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**Bloodstain Pattern Analysis Provides Evidence during Crime Scene Investigation**

**Siniša Franjić**

Faculty of Law, International University of Brcko District, Brcko, Bosnia and Herzegovina

**\*Correspondig Author:** Siniša Franjić, Faculty of Law, International University of Brcko District, Brcko, Bosnia and Herzegovina, Europe, Tel: +387-49-49-04-60; Email: [sinisa.franjic@gmail.com](mailto:sinisa.franjic@gmail.com)

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**Abstract**

When it is determined that there are or should be traces of blood at the crime scene, it is necessary to take search measures of the crime scene and visualize such traces. The next important step is documenting these clues by description, criminal photography, sketching and video made to make them available for potential additional analysis in the later stages of criminal investigation or criminal procedure. Traces of blood are found in many criminal offenses and can be important evidence. It would be a crucial mean, when combined with the information derived from any DNA analysis, to allow an investigator to corroborate or refute specific investigative theories and subsequent statements offered by suspects, victims, and witnesses. So, the current study aim to clarify the crime scene investigation and reconstruction for detecting bloodstain patterns; specific skills of criminalist for analyzing blood traces; different means for interpreting such traces; blood factor and types as important tools in criminal investigation for blood patterns.

**Keywords:** Blood; Crime Scene; Trace

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**Introduction**

Law enforcement personnel must take proper action to enhance all aspects of the crime-scene search so as to optimize the crime-scene reconstruction [1]. First, and most important, is securing and protecting the crime scene. Protecting the scene is a continuous endeavor from the beginning to the end of the search. Evidence that can be invaluable to reconstructing the crime can be unknowingly altered or destroyed by people trampling through the scene, rendering the evidence

useless [1]. The issue of possible contamination of evidence will certainly be attacked during the litigation process and could make the difference between a guilty and not-guilty verdict.

Before processing the crime scene for physical evidence, the investigator should make a preliminary examination of the scene as it was left by the perpetrator [1]. Each crime scene presents its own set of circumstances. The investigator's experience and the presence or absence of physical evidence become critical factors in reconstructing a crime. The investigator



captures the nature of the scene as a whole by performing an initial walk-through of the crime scene and contemplating the events that took place. Using the physical evidence available to the naked eye, he or she can hypothesize about what occurred, where it occurred, and when it occurred. During the walk-through, the investigator's task is to document observations and formulate how the scene should ultimately be processed. As the collection of physical evidence begins, any and all observations should be recorded through photographs, sketches, and notes. By carefully collecting physical evidence and thoroughly documenting the crime scene, the investigator can begin to unravel the sequence of events that took place during the commission of the crime [1].

### Crime Scene

From DNA nanogram quantities to the artificial intelligence databases which are capable of characteristic latent fingerprints, forensic science and also the analysis of terribly minute quantities of physical evidence have advanced and improved. Yet, these applications of the science are remote from the crime scene and its investigation [2]. Crime scene investigation is that the starting purpose for the prospering use of physical proof by the forensic laboratory and also the criminal investigator. Now quite ever, the crime scene should always be properly managed and investigated in the best probable manner.

Successful, prime quality crime scene investigation may be a straightforward, organized method. It is not rigid; it follows a set of principles and procedures that are reasonable and ensure that all physical evidence is discovered and investigated with the result that justice is served. The basic crime scene scene procedures are physical proof recognition, documentation, correct assortment, packaging, preservation, and, finally, scene reconstruction.

Each crime scene is exclusive and, with expertise, a criminal offense scene investigator are going to be ready to use this logical and systematic approach to analyze even the foremost difficult crime scenes to a prospering conclusion.

At the crime scene, the perpetrator may leave traces that may be visible or invisible [3]. When securing the scene, care should be taken not to destroy or alter the tracks or to create new ones. Traces can appear as papillary prints, footprints, traces of fibers from clothing, traces of blood, traces of teeth if the offender consumed food at the scene. During the course of the examination, it is necessary to inspect the vicinity of the scene, as there is a possibility that the perpetrator, upon arriving at and leaving the crime scene after the burglary, left traces to identify him or indicate his movement, hid the stolen objects or discarded used tools [3].

Determine if the police have a legal right to be present conducting the crime scene investigation [4]. A crime scene investigation is basically the search for evidence and properly documenting, preserving, and collecting this evidence. The key word is search; the CSI must ensure that a person's Fourth Amendment rights against unreasonable search and seizure are protected. It is incumbent upon the crime scene investigator to ensure that he or she has legal authority to be present conducting the scene investigation [4].

The key legal premise to determine is who has a reasonable expectation of privacy in the area where the crime scene investigation is being conducted. This may not necessarily be the titleholder of a piece of property. Lawfully rented property requires the authority of the lawful renter, not necessarily the property owner. A roommate may allow a search, but that authority extends to his or her personal area and any shared area (such as the kitchen and living room); such consent would not extend to his or her roommate's bedroom. Either the individual that has a reasonable expectation of privacy in the area to be searched grants

approval, or a judge with appropriate jurisdiction may grant permission to search through a search warrant [4].

Crime scene processing is an inherent task and duty associated with most criminal investigations, for rarely does one encounter a crime without some kind of crime scene [5]. The processing of Crime scene composed of an examination and analysis of the scene for the express purpose of recovering physical evidence and documenting the scene's condition in situ, or as found. To accomplish this, the crime scene technician engages in six basic steps: assessing, observing, documenting, searching, collecting, and analyzing. These steps, and the order in which they are accomplished, are neither arbitrary nor random. Each serves an underlying purpose in capturing scene context and recovering evidence without degrading the value of either. Any way you look at it, this is not an easy task, since the mere act of processing the scene disturbs the scene and evidence. From these efforts however, the investigator will walk away with important items of physical evidence and scene documentation in the form of sketches, photographs, notes, and reports. All of this information plays a significant role in resolving crime by providing objective data on which the investigating team can test investigative theories, corroborate or refute testimonial evidence, and ultimately demonstrate to the court the conditions and circumstances defined by the scene. This is a task that is easily said, but it is not so easily done [5].

Action without purpose is folly and, simply put, becomes wasted effort. This is true in any endeavor, so it is imperative that before pursuing the actions an investigator conducts in the crime scene, the investigator must understand his or her mandate. Crime scene processing is a duty in every sense of the word. Crime scene processing is not something the technicians do because "they were told to," but rather because they have a responsibility to do so. If the investigator fails to recognize this duty and its ultimate purpose, many of the

procedures used at the scene might appear meaningless and therefore unnecessary.

### Reconstruction

Because investigators consider many types of evidence when reconstructing a crime scene, reconstruction is a team effort that involves various professionals putting together many pieces of a puzzle [1]. All team members work to answer the standard "who, where, what, when, why, and how" of a crime scene. Often reconstruction requires the involvement of law enforcement personnel, a medical examiner, and/or a criminalist. All of these professionals contribute unique perspectives to develop the crime-scene reconstruction. Was more than one person involved? How was the victim killed? Were actions taken to cover up what took place? The positioning of the victim in a crime scene can often reveal pertinent information for the investigation. Trained medical examiners can examine the victim at a crime scene and determine whether the body has been moved after death by evaluating the livor distribution within the body. For example, if livor has developed in areas other than those closest to the ground, the medical examiner can reason that the victim was probably moved after death [1]. Likewise, the examiner can determine whether the victim was clothed after death because livor will not develop in areas of the body that are restricted by clothing.

A trained crime-scene investigator or criminalist can even bring specific skills to the reconstruction of events that occurred during the commission of a crime. For example, a criminalist using a laser beam to plot the approximate bullet path in trajectory analysis can help determine the probable position of the shooter relative to that of the victim. Other skills that a criminalist may employ during a crime-scene reconstruction analysis include determining the direction of impact of projectiles penetrating glass objects; locating gunshot residues deposited on the victim's clothing for the purpose of estimating the distance of a shooter from a target; searching

for primer residues deposited on the hands of a suspect shooter; and, as we will see from the discussion that follows, analyzing blood spatter patterns [1].

### Bloodstain Patterns

Bloodstain pattern analysis is a powerful forensic tool used in crime scene investigations [6]. If the investigator understands the dynamics of an altercation, how blood behaves when it exits the body, and the way it reacts once it contacts a surface, then an endeavor are often created to grasp what happened and to see if a crime occurred. The trained forensic scientist looks at the patterns made by bloodshed and tries to determine what did and/or did not happen. To Interpret the bloodstain patterns, physical measure of blood droplets; pattern recognition victimization far-famed pictures or experiments; the utilization of trigonometry; and information of the physics of motion can be used along with different sorts of proof from the crime scene (such as fingerprints, toolmark and footprint impressions, DNA evidence, and chemical analysis), the forensic investigator pieces together the puzzle recreating a logical sequence of events, supported by crime scene evidence. Collecting and documenting the evidence correctly is another skill just as important as interpreting evidence. Bloodstains cannot always be carried back to the lab, so care in documenting the scene is of utmost importance.

The consideration of the bloodstains at the crime scene can provide important information to the crime scene technician [7]. The discipline of bloodstain pattern analysis considers the location, shape, size, distribution, and other physical characteristics of bloodstains in the scene, and from this derives information regarding the nature of the event that created the pattern [7]. Thus bloodstain patterns tell us “what” happened. This information, when combined with the information derived from any deoxyribonucleic acid (DNA) analysis,

may allow an investigator to corroborate or refute specific investigative theories as well as subsequent statements offered by suspects, victims, and witnesses [7]. Although the crime scene technician may not be trained in depth in bloodstain pattern analysis, it is imperative that he or she be able to recognize critical classifications of stains and know how to properly document bloodstained scenes.

The theory of bloodstain pattern analysis is relatively simple [7]. Blood as a fluid (a complex fluid, but a fluid nonetheless) responds to variations of internal and external forces in a predictable fashion [7]. The bloodstain pattern analyst evaluates various mechanisms and collapse mechanics of blood masses with respect to the patterns produced under controlled conditions (known patterns) [7]. This knowledge is compared against the stains found in bloody scenes (unknown patterns) [7]. The predictability of how blood behaves under basic known conditions allows the unknown patterns to be compared via class characteristics [7]. This predictability also allows the analyst to recognize other aspects, such as directional and impact angle and the alterations brought about by environmental conditions.

Crimes including violent contact between individuals are often accompanied with bleeding [1]. Crime-scene analysts have come to appreciate that Crimes including violent contact between individuals are often accompanied with bleeding. The information one is probably going to uncover as a results of interpreting of bloodstain patterns includes the following [1]:

- The direction of blood from which it originated.
- The angle of a blood drop stricken a surface
- The location or position of a victim at the time a bloody wound was inflicted
- The movement of a bleeding individual at the crime scene

- The minimum variety of blows that stricken a bloody victim
- The approximate location of an individual delivering blows that produced a bloodstain pattern

While becoming a certified bloodstain pattern analyst requires years of training and practice, the CSI can learn to examine blood spatter at the crime scene and determine direction of travel and a general location for area of origin of the impact [8]. This understanding is important, because the interpretation of blood spatter patterns and different proof at crime scenes might reveal important investigative information, such as the positions of the victim, assailant, and objects at the scene; the sort of weapon that was accustomed cause the spatter; the amount of blows, shots, stabs, and so on that occurred; and the movement and direction of the victim and assailant after the bloodshed began [8]. It may also support or contradict statements given by victims, suspects, or witnesses, and, most important, may keep an innocent person from being convicted.

Passive bloodstains are created by the force of gravity and can be found on a variety of surfaces, such as carpet, wood, tile, wallpaper, or clothing. A close inspection of the crime scene is required, and all stains must be documented. By applying the law of physics, mathematics, and trigonometry, bloodstain pattern analysis can provide information that will assist the investigator in determining what events occurred, who was or was not present, and the validity of a self-defense claim by the suspected perpetrator [8].

The crime scene may contain several areas where blood spatter is found. During the initial walkthrough, it is important to consider each location for analysis. In addition to the possible determination of the course and sequence of events, the reconstruction will allow the CSI to develop a plan for the collection of blood samples from the most logical sites after the scene has been documented [8]. There is no need to sample every single blood drop. Careful

analysis of the scene will result in accurate representative samples of blood being submitted to the crime laboratory for analysis.

### **Blood Factors**

Until the first Nineties, forensic scientists centered on blood factors, like A-B-O, as providing the best means for linking blood to an individual [1]. What made these factors so attractive to the forensic scientist was that in theory no two individuals, except for identical twins, could be expected to own a similar combination of blood factors. For instance, blood factors are controlled genetically and have the potential of being a extremely daintiness for personal identification. What makes this observation so relevant is the high frequency of occurrence of bloodstains at crime scenes, especially crimes of the most serious nature—that is, homicides, assaults, and rapes. Consider, for example, a transfer of blood between the victim and assailant during a struggle; that's, the victim's blood is transferred to the suspect's garment, or vice versa. If the criminalist might individualize human blood by characteristic all of its familiar factors, the result would be evidence of the strongest kind for linking the suspect to the crime scene.

The approach of forensic science has been dramatically altered by the advent of DNA technology. The search for genetically controlled blood factors in bloodstains has been abandoned in favor of characterizing biological evidence by select regions of our deoxyribonucleic acid (DNA) [1]. The individualization of dried blood and other biological evidence, now a reality, has significantly altered the role that crime laboratories play in criminal investigations.

### **Blood Types**

Blood typing has been used for many years in forensic science and was the main source of blood determinations prior to deoxyribonucleic acid (DNA) being introduced as a more

conclusive form of evidence [9]. Four main blood types are used for identification purposes, but there are eight groups, which are more specific and relate directly to the antigen present in the blood. In addition, the basic A-antigen and B-antigen in an individual's blood will also contain the presence of an Rh factor of positive or negative [9].

According to Erickson E [9] there are four blood types which are:

- A
- B
- AB
- O

Once human blood is identified at a crime scene, the specific blood type can be determined. Unfortunately, this is not individualized to a specific person but helps narrow the percentage of the population that has that specific blood type. If blood typing is the only option in a case, the investigator could narrow the suspect pool by determining the blood type found at the crime scene and comparing the information to the blood type of each possible suspect [9].

### Conclusion

A trace can be defined as any material change made in connection with a crime. The clues point to the existence of the crime in a manner and means of execution, present evidence that can independently and objectively link the suspect with the victim or place of the criminal event, or to connect the suspect to the victim. They also point to the motive for the commission of the crime, as well as to the identity of the unknown perpetrator or victim.

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