

Visualisation of a forensic experiment to determine the trajectory of a projectile at the scene where a hunter was shot – verification of the suspect's account

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Streszczenie

What was the projectile's trajectory during the incident, what position was the victim in, and could observation via a thermal imaging device have led to misidentification of the target? Experts attempted to answer these questions during a forensic experiment carried out in the Milejów-Wieś area in the Lublin Province. Some events cannot be reconstructed solely on the basis of documentation, witness statements or isolated traces. In such situations, forensics employs a forensic experiment – an evidential procedure designed to experimentally re-enact the course of an event, or part thereof, and to verify the statements given. In this case, it was necessary to recreate as faithfully as possible the circumstances in which a hunter was fatally shot.

Keywords: trajectory, projectile, identification, thermal imaging device, ricochet, forensic experiment.

Introduction

The authors were prompted to carry out the procedural steps described below by a request sent by the District Public Prosecutor's Office in Lublin to prepare and conduct a forensic experiment based on the evidence provided from the case file, and to recreate conditions that would come as close as possible to those prevailing at the time of the incident. According to case file, a male was reportedly fatally shot by a fellow hunter during hunting in a village near Lublin. The main issues the authors had to address while conducting the experiment in question were to determine whether

the projectile fired by one of the hunters had struck the other hunter's body directly or had ricocheted, what the position of the hunter who had been shot was at the moment he was hit, and finally to establish whether it was possible to recognise the silhouette of a person while using an optoelectronic device, such as thermal imaging optics.

Some events cannot be verified solely on the basis of case documentation, witness statements or isolated traces. A forensic experiment is an evidential activity aimed at verifying the evidence gathered or establishing new facts by experimentally reconstructing the course of an event or part thereof.

From procedural material to experiment

Before commencing the activities proper, the documentation provided was analysed, including the inspection reports and the forensic medical report on the post-mortem examination carried out at the Institute of Forensic Medicine at the Medical University of Lublin. The reconstruction of the location of the gunshot wounds and their transfer to the simulation mannequin was of particular importance.

The preparations also required collecting the necessary equipment held by the toolmark examination team, in particular the Weapons and Ballistics Unit of the Forensic Laboratory of the Provincial Police Headquarters in Lublin, including a 'Linia' kit with a frame, a laser rangefinder, laser point indicators, a simulation mannequin, probes and an adjustable spirit level for measuring angles. The choice of equipment was guided by the need to maintain as much control as possible over the spatial reconstruction of the incident.



Fig. 1. A simulation mannequin with transferred injuries

The experiment was conducted out on 30 March 2026 in the village of Milejów-Wieś in the Lublin Province. The activities were carried out between 17.00 hrs and 21.30 hrs, i.e. the time corresponding to the incident in question. It was of great importance to recreate the conditions as closely as possible to those that existed at the time of the incident. The sky was overcast on the experiment day, with no rain or fog, and the temperature was around 14–15°C.

On the basis of the available documentation, the points on the ground and the distance between the point of firing and the point where the projectile contacted the body of the man who was shot were deduced and determined. The distance between the marked points

was approximately 167 metres. This made it possible to recreate not only the general appearance of the site, but also the relative positions of its most important features. In order to recreate the weather conditions, namely the rainfall described in the case file, which that prevailed at the time of the incident, two crews from the voluntary fire brigade were called in to assist; they used water curtains to simulate the rainfall on the day of the incident.



Fig. 2. The experiment site following initial preparations

The incident scene matters

The experiment made direct use of the incident scene itself, the nature of which allowed the key elements of the situation to be recreated. Proper preparation of the site was one of the most important stages of the entire venture. One of the stages in reconstructing the incident scene involved restoring the overturned hunting pulpit – from which the shot was allegedly fired – to its original condition, and positioning a mannequin at the correct spot, with the aim of confirming the assumption that the victim had been shot directly.

It was not just a matter of positioning the mannequin or determining where to take the shot from. It was necessary to maintain the correct spatial relationships between the individual points and to recreate the observation conditions.



Fig. 3. A simulation mannequin with a laser beam directed from the pulpit onto the victim's injuries, as determined on the basis of medical records

Laser reconstruction of the projectile's trajectory

In the case of an incident involving a firearm, the marks on the body alone are not always sufficient to provide a complete picture of how the incident unfolded. It is essential to spatially correlate the point from which the shot was fired, the potential trajectory of the projectile, the position of the victim, and any terrain obstacles that may have influenced the bullet's movement; therefore, during the experiment, a laser simulation of the projectile's trajectory was used, which made it possible to confirm that the projectile fired from the hunting pulpit struck the target directly, thereby ruling out the possibility of it ricocheting off obstacles in its path. Thus, it was possible to confront the information contained in the documentation with the actual spatial arrangement of the two shooters, and to determine the position of the victim at the moment of the shot.



Fig. 4. Laser visualisation of the projectile's flight path towards the victim

As a result of analysis of the evidence, i.e. the records in the case file under examination, it was established that at the moment of the shot the victim was standing with his body turned sideways – with his left side facing the direction from which the projectile was fired.

The above findings were fully consistent with the results of the forensic experiment as regards the projectile's trajectory, the exclusion of a ricochet, the position of the victim's body at the moment of the shot, the injuries sustained and the position of the shooter, as well as the position of the shooter's weapon.

Is it a human or an animal? Thermal imaging test

The issue of observation using a thermal imaging device required separate investigation. In the circumstances of the incident, it was not only the visibility of the silhouette itself that may have been significant, but also the ability to identify it correctly.

Consequently, the observation conditions were recreated and assessed in two scenarios: without a water curtain and with a water curtain – simulating fog or rainfall at the time of the incident.



Fig. 5. Visibility of human silhouettes without a water curtain



Fig. 6. Visibility of human silhouettes through a water curtain

The observation carried out in this way was not intended to replace an assessment of the evidence, but rather constituted an attempt to answer a specific question posed prior to the experiment: whether, under observation conditions using a thermal imaging device, a human silhouette might be mistakenly identified as that of an animal, e.g. a wild boar. From the point of view of re-enactment, it was therefore not only what could be seen that was important, but also how the image might be interpreted by the observer. The expert's assessment of the image, based on the above assumption, was subjective, as visibility depends not only on the parameters of the device used, but also on the individual characteristics of the user of that equipment, and the final assessment of the recorded material is a matter for the judicial authority that commissioned the activities.

The experiment as a verification tool

The entire process required a combination of several elements: analysis of the documentation, recreation of the injuries on a mannequin, preparation of the scene, selection of the appropriate equipment, spatial reconstruction of the positions of the individuals involved, and execution of a thermal observation testing. The forensic process experiment indicates that factors crucial to the experiment's success included, among others, the appropriate selection of weather

conditions, the time of day, site preparation and the use of the correct equipment, including a suitable laser to visualise the projectile's trajectory.

In summary, a forensic experiment is a prime example of how knowledge, experience and modern research tools enable looking at an incident from a completely different perspective. What appears to the casual observer as merely a section of terrain, a single trace or a blurred silhouette seen in thermal imaging optics may, to an expert, become a piece of a larger jigsaw and the answer to the questions posed to them.

Sources of the figures: the authors