*, expressly have been waived.

¹⁴ On appeal, the defendant argues that bite mark evidence, in general, is unreliable, and that its acceptance as evidence by the judicial system is “controversial.” We disagree. See *State v. Asherman*, 193 Conn. 695, 716, 478 A.2d 227 (1984), cert. denied, 470 U.S. 1050, 105 S. Ct. 1749, 84 L. Ed. 2d 814 (1985) (defendant unsuccessfully claimed testimony of odontologist was inadmissible because impossible to discern precise position of victim’s scapula at time bite inflicted); see also *People v. Marx*, 54 Cal. App. 3d 100, 107–12, 126 Cal. Rptr. 350 (1975) (defendant unsuccessfully challenged experts’ asserted ability to prove identity from similarities between bite marks and dentition of suspected biter); *Bundy v. State*, 455 So. 2d 330, 348–49 (Fla. 1984) (defendant unsuccessfully argued that act of comparing photographs of bite marks to molds of teeth not reliable or accepted standard of comparison); *Niehaus v. State*, 265 Ind. 655, 660–62, 359 N.E.2d 513 (defendant unsuccessfully argued that odontology not sufficiently recognized as area of expertise and that testifying physician did not qualify as expert in area), cert. denied, 434 U.S. 902, 98 S. Ct. 297, 54 L. Ed. 2d 188 (1977); *Commonwealth v. Cifizzari*, 397 Mass. 560, 569, 492 N.E.2d 357 (1986) (defendant unsuccessfully argued that no foundation laid that bite mark identification techniques had gained acceptance in scientific community); *State v. Temple*, 302 N.C. 1, 12, 273 S.E.2d 273 (1981) (defendant unsuccessfully argued that expert witness did not rely on tested methods or proved hypotheses to establish identification of biter).

¹⁵ Palmbach explained that “scanning” an image “changes it from a spatial domain to a frequency domain” whereby the image is converted into pixels. “[A] pixel is the smallest discrete element of an image It is a set of bits that represents a graphic image, with each bit or group of bits corresponding to a pixel in the image. The greater the number of pixels per inch, the greater the resolution. A rough analogy to painted art is that a pixel is the same as each colored dab of a pointillist painting.” *United States v. Grimes*, 244 F.3d 375, 378 n.4 (5th Cir. 2001).

¹⁶ Palmbach testified that Lucis’ patented algorithm is called “differential hysteresis processing.”

¹⁷ Palmbach testified: “A one-to-one means life-size. It means that the actual image that you would see in the photograph is exactly the same. If we took a picture of my thumb, a one-to-one representation would mean that we could take a photograph and hold it up to my thumb and it would directly overlay.”

¹⁸ Palmbach described an artifact as “an addition. It’s an artificial component. . . . [D]uring the [enhancement] process, the process would create something and do something that was never there to begin with.”

¹⁹ The state, while doubting the appropriateness of the analogy to composite photographs, claims that this foundational standard was met. See *State v. Packard*, 184 Conn. 258, 274, 439 A.2d 983 (1981) (stating that testimony of police officer who helped victim create composite was no more necessary as condition of admissibility than photographer’s testimony would have been had victim identified photograph).

²⁰ Although the state properly identifies the standard for admitting demonstrative evidence; see C. Tait, *Connecticut Evidence* (3d Ed. 2001) § 11.15.1, pp. 810–11; it nevertheless labels the enhanced photographs and the computer generated overlays as merely “illustrative evidence,” and argues that, as such, they may be admitted “if, in the opinion of the trial court, it will assist the jury in understanding an expert’s testimony.” (Internal quotation marks omitted.) *State v. Dontigney*, 215 Conn. 646, 652, 577 A.2d 1032 (1990). The state claims that the photographs and overlays served simply to explain or demonstrate the testimony of Karazulas, the forensic odontologist, but did not themselves constitute evidence. We do not agree with the state’s characterization. The record reveals that these items were admitted as evidence, and as such, constitute demonstrative evidence. “Demonstrative evidence is a pictorial or representational communication incorporated into a witness’s testimony. . . . However, demonstrative evidence is not merely ‘illustrative’; it is just as much substantive evidence of the facts it depicts or portrays as is real or testimonial evidence. *Tarquino v. Diglio*, 175 Conn. 97, 98, 394 A.2d 198 (1978).” (Citation omitted.) C. Tait, supra, § 11.1, pp. 796–97.

²¹ At this time, we reserve judgment on the validity of these two categories

of computer generated evidence, as such, and withhold our agreement as to the merits of this bifurcated approach.

²² “Enlargement is simply a multiplication process. An enlargement merely increases the size of the image. . . . Enhancement differs from . . . enlargement Image enhancement is a subtractive process, which improves image contrast by removing interfering colors and background patterns. . . . [I]mage enhancement technology poses a problem in the validation of the underlying scientific process.

“Image enhancement technology was developed during the late 1960s and early 1970s for the [National Aeronautics and Space Administration (NASA)] space program. . . . Due to the weight and power limitations of spacecraft, it was impractical for NASA to use state-of-the-art camera systems on unmanned craft. The cameras used produced somewhat degraded photographs. Image enhancement reverses the degradation . . . and thereby improve[s] the sharpness and image contrast of the photograph . . . [by] eliminat[ing] background patterns and colors.” (Internal quotation marks omitted.) 2 P. Giannelli & E. Imwinkelried, *Scientific Evidence* (3d Ed. 1999 & Sup. 2003) § 25-6.1, pp. 92–93; see also *State v. Hayden*, 90 Wash. App. 100, 105, 950 P.2d 1024 (1998) (“the technology used to enhance photographs of latent prints evolved from jet propulsion laboratories in the NASA space program to isolate galaxies and receive signals from satellites”).

²³ The state argues that Palmbach’s testimony at trial revealed that the Lucis program does not “add” or “subtract” any details from an image, but merely presents a limited number of “contrast layers” from which to view—that it does not “change” the image, but merely “focuses” on one part of the image rather than another. What is obvious, however, and what Palmbach confirmed, is that the Lucis program reveals details to the human eye that were not visible before the enhancement. We conclude that, simply put, the program actually is “creating” some part of the image, to the extent that it reveals that which was not visible before. Therefore, it is different from a mere enlargement.

²⁴ Specifically, the original photographs of the bite mark were digitized. We note that “[d]igital images are easier to manipulate than traditional photographs and digital manipulation is more difficult to detect.” J. Witkowski, “Can Juries Really Believe What They See? New Foundational Requirements for the Authentication of Digital Images,” 10 Wash. U. J.L. & Policy 267, 271 (2002). After the photographs were put in a digital format, they were enhanced, a process which can also introduce manipulation or alteration of the original image. See M. Cherry, “Reasons to Challenge Digital Evidence and Electronic Photography,” 27 *Champion* 42, 42–43 (2003). We note further that, unlike other types of enhancement wherein the original and the enhanced product could easily be inspected visually for distortion, or dissimilarity, the images in this case involve a bite mark, which, because it actually is composed of multiple smaller marks, is not so easily inspected. Odontological matching depends on millimeters. A visual inspection of the unenhanced and enhanced photographs alone, therefore, is not enough to ensure the enhancement’s reliability because this particular forensic analysis involves the subtle discernment of infinitesimal differences. Other types of enhanced evidence, such as videotapes, may be more amenable to visual inspection because they are larger in scale.

²⁵ Commentators have attempted to explain this lack of case law involving basic foundational challenges to this sort of evidence. “Although computer systems raise serious reliability issues, the reported cases do not adequately reflect this reality.” R. Garcia, “‘Garbage In, Gospel Out’: Criminal Discovery, Computer Reliability, and the Constitution,” 38 *UCLA L. Rev.* 1043, 1087 (1991). “Why do the reported cases fail to adequately expose the serious reliability issues raised by computerized information? Many people, including defense attorneys, prosecutors, judges, and juries, do not understand computers. As a result, people tend to suspend their healthy common sense skepticism when they deal with information technology. Computers make it possible to do some things that could not be done without computers. The mere fact that computers can do some things at all tends to mask the issue of whether the computers can do it well. The ‘gee whiz’ quality of computers may conceal the underlying frailties of the systems.” *Id.*, 1090.

²⁶ We note that the digital enhancement of evidence has been accepted in the courtroom in other contexts as well. For example, in a case involving the digital enhancement of fingerprint evidence, a forensic analyst took digital images of pieces of a bloody sheet and then “utilized computer software to filter out background patterns and colors to enhance the images so that the prints could be viewed without the background patterns and

colors.” *State v. Hayden*, supra, 90 Wash. App. 103. *Hayden*, however, did not involve the basic issue of adequate foundation, and instead involved an analysis under the standard for “novel scientific evidence” laid out in *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923). In *Hayden*, the court held that enhanced digital imaging process generally was accepted in the relevant scientific community “[b]ecause there does not appear to be a significant dispute among qualified experts as to the validity of enhanced digital imaging performed by qualified experts using appropriate software . . .” (Emphasis in original.) *State v. Hayden*, supra, 109. The court also noted that the technique utilized by the forensic analyst “ha[d] a reliability factor of 100 percent and a zero percent margin of error and that the results are visually verifiable and could be easily duplicated by another expert using his or her own digital camera and appropriate computer software.” *Id.*

²⁷ We find *English* to be instructive on the issue although we do not agree with the court’s direct analogy of computer enhancements to photographic enlargements.

²⁸ We note that rule 901 of the Federal Rules of Evidence is consistent with § 9-1 (a) of the Connecticut Code of Evidence, except that rule 901 (b) contains an additional list of illustrations.

²⁹ Originally, the Lucis enhancement was accomplished using the state’s computer equipment, but the actual evidence at issue was produced by Palmbach at the office of Image Content Technology, LLC, which manufactured the Lucis program, because it had a high resolution scanner and printer.

³⁰ Courts that follow such an approach explain that an animation is only illustrative evidence, and thus should have a lower threshold for admissibility than do simulations, which are received as substantive evidence. Compare *Commercial Union Ins. Co. v. Boston Edison Co.*, supra, 412 Mass. 549 (simulation), *Kudlacek v. Fiat S.p.A.*, supra, 244 Neb. 843 (same), and *State v. Clark*, supra, 101 Ohio App. 3d 416–17 (same) with *Pierce v. State*, 718 So. 2d 806, 808 (Fla. App. 1997) (animation), *Cleveland v. Bryant*, 236 Ga. App. 459, 460, 512 S.E.2d 360 (1999) (same), *Harris v. State*, 13 P.3d 489, 495 (Okla. Crim. App. 2000) (same), cert. denied, 532 U.S. 1025, 121 S. Ct. 1971, 149 L. Ed. 2d 764 (2001), and *Mintun v. State*, 966 P.2d 954, 959 (Wyo. 1998) (same); see also F. Galves, “Where the Not-So-Wild Things Are: Computers in the Courtroom, the Federal Rules of Evidence, and the Need for Institutional Reform and More Judicial Acceptance,” 13 Harv. J.L. & Tech. 161, 227–30 (2000) (comparing differing admission standards for animations and simulations); E. Weinreb, supra, 23 Cardozo L. Rev. 403–404; 2 P. Giannelli & E. Inwinkelried, *Scientific Evidence* (3d Ed. 1999 & Sup. 2002) § 25-6, pp. 69–71 (citing cases); 2 C. McCormick, *Evidence* (5th Ed. 1999 & Sup. 2003) § 214, p. 2 (“[c]omputer generated evidence used solely to illustrate testimony is commonly denominated an ‘animation,’ while computer models purporting to recreate the event in question are termed ‘simulations’”).

³¹ We further point out that the reasoning utilized in cases distinguishing simulations and animations is not applicable in the present case in light of the fact that the Adobe Photoshop superimpositions, which most closely resemble animations, actually were used as substantive, not merely illustrative, evidence.

³² We are cognizant of the strong impact that computer generated evidence may have on juries. “Part of the mystique of computers is the aura of reliability that computers share with other forms of scientific and technical evidence. The impact that scientific evidence has on juries has been an issue in the criminal justice system for some time and in various contexts. . . . As one juror explained after a recent trial, ‘You can’t argue with science.’” R. Garcia, supra, 38 UCLA L. Rev. 1091.

³³ We are not the first court to be concerned with the reliability of computer generated evidence. “As courts are drawn willy-nilly into the magic world of computerization, it is of utmost importance that appropriate standards be set for the introduction of computerized evidence. Statements . . . that a computer is but [a calculator] . . . with a giant memory . . . represent an overly-simplified approach to the problem of computerized proof which should not receive this Court’s approval. Although the computer has tremendous potential for improving our system of justice by generating more meaningful evidence than was previously available, it presents a real danger of being the vehicle of introducing erroneous, misleading, or unreliable evidence. . . . Because of the complexities of examining the creation of computer-generated evidence and the deceptively neat package in which the computer can display its work product, courts and practitioners must exercise more care with computer-generated evidence than with evidence

generated by more traditional means.” (Internal quotation marks omitted.) *Perma Research & Development Co. v. Singer Co.*, supra, 542 F.2d 124–25 (Van Graafeiland, J., dissenting); accord *United States v. De Georgia*, 420 F.2d 889, 895–96 (9th Cir. 1969) (Ely, J., concurring); *Commonwealth v. Klinghoffer*, 522 Pa. 562, 569, 564 A.2d 1240 (1989) (Larsen, J., dissenting).

³⁴ The photograph of the victim’s left breast actually revealed two separate bite marks. Karazulas explained that all tests and observations were conducted on the inner bite mark—the one closest to the nipple. Karazulas testified that, although the outer bite mark was consistent with the inner one, it was more difficult to match the models of the teeth to the outer mark because it was made on an area with a larger circumference. He explained that, with compression of a large area that is soft and curved, like breast tissue, when the pressure is released, the mark expands beyond the point where it was compressed. Karazulas further testified that, with reasonable medical certainty, the same teeth had made both marks on the victim’s breast.

³⁵ Karazulas testified that this wax impression revealed the shape of the jaw and the arch of the teeth, the diastema, as well as the depth into the wax that each tooth entered, which in turn illustrated the varying length and width of each tooth. The impression also revealed the cutting edges of the teeth, that some teeth were tipped forward more than others and that some teeth were further back in the mouth than others.

³⁶ The record reveals that some of the dentition tracings were created with the use of a computer scanner, instead of a photocopier.

³⁷ Karazulas testified that the acetate tracings demonstrated several unique characteristics of the defendant’s dentition, including two rotated cuspids, two incisors that were tipped forward, and diastema between numerous teeth.

³⁸ The record does not reflect why Weddle did not testify at trial.

³⁹ Karazulas described the creation of state’s exhibit 115 as follows: “[The] models [of the defendant’s teeth] are laid on a scanner, [on] top of the glass. The scanner top is closed. And you go through a process of scanning with the Adobe Photoshop program. And the image from the scanner goes into the computer. And after this image appears on your screen, you press print and this comes through the printer.”

⁴⁰ We note that the defendant’s objection extended to both types of overlays—those that used dentition tracings and those that used scans of the dental molds.

⁴¹ Additionally, the state argues on appeal that the overlays, like the enhanced photographs, constituted mere “illustrative” evidence. We disagree with this contention. See footnote 20 of this opinion. Likewise, we are not persuaded by case law cited by the state in support of admissibility of evidence created by Adobe Photoshop wherein the question before that court involved a challenge concerning a poster created by Adobe Photoshop that had *not* been admitted as substantive evidence. See *State v. Bauer*, 598 N.W.2d 352, 362–63 (Minn. 1999) (“[b]ecause the trial court did not receive the poster as substantive evidence . . . we need not decide whether the proper foundation was laid”).

⁴² Just as the enhanced photographs did not fall cleanly into one of two “types” of computer generated evidence, either animation or simulation; see part I A of this opinion; these overlays of the defendant’s dentition over images of the bite mark are not exactly animations, but they are nearly so. Therefore, they, too, will be considered computer generated evidence for the purposes of this opinion.

⁴³ We note that the state attempted to have Palmbach testify as to the program’s acceptance in the field. Palmbach stated: “I am aware of applications, and I’m also personally aware of uses within the odontology field. I’ve read several papers in which they’ve spoken of the use of programs, specifically Adobe Photoshop, to use in their bite mark analysis.” This testimony, however, does not establish adequately that the program has been proven reliable enough to be deemed “competent” or that it has become standard practice in the field.

⁴⁴ In fact, the defendant claims that Karazulas deviated from proper procedure in producing the Adobe Photoshop overlays.

⁴⁵ The state points out that the defendant’s own expert testified that, according to the American Board of Forensic Odontology, Adobe Photoshop is an appropriate aid in bite mark identification. This, however, does not conclude our inquiry in this matter, because identifying a tool or process as an “aid” does not satisfy our multifaceted standard.

⁴⁶ Palmbach testified: “Now, [Adobe] Photoshop has . . . a lot of features,

many of which I'll be the first to say I don't know or use. But some of those features will allow you to filter out components, some of them will allow you to cut and crop and paste components." Palmbach further testified that Adobe Photoshop "certainly has features where you can take multiple images and bring them in and out of plane in an attempt to overlay them over each other or rotate them and try to align them. So it has that moving, cropping, editing, [and] overlaying capability."

⁴⁷ We recognize that Karazulas testified that, to the naked eye, the portion of the bite mark photographs, the manual and computer copies of the tracings of the defendant's dentition, and the scanned images made from the molds of the defendant's teeth that appeared in the computer generated overlays were all fair and accurate portrayals of their original corresponding evidence, which had been marked as exhibits at trial. Because odontological matching depends on millimeters, a millimeter or two either way could make the difference between a point of concordance and a point of discordance. A visual inspection of the separate pieces, therefore, was not enough to ensure the reliability of the superimpositions.

Karazulas further testified that there had been no alteration between the scanned images and the images that appeared in the superimpositions. Although he testified that he "asked [Weddle] not to make any changes" to the images of the original exhibits when creating the overlays, Weddle himself did not testify that he had not, in fact, made any changes, nor was Karazulas proficient enough in the process used to create the overlays to determine for himself whether, in fact, Weddle had altered or manipulated the exhibits in the process of using the Adobe Photoshop software.

⁴⁸ The state also had Palmbach testify briefly regarding Adobe Photoshop, but his testimony regarding the program fails to illuminate the subject. He testified merely that he was "generally" familiar with the Adobe Photoshop program and its uses in forensic science, but admitted that there were many features that he did not understand or use.

⁴⁹ Karazulas testified: "I guess it works like an MRI [magnetic resonance imaging], and you can select the layers as you cut through an object. So as . . . Weddle went through the process, I would say, 'Hold it. That's it. That's what we need.' We needed the teeth. Because they have a thing called the opaquer or the opacity maker. And as you change the dial, then you would see through the object a little more clearly. So we did this for two or three hours until we got what we thought was the incisal edges and enough opacity to move these edges to the marks."

⁵⁰ Weddle, by nature of his role in the actual creation of the overlays, is the most obvious choice to be the person qualified to testify regarding the Adobe Photoshop program, but we make no determination regarding whether his testimony, in and of itself, would have been enough to establish the reliability of this evidence.

⁵¹ Once courts are satisfied with the inherent reliability of computer programs, like Lucis and Adobe Photoshop, we note that a trial court may dispense with imposing on the offering party the burden of meeting more stringent foundational requirements. Compare *Dyson v. New York & New England R.R. Co.*, supra, 57 Conn. 24 (offer of photographs accompanied by testimony of photographer who took them as to their accuracy, and of surveyor who identified points of view) with *McGar v. Bristol*, supra, 71 Conn. 655 (photographer's in-court testimony not essential). Furthermore, we recognize that "[t]he potentially limitless application of computer technology to evidentiary questions will continually require legal adaptation." *Penny v. Commonwealth*, 6 Va. App. 494, 499, 370 S.E.2d 314 (1988) (concluding that Virginia courts may admit telephone "call trap" results into evidence only after reliability of particular trap has been shown). Until the reliability of computer programs are no longer questioned, however, we rely on the factors enunciated in this opinion to guide the admissibility of such evidence.

⁵² "The confrontation clause of the sixth amendment is made applicable to the states through the due process clause of the fourteenth amendment." *State v. Sandoval*, 263 Conn. 524, 532 n.17, 821 A.2d 247 (2003).

⁵³ Referring to state's exhibit 120, Riesner testified: "[N]ow, let's remember this is a trick of the computer. You're looking . . . from the root side of the teeth. You're not looking down on it. So this is a computer generated thing. I mean, you've got something here that's a layer so you're looking at it. What you're looking at is this. What you see is this tooth that's turned here is this tooth on this side and you're looking down on it because it's creating it this way. So you can't look at it this way and make a judgment. (Indicating.)"

⁵⁴ "In *State v. Meehan*, supra, 260 Conn. 397 n.13, we reiterated that two

lines of cases had developed in addressing the standard for reversing nonconstitutional evidentiary improprieties: One line of cases states that the defendant must establish that it is more probable than not that the erroneous action of the court affected the result. . . . A second line of cases indicates that the defendant must show that the prejudice resulting from the impropriety was so substantial as to undermine confidence in the fairness of the verdict.” (Internal quotation marks omitted.) *State v. Kirsch*, supra, 263 Conn. 412 n.16. As in *Kirsch*, we conclude that the defendant in the present case has failed to prove the requisite harm under either standard. *Id.*

⁵⁵ The defendant also maintains that the state’s treatment of the issue of harmless error constitutes inadequate briefing because it addressed the issue in a series of cursory footnotes. See *State v. Ruscoe*, 212 Conn. 223, 241 n.9, 248, 563 A.2d 267 (1989), cert. denied, 493 U.S. 1084, 110 S. Ct. 1144, 107 L. Ed. 2d 1049 (1990). Although we agree that the state’s handling of the issue was deficient, our determination that the evidence was improperly admitted nevertheless necessitates that we address the harm.

⁵⁶ The state argues that the admission of the Adobe Photoshop overlays constituted harmless error because the jury was able to test the accuracy of what the computer had generated by taking the original exhibits and manually laying one over the other to replicate the computer’s results. This is true, however, only for those few exhibits composed of tracings of the defendant’s dentition superimposed over photographs of the bite mark. It would be impossible for anyone to recreate, manually, those overlays depicting translucent images of the defendant’s teeth superimposed over the bite mark.

We note that Karazulas did reconstruct the “overlay” technique manually for the jury. Karazulas testified that, by taking an acetate tracing of the defendant’s teeth and placing it over a photograph of the bite mark, it gave him “an idea of the general edges and the shape of the bite mark [in] relation to the model.” Karazulas additionally testified that, by sliding an acetate tracing of the defendant’s teeth over an enhanced photograph of the bite mark, he observed that “[the] pattern generated by the teeth was compatible with the pattern on the breast.”

⁵⁷ Practice Book § 40-13 provides in relevant part: “(a) Upon written request by a defendant filed in accordance with Section 41-5 and without requiring any order of the judicial authority, the prosecuting authority, subject to Section 40-40 et seq., shall promptly, but no later than forty-five days from the filing of the request, unless such time is extended by the judicial authority for good cause shown, disclose to the defendant the names and, subject to the provisions of subsections (g) and (h) of this section, the addresses of all witnesses that the prosecuting authority intends to call in his or her case in chief and shall additionally disclose to the defendant:

“(1) Any statements of the witnesses in the possession of the prosecuting authority or his or her agents, including state and local law enforcement officers, which statements relate to the subject matter about which each witness will testify”

⁵⁸ Practice Book § 40-41 provides in relevant part: “In deciding the motion for a protective order the judicial authority may consider the following . . .

“(3) The maintenance of secrecy regarding informants as required for effective investigation of criminal activity”

⁵⁹ An unredacted copy of a third letter written by Arnold, dated November 14, 1991, was given to the defendant.

⁶⁰ Practice Book § 40-13 (c) provides: “If the entire contents of a statement under subdivision (1) of subsections (a) and (b) of this section relate to the subject matter of the anticipated testimony of the witness the statement shall be delivered directly to the opposing party or his or her counsel for his or her examination and use. If the party calling the witness claims that any statement to be produced under subdivision (1) of subsections (a) and (b) of this section contains matter which does not relate to the anticipated subject matter of the testimony of the witness, the judicial authority shall order the party calling the witness to deliver such statement for the inspection of the judicial authority in camera. Upon delivery the judicial authority shall not disclose the portions of such statement which it is claimed do not relate to the anticipated subject matter of the testimony of the witness. The judicial authority shall determine whether any such material should be excised. The judicial authority shall then direct delivery of such statement to the opposing party for his or her use and shall further review the contents of such statement after the direct testimony of such witness and may provide to the opposing party any additional portions of such statement which the judicial authority determines relate to the subject matter of the direct

testimony of such witness. If, pursuant to this procedure, any portion of such statement is withheld from the party and that party objects to such withholding, the entire text of such statement shall be sealed and preserved as a court's exhibit in the case."

⁶¹ Practice Book § 40-42 provides: "Upon the hearing of any motion under Sections 40-40 through 40-43, the judicial authority may permit all or part of any showing of cause for denial or deferral of access to be made in camera and out of the presence of the opposing party. Any in camera proceedings shall be recorded verbatim. If the judicial authority allows any access to be denied or deferred, the entire record of the in camera proceedings shall be sealed and preserved in the court's records, to be made available to the appellate court in the event of an appeal."

⁶² General Statutes § 54-85a provides: "In any criminal prosecution, the court, upon motion of the state or the defendant, shall cause any witness to be sequestered during the hearing on any issue or motion or any part of the trial of such prosecution in which he is not testifying."

⁶³ General Statutes § 54-85f provides: "Any victim of a violent crime or the legal representative or member of the immediate family of a victim who is deceased shall be permitted to attend all court proceedings that are part of the court record."

⁶⁴ Article first, § 8, of the constitution of Connecticut, as amended by articles seventeen and twenty-nine of the amendments, provides in relevant part: "(b) In all criminal prosecutions, a victim . . . shall have the following rights . . . (5) the right to attend the trial and all other court proceedings the accused has the right to attend, unless such person is to testify and the court determines that such person's testimony would be materially affected if such person hears other testimony"

⁶⁵ We note that, inherent in the defendant's claim is a misunderstanding of the purpose behind a sequestration order. "Sequestration serves a broad purpose. It is a procedural device that serves to prevent witnesses from tailoring their testimony to that of earlier witnesses; it aids in detecting testimony that is less than candid and assures that witnesses testify on the basis of their own knowledge." *State v. Robinson*, 230 Conn. 591, 600, 646 A.2d 118 (1994). Laverne Terry's testimony regarding courtroom events violated none of these purposes.

⁶⁶ We further note that Laverne Terry was not the only source of the particular evidence to which she testified. Indeed, Larry Swinton also testified regarding the exchange.

⁶⁷ Previously, Rovella had been a member of the Hartford police department for twenty years and had interviewed the defendant in 1991 regarding the murder in the present case.

⁶⁸ When Scalise met with Daigle and Rovella on February 22, 2001, he was fitted with "electronic eavesdropping equipment," which he used to intercept additional disclosures by the defendant on February 25 and 26, 2001. Because the state declared its intention not to seek admission of any of those disclosures, they are not part of this claim.

⁶⁹ Additionally, we decline to exercise our supervisory authority pursuant to *State v. Payne*, 260 Conn. 446, 452, 797 A.2d 1088 (2002) ("[w]e exercise our supervisory authority in order to protect the rights of defendants and to maintain standards among prosecutors throughout the judicial system rather than to redress the unfairness of a particular trial").

⁷⁰ We note that claims of prosecutorial misconduct, when supported by the record and developed by the briefs, are taken very seriously by this court. See *State v. Rizzo*, 266 Conn. 171, 243-44, 833 A.2d 363 (2003). Unsubstantiated assertions such as those claimed in this case, however, serve only to transform what should otherwise be an earnest challenge to the fundamental fairness of a trial to a claim du jour.