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Case Report

A Forensic Case Study with Only a Single Piece of Evidence

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Abstract

Suspects in criminal cases are frequently tried when only a single piece of forensic evidence implicates them. How can a pre-trial judge, a trial judge, or a jury member determine whether the single piece of evidence is sufficient? We apply commonsense guidelines that can be used by the finder-of-fact: the probability that the forensic evidence correctly identifies the suspect as the perpetrator based on the error rate for that forensic discipline; the probability that the forensic evidence points only to the suspect and not others in addition to the suspect (the random match probability); and the prior probability that the suspect is the perpetrator before any forensic evidence appears. In the present article, we present a detailed case study of a sexual assault: the crime; its investigation; and the trial of a suspect, in which the only evidence is a single eyewitness identification of the suspect. We conclude that proceeding to indictment and trial with only a single piece of forensic evidence creates a high risk of convicting innocent persons.

Keywords: Forensic Evidence; Bayes Theorem; Prior Probability; Erroneous Identifications; Rational Decision-Making; Case Studies

Introduction

Roman law required multiple pieces of evidence in order to try a suspect. In contrast, most western countries, including the United States, are willing to treat a single piece of identification evidence as sufficient to proceed to indictment and beyond: a single fingerprint, a single eyewitness, or a single DNA swatch. The percentage of criminal cases involving only a single piece of forensic evidence is unknown, because criminal cases in the United States are not classified by evidence type and evidence amount. In the personal experience of the authors, in over half the fingerprint and eyewitness cases on which we have been retained, the only evidence presented against the defendant was a single fingerprint or a single eyewitness statement. When only a single piece of evidence is offered, what could the prosecuting attorney, the defense attorney, the judge, and especially the jury use to evaluate the weight to give to that evidence? Three criteria have been suggested, which, in combination, provide reasonable ground rules and satisfy commonsense [1,2,3].

Probability that the Identification of the Suspect is Erroneous

Is the probability known that the identification is accurate, based on a known error rate for examiners in that forensic discipline? For example, if fingerprint examiners are shown to average one erroneous identification in every one thousand identifications, this specifies a very low error rate of 0.001 (0.1%). In contrast, ten erroneous identifications per 100 identifications translate into a much higher error rate of 10%, suggesting the forensic evidence is less likely to be correct. In general, if the error rate for the discipline is very low, it is more likely that the suspect is the perpetrator when the forensic evidence points to the suspect. Conversely, with a high error rate, it is more likely that the identification is erroneous.

At present, the various forensic disciplines lack good estimates of their error rates, though some rough estimates are available.

Probability the Identification Fits More People than Just the Suspect

The second criterion concerns the number of people other than the suspect who fit the crime scene evidence and could have committed the crime (called the random match probability). The more people matched by the evidence, the less likely the suspect is to be the perpetrator. In the case study presented below, the eyewitness said that her assailant was male; about 5'8" or 5'9" in height; had an athletic build; close-cropped brown hair; wearing

a uniform shirt, pants and black boots; and smelled of fuel oil. In some contexts, such as a gas station or small auto repair store, this description might fit only a single person, so the probability that the identification matches someone other than the suspect is very low. However, for the particular case presented below, the identification of the suspect with this description occurred on a large navy ship containing literally hundreds of men who fit this description. When the identification evidence applies to hundreds of people in addition to the suspect, the individual suspect identified by the forensic evidence is less likely to be the perpetrator.

Probability that the Suspect is Likely to be the Perpetrator Before any Forensic Evidence is Produced.

The third criterion considers whether the suspect singled out by the evidence would have been a likely perpetrator before the evidence was produced (called the a priori probability). The lower this prior probability, the less likely the suspect is to be the perpetrator.

As an example of a high a priori probability, consider a suspect with a motive to commit the crime, or an opportunity and the wherewithal to commit the crime, or who has a personality consistent with the crime and is without an alibi at the time of the crime. If all of these were plausible or true, even before the eyewitness or forensic expert came forward with the identification, the a priori probability suggests this suspect could likely be the perpetrator. At the other extreme is a suspect without a motive, did not live in the same city, did not have access to a weapon, and had no history of violence: this suspect is unlikely to be the perpetrator to begin with, even before any evidence has been produced.

Most a priori evidence is circumstantial: it does not show by itself that the suspect was the person who committed the crime. Circumstantial evidence might be consistent with the suspect being the perpetrator, but does not directly link him to the commission of the crime. Living in the neighborhood, or having a motive, or a violent personality is each circumstantial: each such factor increases the a priori probability of guilt, but does not tie the suspect directly to the crime and hence is not considered forensic evidence.

A Balancing Act of Probabilities and Standards for Conviction

When there is only a single piece of evidence against the suspect, the finders-of-fact can weigh these three criteria to decide if any reasonable doubt remains whether the suspect is the perpetrator. This is easy to do when the three probabilities each point in the same direction. When one weighs toward guilty and another weighs toward not guilty, the balancing is much more difficult for fact-finders.

A further complexity, when considering the three criteria just discussed concerns how strongly a juror should be convinced that the defendant is the perpetrator before voting to convict. For criminal trials in the United States, the standard instruction given to jury members is to be convinced "beyond a reasonable doubt" that the defendant is the perpetrator [4]. Blackstone, an English judge, focusing only on the accuracy of the evidence, suggested a probability standard of at least 0.90 that the defendant is the perpetrator [5]. Others have suggested a more conservative standard: vote to convict only if the probability of an erroneous identification, the random match probability of a fit to another person and the a priori probability combine to produce a final probability of 0.99 or greater that the suspect is the true perpetrator. This is equivalent to a statement that for every 100 criminal trials in which a conviction is voted, only one of those convictions would be of an innocent person. No court to our knowledge has suggested a numerical probability standard of proof equivalent to the verbal statement of the non-quantitative standard of "beyond a reasonable doubt".

In what follows, we apply these analyses of probabilities using non-numerical language to real evidence in an actual case that had only a single piece of forensic evidence: a victim of a sexual assault identified her attacker in a line up.

A Sexual Assault Case Based on Eyewitness Evidence

The first author of this article was retained as a perception and eyewitness expert in a trial in which a suspect was arrested and indicted on the basis of an eye witness identification. There was no other evidence. I was asked to provide expert testimony about the chances that the eyewitness identification was correct, no one else fit the victim's description, and the person identified was a reasonable suspect even before the identification. The three probabilities were each relatively easy to estimate, and I used this opportunity to testify about them.

The Assault

On August 25, 2012, the USS George Washington, a nuclear powered aircraft super carrier, was at sea in the Pacific on maneuvers (see Figure 1). The ship carried just over 5,000 crewmembers, one fifth women. By midnight, virtually all crewmembers involved with aircraft were off duty.

Figure 1: A view of the USS George Washington (73 CVN), a nuclear powered super carrier on maneuvers at sea.

Just after midnight, a young sailor was sexually attacked in a narrow under-lit corridor as she was returning the very short distance from the head to her berth near the stern of the 1,200-foot ship. The attacker punched her in the stomach, and as she doubled up unable to breathe, he knocked her to the deck. She hit her head on the bowl of a drinking fountain in the corridor wall as she fell to the deck. The attacker pulled a knife, straddled her body, placed one hand over her mouth and pressed the knife against her neck, and whispered: "If you scream, I will kill you!" The victim reported she could see her assailant's face during the next few minutes of the assault, when he cut open her t-shirt from her collar to her bellybutton, and began to fondle her breasts. A sudden noise in an adjacent stairwell apparently scared her attacker, and he grabbed his knife and fled. The victim escaped with a number of superficial knife cuts on her chest, an invasion of her person, and a massive state of panic.

When security personnel reached her, about 20 minutes after the attack, they sounded a ship-wide alarm requiring all security and medical personnel to report immediately to their duty stations. To the first of them, the victim described her assailant as a white male, just slightly taller than herself (she was 5'7"), athletic build, closely cropped brown hair, wearing a green shirt, camouflage pants and black boots. She was unable to describe any facial features. She said her assailant smelled of fuel or oil. The green-shirt description was important: crewmembers working on or just under the flight deck, including all the aircraft retrieval and launch crews, wore green shirts to signify their duty assignments with aircraft. Of the more than 5,000 sailors on the ship, about a third had worn a green shirt on duty that day.

The ship was at sea, so no one could have left the ship after the attack. Several males were reported by witnesses or found by security in the nearby corridors to the assault: they were interviewed, and their pictures shown to the victim the next morning. She said none of them was similar enough to her attacker. That morning, she was also shown a book containing photographs of the entire population of the crew on the ship. One of the crewmembers had to have been her attacker. She looked through the picture book several times, and marked six men, but without confidence.

Construction of the Lineup

On the second full day after the attack, the lead investigator on the ship asked every officer and enlisted person on the carrier who had ever worn the green shirt uniform to report to the hangar deck, four levels below the fight deck, a space larger than several football fields in length and width. These crewmembers were told to line up in rows of about 20 persons each. The individuals in each row were video-recorded live with a hand-held camera. The camera operator paused about 2 seconds to record a 2-second picture of the face and upper torso of each person in a row, followed by a 1-second blank which allowed the camera operator to move and point the camera at the next person in the row. While the camera recorded primarily the person at whom it was pointed during the 2 seconds, each frame also included parts of the prior and next person in the row, and included some people standing in the row behind the one being recorded. After each person in a row was recorded, the camera moved to the next row, and so forth. Figure 2 shows an equivalent view of a large crowd of crewmembers on the George Washington's hangar deck.

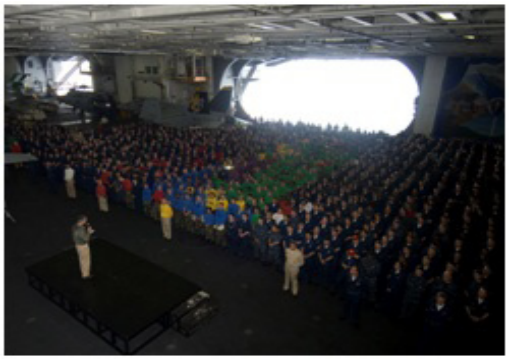

Figure 2: A view of the hangar deck of the USS George Washington when occupied by 4-5,000 crewmembers. This is not a photograph of the lineup employed in the case study in this article, but it does provide an impression of a similar number of crewmembers congregated at one time on the hangar deck.

The video recording required about 2.5 hours to complete, which at an average of three seconds per person, suggested that about 3,000 persons were recorded (no one counted). The lineup contained men and women, of all heights and races, and various hair colors and styles. Some were wearing green shirts at the time of the lineup, but most were not.

Viewing the Lineup

The witness was not present during the video recording. She viewed it later that day on a large screen TV in a quiet room, with only herself and two investigators present. She was told the perpetrator may or may not be among the persons recorded. She was told she could ask to stop the video at any time, or to go back. After about 15 minutes (covering about 300 of the roughly 3,000 persons), she asked that the video be reversed back several people. She yelled stop, pointed to the man displayed in the center of the screen, said he was her attacker, and then she broke down and cried. When she recovered, the investigator asked her: "If 1 is very uncertain and 10 is absolutely certain, how certain are you?" She reported an 8. She said that if she could hear that man's voice, she could be absolutely certain.

Subsequent Investigation and Another Identification

Security located the man the victim had identified in the line-

up. The lead investigator interviewed him, describing him as 6 feet two inches in height, 160 pounds (very thin), with close-cropped brown hair, and without distinguishing facial features. He worked on one of the fighter retrieval crews that were on duty until shortly after 10:30 PM the night of the assault. The suspect denied guilt.

This interview with the suspect was video-recorded, and later the lead investigator asked the victim to view that recording to see if she could recognize the suspect's voice. After just a few seconds seeing and hearing the suspect speak, she told the investigator that she was now 100% certain. The man was arrested. The next day, the investigators asked her to view the rest of the 3,000-person video lineup, which she did. She expressed no interest in any of the rest of the people depicted.

Preliminary Hearing

The Navy held a preliminary hearing on the ship a few weeks later under a senior investigation officer. The victim described the assault and her identification of one of the 3,000 sailors and officers in the lineup. The Lead Investigator reported the suspect said he was giving a guitar concert from about 11 PM to 1 AM in a room under the ship's bow, nearly a thousand feet away from the location of the attack. The suspect in his interview also named a number of people whom he saw listening to him during his performance. The Lead Investigator reported interviews with seven of these potential alibi witnesses: they all said they were present during part or all of the concert, but none could pinpoint any exact times of when they arrived and when they left the concert. The defense also presented a number of character witnesses and introduced evidence of the suspect's spotless record and many commendations.

The Investigation Officer concluded at the end of the hearing that the suspect should be held in the brig pending a court martial, based on the victim's identification. The Investigation Officer did not mention the unproven alibi or the suspect's exemplary record.

The Court Martial Trial

Eight months later, the court martial trial of the suspect began while the ship was undergoing refurbishing in port in Japan. The first author was present throughout the trial.

The potential members for the court-martial jury were active officers or enlisted members of the US Navy stationed at other bases and on other ships; they knew nothing about the crime. They were selected by their respective superior officers to serve on a jury based on their abilities to evaluate evidence fairly. Each potential juror was questioned by the prosecution and defense attorneys and by the judge. By chance, the members selected to be on the jury were all male.

The Prosecution Case

After brief opening statements, the victim testified first. She said that when the assailant was hovering over her with his knife, she thought that evening would be her last night on earth. She gave essentially the same description of her assailant, and the same description of the sequence of events that she had given eight months earlier. She identified the defendant in court with absolute certainty. Her cross-examination was brief, and she was very convincing.

The Lead Investigator testified next, describing the activities of security personnel. He emphasized that the seven alibi witnesses could not pinpoint the exact time each of them saw the defendant at the concert in relation to the estimated time of the attack. The defense cross-examined him vigorously. He was asked to justify the massive lineup; the inclusion of persons who should have been eliminated by the victim's description; his failure to conduct a voice "lineup" including the suspect's voice among other voices (rather than allowing the victim to see the man she had already identified while he alone was speaking); and his failure to follow-up with other potential suspects. These included a sailor who was seen running from the area of the attack just a few minutes after the assault, and a sailor apprehended a few weeks later who possessed a large collection of knives (not normally available on the ship). The investigator responded that both of those suspects were included in the lineup and the victim did not pause on either. In closing, the Lead Investigator claimed that the only way the victim could have identified the defendant in the lineup was because she saw him as he attacked her.

The Defense Case

The defense began with the ship's doctor who had answered the alarm and examined the victim about 20 minutes after she was attacked. From his contemporaneous medical notes, he was able to provide exact times: working backwards from when he examined the victim, and the known time of the alarm sounding, and using her descriptions, he was able to pinpoint the time of the attack to 12:15 AM.

Next, the defense called each of the seven alibi witnesses, and elicited from them the different times they saw the defendant playing his guitar in the bow, and their location on the ship when they heard the alarm (some heard the alarm while listening to the defendant playing at the guitar concert). Using the doctor's testimony, these times from the alibi witnesses narrowed the window of opportunity for the defendant to absent himself from the room in the bow to a near impossibility. He would have had to leave the concert and go to his nearby berth to change from printed shirt, shorts and flip-flops (the clothes he and all of the alibi witnesses reported him wearing during the concert) back into work clothes, travel by foot through the length of the ship about 900 feet to near the stern, attack the victim he had no reason to believe would be

there, return 900 feet to his berth near the bow to change back into the very informal clothes he wore during the concert, and sneak back into the concert, all of this unobserved.

Next, the defense called "character" witnesses who testified to the defendant's non-violence, his trustworthiness, his commitment to the Navy, and his skills as a leader and a team member.

As the final witness for the defense, I testified to the scientific evidence regarding the factors that affect the accuracy and confidence of eyewitness identifications. Prior to the start of the trial, I was allowed to tour the full length of the ship on each of its twelve levels of walkways that connected the ship from bow to stern, and the relevant vertical stairways between levels. I also visited the victim's berth, the nearby head, the stairwell down which the victim reported the route taken by her attacker when he fled, and the connecting corridors to observe and measure the distances and lighting. I testified to a variety of factors that have been studied scientifically and that applied specifically to the victim-eyewitness in this case.

Probability that the Forensic Evidence is Correct

Lighting

On the night of the attack, the entire ship was on dark-light conditions; every internal corridor and room was illuminated by low level red lights in the ceilings: sufficient for walking but not for reading or other close work. Only the heads retained their bright white lighting throughout the night. According to the victim, she had been asleep in her berth (under red light), woke up, walked out into the corridor (also under red light) and went into the head (under intense white light), a distance of less than 20 feet. She said she remained in the head for about 5 minutes, and then walked back into the red-lit corridor where she was immediately attacked.

Vision

The victim had normal daylight vision. However, she was in the head long enough to become light-adapted to the high level white light, which seriously impaired her night vision when she re-entered the darkened red-lit corridor from the head. I testified that her recovery from her light-adaptation in the head would take several minutes at a minimum. Because the attack occurred almost instantly after she reentered the corridor, her acuity would not have returned to a dark-adapted state. The ship's doctor had also testified to her impaired acuity during the attack. When she fell to the deck, her head was under the bowl of the water fountain, which reduced the intensity of the red light from the ceiling even more. She also testified that when she fell, her head was directly under the nearest red light. When the attacker leaned over her head, whatever light was present would have back-lit him, reducing his face to an un-detailed silhouette.

I concluded in this part of my testimony that the witness did not have adequate lighting levels, sufficient visual acuity, or sufficient front lighting on the attacker to perceive his facial features, reducing her chances of identifying him correctly in a lineup.

Stranger Effect

Research has shown that the accuracy of identifying a stranger observed committing a crime is much lower than when the perpetrator is familiar to the witness. Accuracy is virtually 100% correct for familiar people, whereas for strangers, the overall accuracy, under otherwise optimal conditions, is rarely above 50%. In this case, the victim testified that she never saw the suspect before.

Intense Fear and Injuries

Research has shown that the victim's intense fear for her life, her reasonable expectations of being raped and/or killed, coupled with her physical injuries, would reduce the accuracy of her perception of her attacker, and her ability to remember him sufficiently to recognize him later in a lineup. One set of empirical experimental data I described to the jury was obtained from military training of soldiers to resist interrogation if they are captured [6]. Over 500 soldiers were individually subjected to very high stress and fear levels appropriate for combat conditions. Each "captured" soldier was then brought into a well lit interrogation room and seated directly facing an "enemy" interrogator for at least a half hour. Half of the soldiers suffered physical abuse when they failed to provide requested information, designed to increase their stress and fear levels. Even so, these were optimal viewing conditions for the soldiers to observe their interrogator (good lighting, long duration, focused attention). The next morning, when the soldiers were each shown a live lineup containing their interrogator and five foils, only about 30% of them were able to identify their interrogators. Since the interrogators were different, and the foils were different for each lineup, the results cannot be attributed to the particular lineups. Most of the mistakes were erroneous identifications of foils.

The second empirical data set I described was comprised of over 300 cases of men who had been erroneously convicted for rape or sexual assaults and then were exonerated by DNA evidence [7]. The evidence used to convict 75% of these men (over 200 of them) came from an erroneous identification made by the victim of her attacker. These empirical data suggest that misidentifications in sexual assault cases occurred frequently.

I concluded that the great fear and stress felt by the victim in this case probably interfered with her observation of her attacker and interfered with her ability to maintain a memory of what she

did perceive.

Other Research Evidence Related to the Accuracy of an Identification

Description of the Attacker

Research has shown that when an eyewitness provides a broad array of descriptors of the suspect, a subsequent identification of that suspect from a lineup is more likely to be correct. In the absence of a description of facial features or distinctive features, lineup identification is more likely to be erroneous. In this particular case, this witness provided no facial features in her description of her attacker. The details that she did provide (white, male, close-cropped brown hair, athletic build, and average height) fit hundreds if not a thousand people in the population on the ship. The clothing description fit over 1,500 people. Because the attacker was a stranger to her, the victim would have difficulty remembering what he looked like, and she would be unlikely to retain that information to differentiate her attacker from other similar men, given her terror and bodily pain and sensory loss at the time of her attack. While she was absolutely confident her lineup identification was correct, the 225 victims who made erroneous identifications in their rape trials also testified with great confidence, sufficient to convict the innocent defendant in each trial.

Lineup Construction

Lineups have been intensely studied since the early 1960's, and that work has uncovered a number of factors that affect the accuracy with which eyewitnesses can make correct identifications. However, no research has documented the effects of having 3,000-person lineups, containing people bearing no resemblance to the witness's description: including wrong sex, wrong race, wrong hair color, wrong body shape, and wrong height.

Lineup Presentation Procedures

The lineup presentation procedure used in this case had never been tested. No evidence exists on the effects of rapid presentation of suspects, and of being able to see multiple persons in each frame. Because of the spacing between people, each two-second frame revealed three people in that row, plus some more in rows behind the person centered in the frame. Is this a simultaneous, successive, or a new procedure? Whatever it is called, it has never been tried before or tested.

Suggestiveness

The voice identification procedure was flawed by its suggestiveness. This witness heard not only the voice of the man she had identified, she simultaneously was visually shown the person she had already identified. I testified that there was no probative value to the voice identification made following the procedure used in this case.

Probability that Someone Else Matches the Victim's Description

How many other men on the ship were brown-haired white males with close-cropped hair and athletic build, between 5'7" up to 5'11" in height and wearing a green shirt? From my cursory visual inspection of the 3,000 crewmembers in the lineup, at least several hundred men very closely met the victim's description, a very high random match probability of about 1 in 10.

A Priori Probability that the Defendant is the Perpetrator

The defendant's location in the bow at the time of the crime made it unlikely he could have also been in the corridor near the stern. No witness reported, even when questioned under oath, that the defendant left the concert area at any time near the time of the attack. The defendant's four-year record in the Navy, or his civilian record prior to enlisting, contained no evidence of sexual or physical assaults or any behavioral irregularities. The character witnesses all testified to his peacefulness, his commitment to the Navy, and his leadership qualities.

Outcome of the Court Martial

I had documented to the jury that all three of the probabilities strongly suggested that the suspect on trial was not the perpetrator and that the witness was very likely to have made an erroneous identification. The jury's decision was unanimous: the defendant was judged not guilty on all counts.

A note in passing: the Navy has never located the perpetrator of this attack. Both the victim and the defendant were re-assigned to duties on different ships after the trial.

The Moral of This Case

In this case the defendant was not convicted. How common this outcome is, we do not know. Cases based on a single instance of forensic evidence are not unusual. A suspect may be identified by a single piece of evidence out of the blue: he or she would never have been a suspect except for that evidence. Then the identification evidence is presented with great confidence. Few trials employ expert witnesses to evaluate these probabilities and explain them to the jury. Until courts forgo indictments with only a single piece of forensic evidence, and subsequent trials without further evidence, the defendants in such trials cannot be protected from erroneous convictions.

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References

1. Thompson W, Taroni F, Aktkin CGG (2003) How the probability of a false positive affects the value of DNA evidence. Journal of Forensic Sciences 48: 542-552.
2. Bayes T (1763) An essay towards solving a problem in the doctrine of chances. London, England: The Philosophical Transactions of the Royal Society of London 53: 377.
3. Haber RN and Haber L (in preparation) Unis Testis; Unis Nullus. One Witness is No Witness.
4. Diamond SA (1990) Reasonable doubt: To define not to define. Columbia Law Review 90: 1716-1736.
5. Blackstone W (1766) Commentaries on English Law 358.
6. Morgan CA, Hazlett G, Doran A, Garrett S, Hoyt G, Thomas P, Baranoski M, Southwick SM (2004). Accuracy of eyewitness memory for persons encountered during exposure to highly intense stress. International Journal of Law and Psychiatry 27: 265-279.
7. Gross SR and Shaffer M (2012) Exonerations in the United States, 1989-2012 University of Michigan Public Law Working 277.