Title: Blood spatter interpretation at crime and accident scenes: a basic approach
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74.2 (Feb. 2005): p21.

Many new technologies can help law enforcement personnel solve crimes and apprehend offenders. While specialists in these fields must keep abreast of new developments, law enforcement personnel do not have to become experts to take advantage of the innovations or to apply the scientific methods. For example, once, albeit a long time ago, authorities often ignored fingerprint evidence at crime scenes because they either did not understand its value or did not have skilled personnel to process it. As specialists became available, however, law enforcement agencies began collecting the evidence. Today, it would prove a misfeasance for an officer or crime scene technician to ignore fingerprints at the scene of a violent crime.

Blood spatter analysis requires the same expert interpretation as fingerprints. Yet, at crime scenes today, authorities often treat blood stains the same as their counterparts did fingerprints a century ago: not routinely measuring or properly photographing them. In many trials, the story composed by the blood that could help law enforcement understand more about what happened during a violent attack or prove a defendant's version of the incident improbable or impossible never gets told.

In the future, resident blood spatter analysts may become as common as fingerprint experts in law enforcement agencies; however, the lack of these specialists in no way should preclude obtaining vital blood spatter evidence at crime scenes. Officers or technicians do not have to interpret the blood spatter but only measure it, record their findings, and photograph the stain so experts can analyze it later.

EVIDENCE VALUE

Recording blood spatter evidence requires little training. Officers and technicians do not have to learn the trigonometric formulas and calculations involved in interpretation. Measurement training does not require weeks of classroom lectures and months of on-the-job experience. Instead, law enforcement personnel can learn the measurement and photography procedures in 2 days at police academy classes, college criminal justice courses, or in-service seminars.

How much knowledge do officers and crime scene technicians need to preserve blood spatter evidence? First and foremost, they must recognize the importance of the evidence--equal to that of fingerprints, shell casings, bullet holes, or murder weapons. Next, they need to understand that blood spatter indicates the direction from which it came. Then, they must learn how to measure the length and width of a single blood drop, how to tell the direction of travel (visible with the naked eye), and how to find the distance from the drop to the point from which the blood came (also visible with the naked eye). Finally, they need to record those measurements. A form with columns can create a permanent record of the blood spatter evidence at a crime scene. These measurements and the photographs are all an expert requires to analyze the evidence at a later time.

A basic understanding of blood spatter analysis allows the first responding officer, crime scene technician, or detective to assist in correctly collecting and preserving blood stain data at the scene. The principles and procedures are not complicated. The interpretation of blood spatter patterns at crime scenes may reveal critically important information, such as the positions of the victim, assailant, and objects at the scene; the type of weapon used to cause the spatter; the minimum number of blows, shots, or stabs that occurred; and the movement and direction of the victim and assailant after bloodshed began. It also may support or contradict statements given by witnesses. (1) The analyst may use blood spatter interpretation to determine what events occurred; when and in what sequence they occurred; who was or was not present; and what did not occur. (2)

Officers or crime technicians can record the measurements of the stains needed and leave it to the experts to interpret them. However, officers and technicians should have a basic idea of what the blood spatter means, including--

Stain	Width (mm)	Length (mm)	Cm to POC	Photo Nos.
1	.5	1.0	24.0	11-15
2	.7	1.2	24.5	9, 16-18
3	.5	1.0	23.75	21-23
4	1.0	2.0	30.25	8, 26

* an understanding of the three classifications of blood spatter velocity and what they indicate;

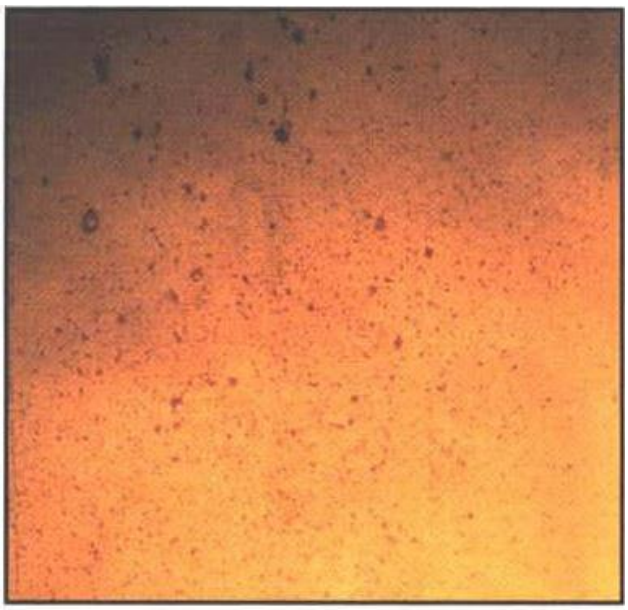
* how to tell which way a drop was traveling;

* how to measure the length and width of a stain;

* how to measure from the stain to the point of convergence; and

* how to properly photograph blood stains.

Low and medium velocity, slightly magnified.



The high velocity gun shot wound leaves a mist-like appearance.

VELOCITIES OF BLOOD SPATTER

The velocity of the blood spatter when it strikes a surface is, within certain limitations, a strong and reasonably reliable indicator of the speed of the force that set the blood in motion in the first place. The classification of the velocity (whether high, medium, or low) is that of the initial force causing the blood to move, rather than the speed of the blood itself as it moves, and is measured in feet per second (fps). High velocity blood spatter, for instance, may have come from a gunshot wound inflicted by a bullet moving at 900 fps, whereas medium velocity may have resulted from a spurting artery or a blunt instrument striking the already bloody head or limb of a victim, and low velocity blood may have dripped from a wound or blood-soaked item.

High Velocity

High velocity blood spatter is produced by an external force greater than 100 fps. The stains, sometimes referred to as a mist, tend to be less than 1 millimeter. Usually created by gunshots or explosives, high velocity patterns also may result from industrial machinery or even expired air, such as coughing or sneezing. In any case, the spatter tends to come from tiny drops of blood propelled into the air by an explosive force. High velocity droplets travel the shortest distance because of the resistance of the air against their small mass.

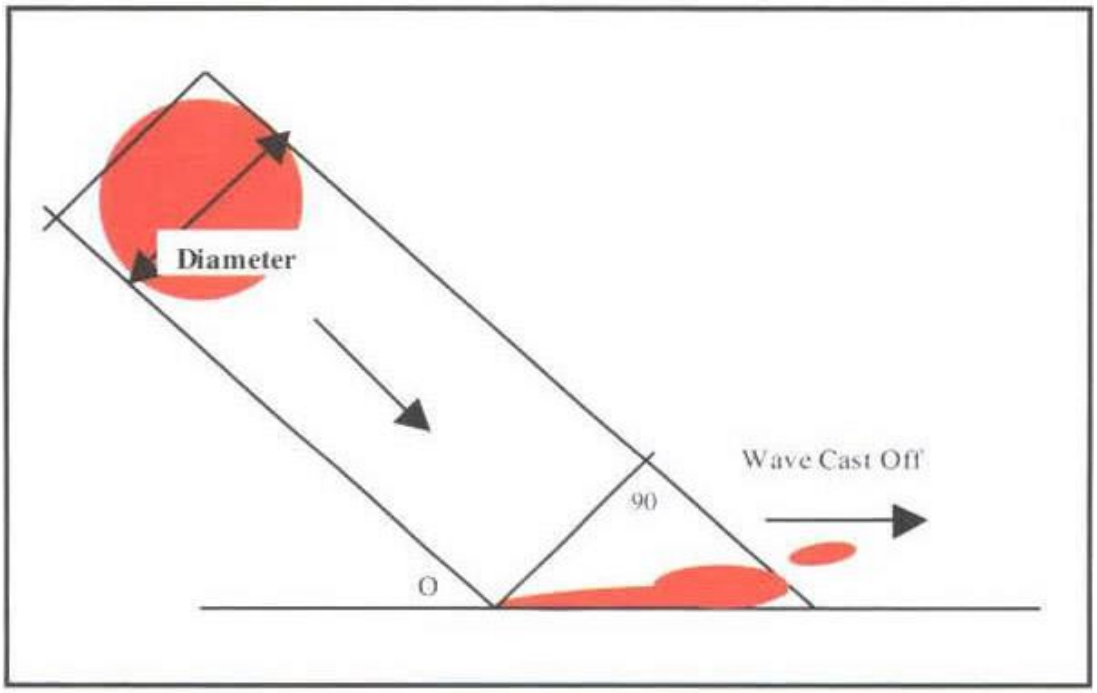


***Figure 1**. Side view of blood drop in air, and then striking a flat surface.*

Medium Velocity

An external force of greater than 5 fps but less than 25 fps causes medium blood spatter. The stains generally measure 1 to 3 millimeters. Blunt or sharp trauma, often from knives, hatchets, clubs, fists, and arterial spurts, can produce such stains.

Most medium velocity stains found at crime and accident scenes form patterns created by blood flying from a body to a surface as a result of blunt or sharp trauma or the body colliding with rounded or edged surfaces. It

may result from a punch, stabbing, or a series of blows or, in the case of an accident, the body striking surfaces inside or outside a vehicle. Any object that blocks the blood from falling on the surface where it would have landed, including the victim or the attacker's body or a piece of furniture moved to stage the scene, creates a void space in the stain.

Low Velocity

Low velocity blood spatter is created by an external force less than 5 fps (normal gravity) with the stains generally 3 millimeters and larger. It usually results from blood dripping from a person walking or running or from a bloody weapon. Dripping blood often falls at a 90-degree angle and forms a 360-degree circumference stain when it hits a flat surface, depending, of course, on the texture of the surface. Investigators also may find low velocity blood spatter in the trail of an individual who is bleeding with larger pools of blood indicating where the person paused.

THE BLOOD DROP IN FLIGHT

Experiments with blood have shown that a drop of blood tends to form into a sphere, rather than a teardrop, when in flight. Fresh blood is slightly more viscous than water and, like water, tends to hold the spherical shape in flight.

This spherical shape of blood in flight is important for the calculation of the angle of impact of blood spatter when it hits a surface. That angle determines the point from which the blood originated, called the point of origin (PO).

When a drop of blood strikes a flat surface, the diameter of the drop in flight will be the same as the width of the spatter on the surface. The length of the spatter will be longer, depending on the angle at which the drop hit.

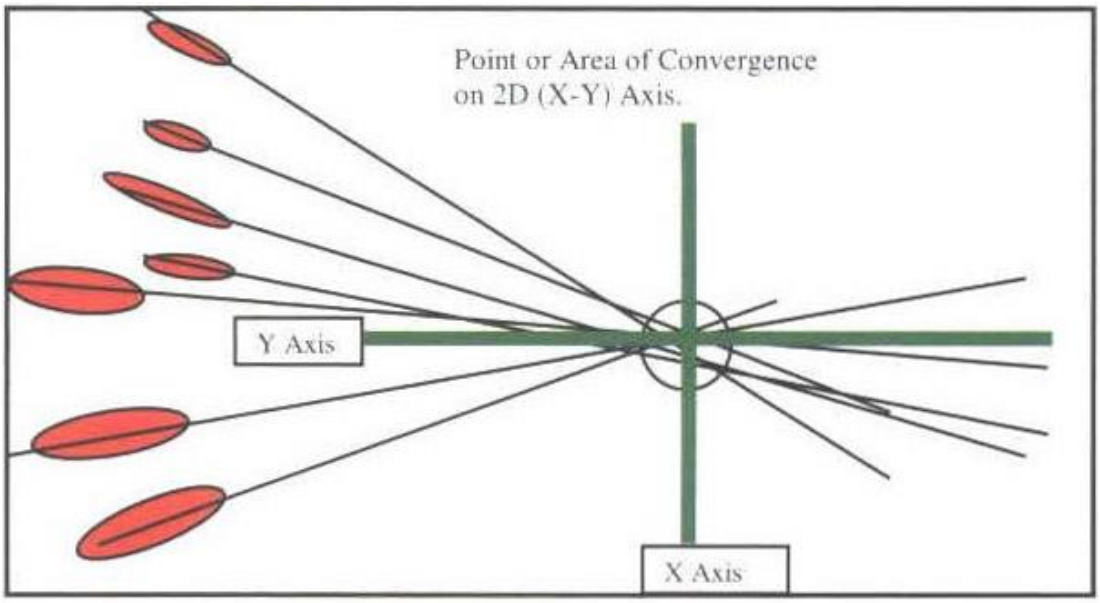


***Figure 3**. Lines through the central axes of the individual stains cross at the point of convergence.*

POINT OF CONVERGENCE

A fan-shaped blood pattern found on a floor as the result of a gunshot wound to the head can illustrate the point of convergence. When blood disperses in various directions from a wound, the blood drops tend to fan out. As the drops strike the floor, they elongate into oval shapes. An imaginary line drawn lengthwise through the middle of the oval shape will trace back to the area where the blood came from. Lines drawn through several of the blood spatters will cross at the point where the person was standing, called the point of convergence. Somewhere above that point, the blood originated. If the victim was shot in the head, it may be 4 to 6 feet (roughly the height of an average person) above that point.

CONCLUSION

Blood spatter analysis experts can develop important information from the patterns of blood at a crime scene. First-responding officers, crime scene technicians, and detectives can learn to photograph and preserve the measurements of blood spatter evidence at crime and accident scenes, gleaning a great deal of information without becoming experts themselves. If they properly photograph and accurately measure the length and width of the individual blood spatters and the distance from each spatter to the point of convergence, they can provide the expert analysts with data to make the necessary calculations and draw their conclusions. If agencies fail to obtain measurements and photographs, they risk losing critical information forever. Therefore, the collection of blood spatter evidence must be brought into today's world of technological advances and treated as important, but common, crime scene evidence easily preserved by law enforcement personnel who have acquired the necessary skills with a minimum of time and effort.

Endnotes

(1) Stuart H. James and William G. Eckert, Interpretation of Bloodstain Evidence at Crime Scenes, 2d ed. (Boca Raton, FL: CRC Press, 1999), 10-11.

(2) The list of precisely what information can be learned by the interpretation of blood stain patterns are similar for Tom Bevel and Ross M. Gardner, Bloodstain Evidence at Crime Scenes, 2d ed. (Boca Raton, FL: CRC Press, 2002); Stuart H. James and William G. Eckert, Interpretation of Bloodstain Evidence at Crime Scenes, 2d ed. (Boca Raton, FL: CRC Press, 1999); Edward E. Hueske, Shooting Incident Investigation/Reconstruction Training Manual, 2002; Louis L. Akin, Blood Spatter Interpretation at Crime and Accident Scenes: A Step-By-Step Guide for Medicolegal Investigators, (On Scene Forensics, 2004); and Paulette T. Sutton, Bloodstain Pattern Interpretation: Short Course Manual (University of Tennessee at Memphis, 1998).

RELATED ARTICLE: Blood Spatter Evidence Form

Law enforcement personnel can use a form to record the distances of the point of convergence (POC) from two reference points, the same ones used to position other objects in the scene. They enter the width and length of the individual drops, as well as the distance to the POC, and then place the numbers of the photographs taken in the last column. They can use either metric or English measurement. In the sample below, for the point of convergence, the distance from reference point 1 equals 156 cm and from reference point 2 equals 350 cm.

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