

A Case Study: Complex Officer Involved Shooting Reconstruction

Complex Officer Involved Shooting Reconstruction

The Scenario

An unarmed, young man is shot in the back as he is running away by a police officer. The officer states that the deceased had fallen and was in the process of turning towards the officer with a weapon in his hand when the officer elected to fire, claiming self-defense. PSI was retained to reconstruct the events based upon the physical evidence, the testimony of the officer and other eye witnesses. The results of the exhaustive analysis showed that the officers' statements were not supported by the evidence.

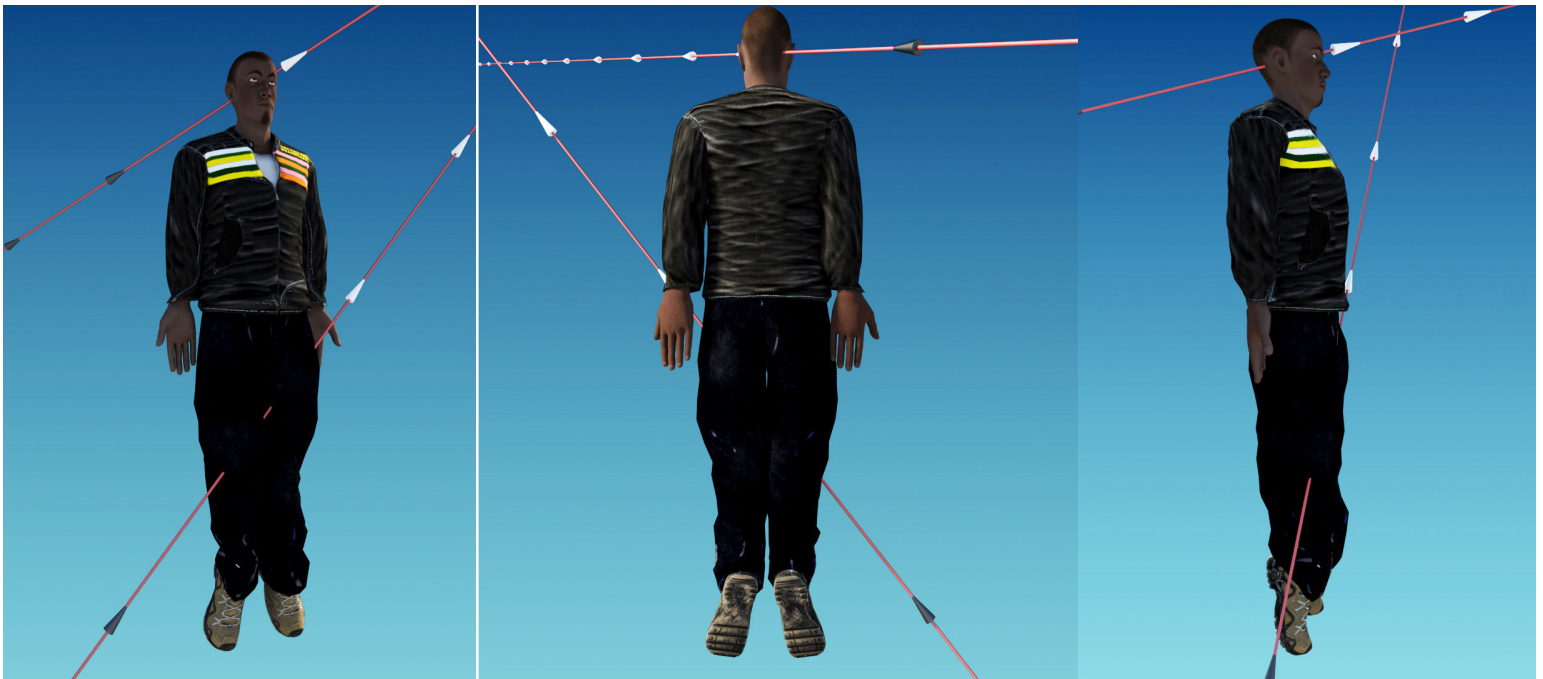


The officer shot at the young man as he was fleeing and had entered an area that was too dark to allow the officer to discern the specific motions of the deceased. Additionally, PSI determined that prior to being shot by the officer, the deceased had discarded his legally carried and owned firearm and was therefore unarmed at the time the officer elected to shoot him.

Case Facts

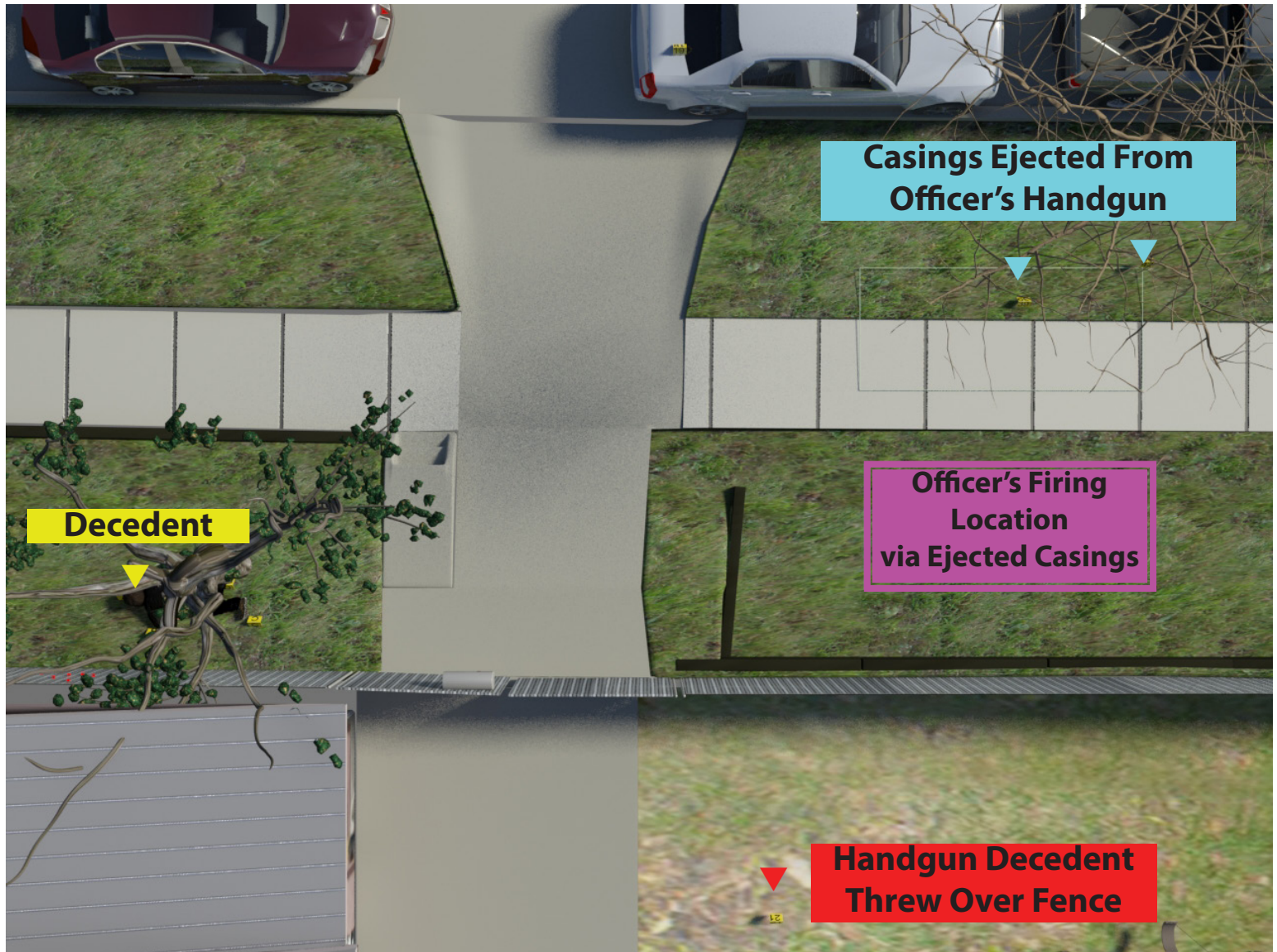
In reviewing the massive dataset associated with this event, PSI's engineers determined the following facts:

1. The officer fired two rounds from his department issued Glock 22 .40 cal. handgun at the decedent as he was fleeing on foot. Of the two rounds that struck the decedent, one round struck him in the right side of the back of the head, exiting over the left eyebrow. The other round struck the decedent in the anterior right calf and lodged in his right patella.



2. A witness called 911 and was on the phone with the emergency operator during the foot pursuit and when the officer fired two shots at the decedent. The recording of the gunshots shows that approximately 0.30 seconds elapsed between the first and second shot. The officer testified that the two rounds were both fired from a stationary position.
3. After the two rounds were fired, the decedent was found dead, face down, adjacent to a tree and a fence.
4. Two cartridge casings that ejected from the officer's Glock 22 .40 caliber handgun were found approximately 39 feet and 44 feet from the decedent's point of rest.

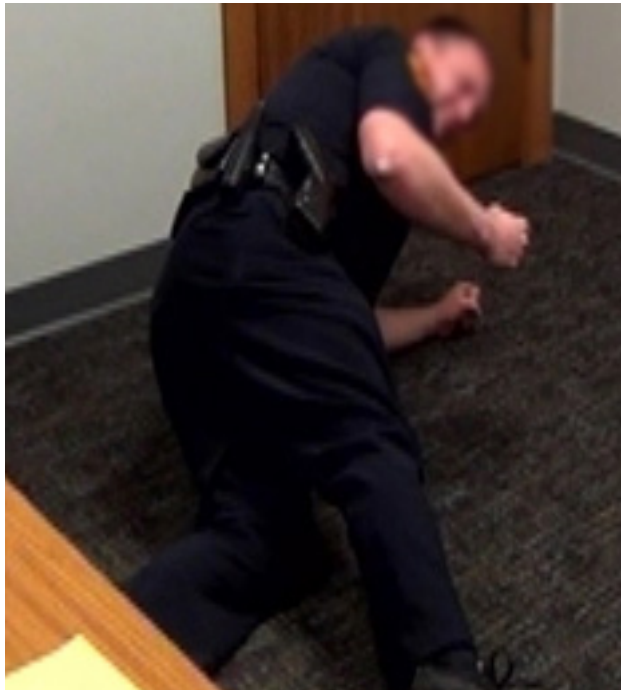
5. The decedent had been in legal possession of a firearm prior to the shots fired by the officer. After the event, the decedent's handgun was located on the opposite side of an adjacent fence from where he was shot and where his body came to rest. The gun was located at a distance of approximately 29 feet from the decedent's body.



Top Down Diagram Including Evidence Location Markers

6. The shooting occurred after a foot pursuit of approximately 315 feet in length. The elapsed time from the beginning of the foot pursuit to the point that shots were fired was approximately 15 to 20 seconds, resulting in an average foot speed of the pursuit between 16 and 21 feet per second.

6. According to his interview and deposition testimony, the officer maintained a distance of 5 to 15 feet behind the decedent during the foot pursuit.
7. At the time the officer fired the two rounds, he was approximately 25 to 40 feet away from the decedent's back.
8. The officer stated that he fired at the decedent after he tripped at a point prior to where he was found under the tree. The officer also stated that he fired at the decedent after he fell to the ground, face down and then turned towards the officer in a manner that he felt was threatening and could result in the decedent shooting at him. During his deposition and his interview, the officer demonstrated the position he claims the decedent was in, just prior to firing the two rounds.



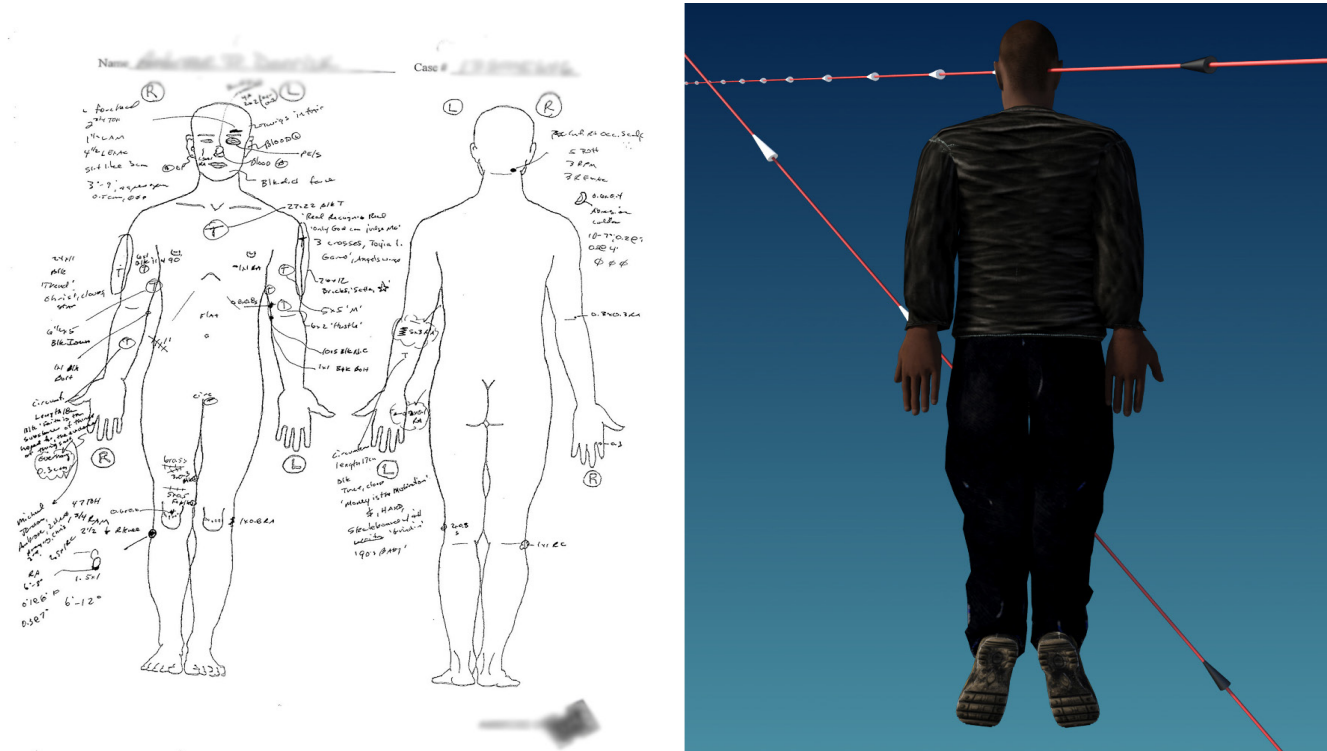
Shooting Officer Demonstrating the Position He Claimed Decedent in - Prior to Firing

9. During the pursuit and subsequent shooting, the officer did not use his available flashlight to assist in illuminating the decedent.
10. A second witness stated that he saw the decedent stumble after the first shot and that there was approximately half a second between the first and second shots fired. The second witness also stated that he saw the decedent either throw something or grab for something prior to hearing the first shot and subsequent stumble.

PSI was tasked in taking the above data in conjunction with the physical environment and determining the locations and actions of both the shooting officer and the shooting victim, and then comparing the results with the officer's sworn testimony. PSI worked with Forensic Pathologist Dr. Judy Melinek and Human Factors expert Jerry Wachtel on the analysis. The multi-step process required to reconstruct this complex and dynamic event is detailed below.

Gunshot Wound Modeling

PSI used the measurements and descriptions of the wounds in the autopsy report to create a 3D model of the decedent, 63 inches in height and the entry and rest/exit locations for the wounds in the back of the head and the back of the right leg. These entry and exit/rest locations were connected by a straight line to create the wound path and then extended in order to align each of them with the location and general height of the shooting officer's weapon.



Autopsy Report Diagram and 3D Model of Decedent with Gunshot Wound Paths

Creation of the 3D Working Model

In order to determine the location and body posture of the decedent when he received the gunshot wounds, it is necessary to properly place the 3D model of the deceased and the gunshot wound paths within the overall crime scene. The Total Station measurements derived by the Police Department depicted the dimensions of the overall scene including roadways, adjacent buildings, fences, areas of grass, sidewalk and the location of all the physical evidence. PSI created a 3D model directly from the Total Station measurements, adding the 3D model of the officer holding his weapon and positioning it to match the location he testified he was in when he fired the two rounds. This compiled 3D Working Model contained all the physical evidence needed to recreate the scene as it was immediately after the shooting.



Photo of Shooting Scene



3D Model of Shooting Scene



Photo of Shooting Scene



3D Model of Shooting Scene

Deriving the Posture of the Victim When Shot

With each of the individual 3D models completed, the final step is to combine the 3D model of the decedent and the gunshot wound paths with the physical evidence at the scene. PSI imported the 3D model of the decedent and the gunshot wound paths into the 3D Working Model of the scene and positioned the decedent model according to the measured location of his body. In order to derive the relative body posture at the time each gunshot wound occurred, the 3D model of the decedent's body is articulated, rotating the torso, head and right leg until the initial end of the trajectory aligns with the 3D location of the officer. This process was repeated for both the head wound and the wound to the lower right leg. Also considered was the shot timing. From the 911 call, PSI was able to determine that the time between the two shots fired was approximately 0.30 seconds.

Using this process, we determined that the gunshot wound to the right lower leg was only possible while the decedent was upright and likely running with his right leg extended behind him and flexed at the knee, near his point of rest. Given the short timeframe between the two shots, the head shot occurred in a similar posture and before the decedent struck the ground, evidenced by the abrasions to his face and the fact that his hands and arms were not extended to break the fall, but found underneath his torso, indicating the loss of motor control due to brain injury before he landed on the ground.



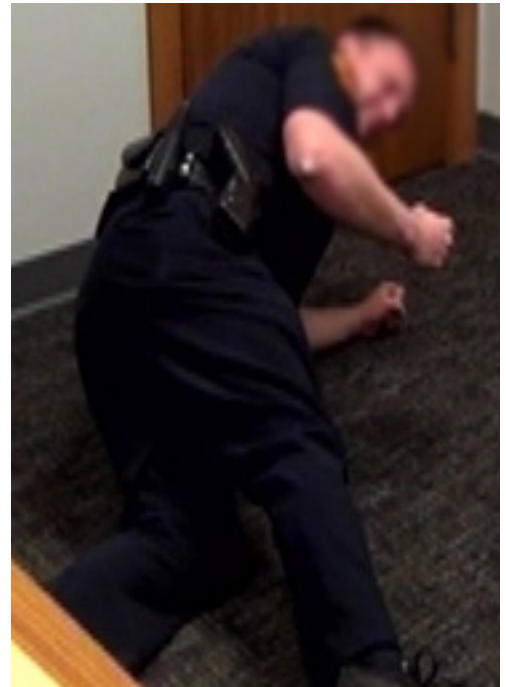
Derived Body Postures for Gunshot Wound 1



Derived Body Postures for Gunshot Wound 2

Nighttime Visibility Study

The officer described the location where he shot the decedent as “...this is like pitch black you know...” and “I would say it was probably you know one to 10, it would probably be like an eight towards the pitch black”. The officer testified that he did not use his flashlight during the pursuit nor did he use it to light the scene before he fired into the dark, as he was trained to do. He further testified that he could only see a silhouette of the decedent before he shot, and at the time he fired the two rounds towards the decedent’s location, he could not see the gun that the decedent had been carrying. During both his deposition and his interview, the officer demonstrated on video the posture that he claims the decedent was in when he decided to fire at him. PSI extracted a still frame from his video deposition illustrating his demonstrated position of the decedent.



PSI undertook a visibility study at the scene with Human Factors expert Jerry Wachtel.

In order to recreate the event, the lighting and visibility conditions, five distinct areas are replicated:

- 1) The celestial lighting conditions
- 2) The environmental conditions
- 3) The additional ambient light sources at the scene
- 4) The point of view of the witnesses
- 5) The clothing, location and orientation of the decedent

PSI traveled to the shooting location to document the lighting conditions and resultant visibility at the location.

In addition to controlling for the above, the measurements taken by the police department with their Total Station were used to re-introduce exemplar physical evidence into the scene to match their locations at the time of the shooting. The final piece in recreating the crime scene was positioning an exemplar person similar in size and dress to the decedent in the recreated scene. The exemplar was directed to assume a pose that matched that given by the officer during his deposition, wherein he was videotaped demonstrating the posture he testified the decedent was in just prior to firing the two rounds.

With the shooting scene accurately recreated, PSI took photometric readings and high resolution photographs from the officer's stated location both with and without a flashlight illuminating the area where the officer claimed the victim was when he shot him. Under similar lighting conditions, we were unable to see the exemplars body, face, any details of his clothing or his posture, and could see only the light reflected off the bottom of his work boots. When the same scenario was viewed with the flashlight on, we could clearly make out the exemplars face, eyes, clothing and posture. This analysis made two things clear – the officer's testimony about seeing the victim in a threatening posture is not possible given the available lighting conditions, and, taking the officer's claims as true, he was negligent in shooting into the dark when the flashlight he had available and was trained to use under similar conditions was not deployed. In truth and as described below, the physical evidence refutes the officer's claims that the deceased was prone under the tree when he shot him.



Officer's View Without Flashlight



Officer's View With Flashlight

Analysis of Timing and Locations Leading up to and Including the Shooting

In order to reconstruct the timing of the event, it is broken down into individual components, just as a vehicular reconstruction would be. Starting at the point of rest of the victim, facedown with his hands underneath his body and his right leg propped up against the tree, PSI analyzed each phase of the dynamic event:

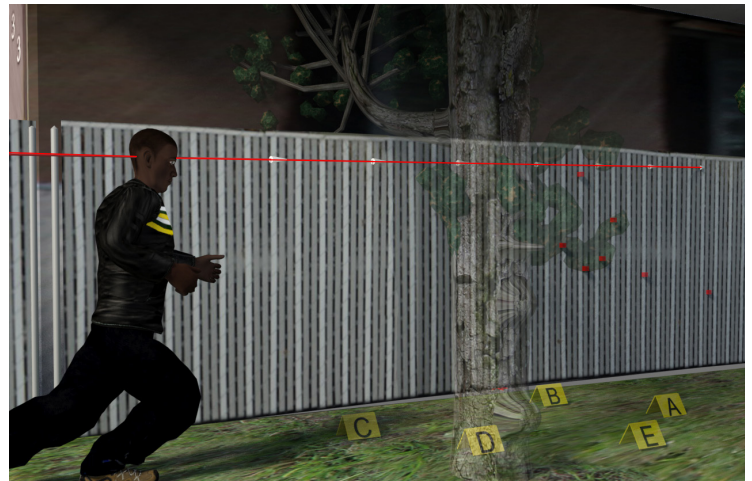
- Given the 315-foot distance of the pursuit and the elapsed time of approximately 19 seconds based upon the recording of the 911 call, the average footspeed of the officer and victim is 17 feet per second.
- Given a footspeed of 17 feet per second and that the headshot was the final shot resulting in loss of motor control, the victim was approximately 7 feet from his point of rest when he was shot in the head. This value is derived using the deceased's forward speed and a calculation of the time it takes for gravity to drop his center of mass to the ground. This is in direct contrast to the officer's statements that the victim was already prone and at the point of rest when the officer fired.

Moving back in time, using the previously derived values and the officer's testimony, the following critical positions and times are derived:

- The shot to the decedent's leg occurred 5 feet and 0.30 seconds prior to the headshot, while the victim is upright and running – 12 feet prior to reaching the point of rest. Again, this is in direct contrast to the officer's statements that the victim was already prone and at the point of rest when the officer fired.



Close-up of Knee Shot



Close-up of Head Shot

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- An aerial photograph of a crime scene. A yellow line with arrows at both ends spans a distance of approximately 36 feet, labeled '~ 36\''. Another yellow line with arrows at both ends spans a distance of approximately 16 feet, labeled '~ 16\''. A yellow rectangular box highlights a dark object on the grass. Yellow evidence markers are numbered 1 through 16. A yellow text box in the upper left corner contains the text: 'Officer Stops Chasing Decedent at This Location'. The scene includes a grassy area, a paved path, a concrete wall, and a large tree on the right.

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Comparison of the Shooting Officer's Testimony to the Physical Evidence

With the 3D Working Model completed, PSI compared the results driven by the physical evidence with the statements made by the shooting officer. PSI found a number of areas where the shooting officer's testimony was not supported by the evidence.

- **Officer's Testimony: The decedent was on the ground under the tree and may be pointing a weapon when the officer fired.** - This is not supported by the available evidence. The evidence shows that the decedent was upright and running with his back turned and no longer had the handgun when he was shot.



Conclusion from Trajectory; Gunshot Wound to Leg is Impossible

- **Officer's Testimony:** The decedent was raising up from a prone position, turning towards and beginning to point towards the officer when he was shot. - The 3D working model and trajectory analysis illustrates four main discrepancies between this claim and the physical evidence. First, the head shot is impossible to effect if the decedent is on the ground in the described position. The resultant trajectory would require the officer to have been either standing right over the decedent or on the other side of the fence when he fired this shot. The evidence shows that the decedent received this gunshot wound while upright. Second, the gunshot to the decedent's knee could not have been received while stationary and prone. The resultant trajectory would require the officer to have been shooting from a location well above his own head. The evidence shows that the decedent received this wound while upright and running. Third, the described posture does not match the evidence of how the decedent fell after being shot. The crime scene photos clearly show that the decedent's right leg is flexed at 90 degrees and his right foot is resting against the tree. The officer testified that the decedent's right foot was on the ground, with the right leg straight and the foot rotated. Finally, the posture the officer puts the decedent in does not line up with the blood spatter evidence located on the white fence. The second witness testified that he saw and heard the officer shoot the decedent the first time while he was running away and the decedent stumbled after this first shot. The witness testified that he heard a second shot approximately 0.5 seconds later. Both of these statements are supported by the evidence and are in direct conflict with the officer's testimony.



Conclusion from Trajectory; Gunshot Wound to Head is Impossible



Conclusion from Blood Spatter; Gunshot Wound to Head is Impossible

- **Officer's Testimony:** The officer could see the decedent well enough to discern his posture as described in his videotaped deposition. - The visibility study was performed under the proper man made and celestial lighting conditions, with a well matched exemplar while maintaining fidelity to the crime lab measurements and the officer's own testimony. The study shows that, had he actually been prone under the tree, the decedent would have been nearly impossible to see and discern against the dark background.

Conclusions

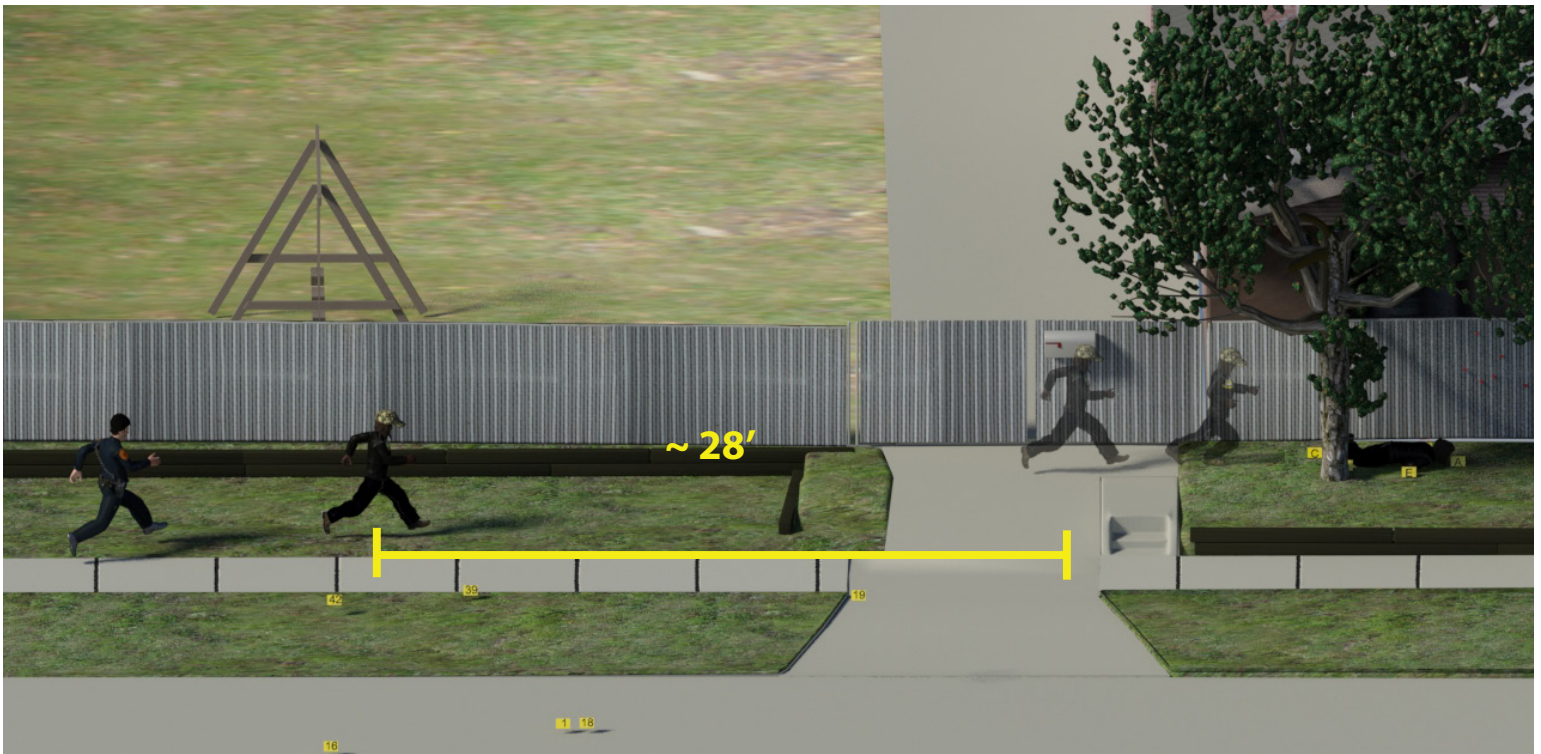
From the analysis of the data PSI concluded the following:

1. The officer fired two times at the fleeing victim. The officer was stationary as he fired two rounds at the decedent's back. The officer was approximately 25 to 30 feet away from the decedent when he began firing at his back in the dark, seeing only a silhouette of the decedent. The decedent was upright and running away from the officer at the time the officer shot him. At the time he was shot, the decedent did not have a handgun on his person, having thrown it over fence well before - as commanded by the officer.
2. The first shot fired by the officer struck the decedent in the right leg as he was running away. The decedent was approximately 12 feet from his eventual point of rest, (and the location claimed by the officer) when he suffered this gunshot wound.
3. The second shot fired by the officer struck the decedent in the back of the head. The officer fired this shot as the decedent was upright, running away and looking straight forward in his direction of travel. The decedent was approximately 7 feet from his point of rest when he suffered this gunshot wound. Upon receiving this gunshot wound, he fell directly on the ground, face down without putting his arms out to break the fall.



Officer Shoots Decedent in Right Leg while Decedent is Upright, Running Away and Approximately 12 Feet from his Point of Rest Under the Tree

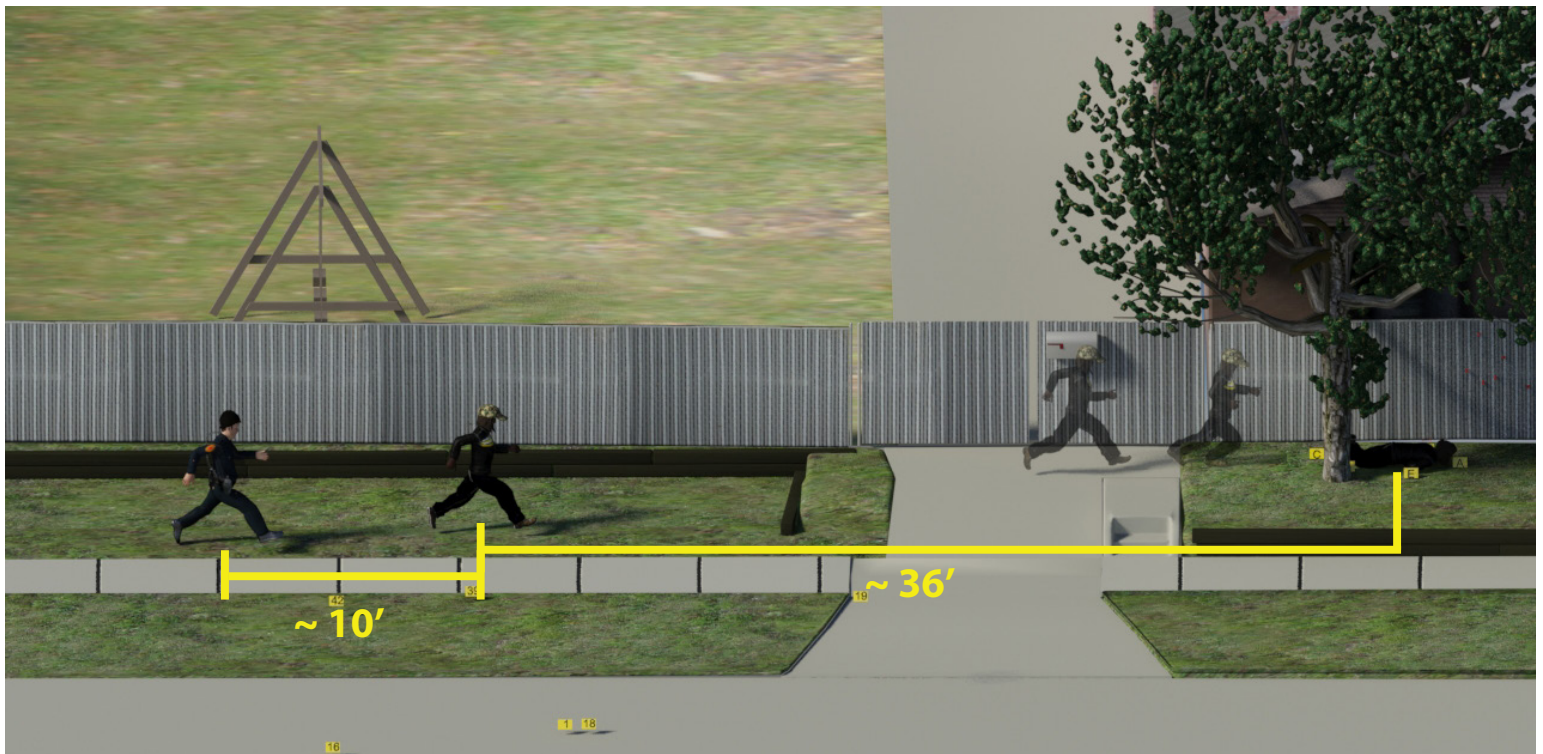
4. The handgun was found over the fence after the shooting, thrown there by the decedent during the pursuit and as commanded repeatedly by the officer. The decedent had thrown the gun over the fence prior to being shot – approximately 28 feet east of the point where he was first shot.
5. The second witness observed the decedent make the throwing motion at or near the fence, while the witness was approximately 130 feet away. Given that the officer was directly behind the decedent and only 10 feet away, he should have been able to see the victim throw the weapon, although he testified he did not.



**The Decedent Throws the Gun as Commanded by the Officer
Approximately 28 Feet Prior to Being Shot**

6. Given the lighting conditions at the scene, described as “pitch black” by the officer, and his lack of dark adaptation as he ran from the well-lit area to the pitch black area where the decedent was shot, the officer could not have seen the decedent make the threatening moves that he claims. Had the officer fired while prone under the tree, he would have essentially been shooting “blind”.
7. Had the officer followed his training and used the flashlight he had available, he would have been able to see that the decedent did not have the handgun at the time the officer fired nor did the decedent make the threatening move the officer claims.

8. The officer's testimony that the decedent was on the ground, under the tree and turning towards him in a threatening manner prior to firing is false and is totally unsupported by the evidence and witness testimony. In fact, the officer shot the deceased as he had his back turned, was upright, running away and was visible only as a silhouette.
9. The officer made a decision to stop chasing the decedent, come to a stop and shoot two times at his fleeing silhouette in response to something other than what he claims. The officer stopped chasing the decedent, quickly transitioned to a stop, and fired two times at the fleeing victim nearly simultaneously with the decedent throwing the gun away.



The Officer Stops Chasing the Decedent and Quickly Transitions to Firing his Weapon when the Decedent is Approximately 36 Feet from the Tree.