Geometric Bloodstain Interpretation

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Crimes of violence frequently produce bloodstains which, when properly studied, will aid in a reconstruction of the occurrences that took place and produced the patterns found at the scene. In the study of specific bloodstain patterns, care must be taken to record location, stain shape, direction, size, and surface of the impact area. When this information is applied to the known physical characteristics of blood, the following information may be revealed:

1. Origin of blood.
2. Distance between impact area and origin at the time of occurrence.
3. Type and direction of impact.
4. The number of blows struck.
5. Position of victim during blows.
6. Movement and direction of suspect and victim during bloodshed or after.
7. Which hand the blows were stuck with.

The following known physical characteristics of blood should be kept in mind during the study of the crime scene:

1. Uniform in character and able to reproduce specific patterns.
2. Drop is circular in shape during free-fall.
3. Drop does not break up unless acted upon by some force or energy.
4. Single drop of blood has a volume of 0.05ml.
5. Terminal velocity is 25.1' per second (±0.5') in free-fall.
6. The majority of high velocity droplets have diameters of less than 1mm which travel usually no further than 3'.

The following rules should also be applied to the interpretation of the bloodstain patterns:

1. Surface texture, not distance fallen, determines degree of blood spatter.
2. Teardrop stains, sharp or pointed ends, point in the direction of travel. Smaller and longer droplets have their sharp or pointed ends pointing back to the larger stains from which they originated.
3. The smaller the drops of blood, the greater the energy of impact.
4. Angle of impact of a bloodstain may be estimated by the geometry of the stain.

LAWS OF PHYSICS ON FLUIDS

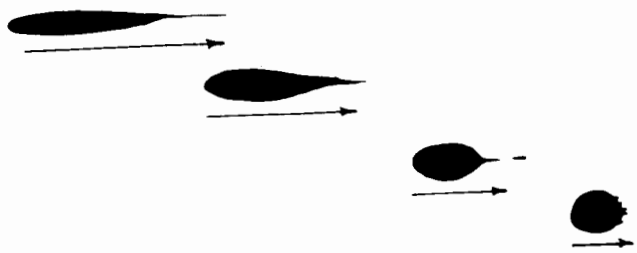
Due to molecule attraction called cohesive force, a drop of blood is held together in a "skin" similar to a balloon. The skin of the drop is actually surface tension. The cohesive force and surface tension are what cause a drop to be circular in shape during free-fall. These forces cause the drop to resist breaking up or rupturing even upon impact on a surface. On a perfectly smooth and clean surface, a drop will not rupture or break upon impact regardless of the height of the free-fall. Blood drops break or rupture due to a rough impact surface or due to some other force or energy.

DISTANCE FALLEN

The only accurate way to estimate dropping distance is to conduct a series of blood drop versus distance experiments on the **specific surface** in question, and to use these as known standards for direct comparison to the unknown.

DIRECTIONALITY

Determining directionality of blood droplets is the easiest interpretation to make. A blood droplet, when striking a surface, produces a teardrop shaped pattern. This is caused by the physical law of inertia, i.e., the resistance of a moving body to any force operating to change its motion, direction, or speed. Therefore, as the speed is dissipated abruptly by the surface upon which it is deposited, the blood droplet trails off into a pointed end of varying degrees, dependent upon the angle of the surface deposited upon. The greater the degree of angle, the more elongated or longer and narrower the stain pattern produced. The pointed end points or shows the direction of travel of the blood droplet.

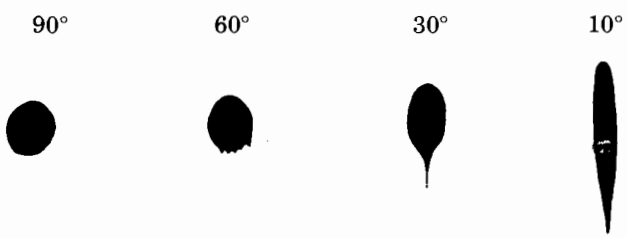


SECONDARY / CAST-OFF

The above primary blood droplets may produce smaller cast-off spatter which points back to its source. The smaller droplet travels very close to the surface and quickly begins to break the surface, producing an exclamation-like mark as shown below.

IMPACT ANGLE

Blood dropping onto a flat surface that is **nearly horizontal,** will produce an **elliptical** rather than a circular stain. As the angle decreases from 90° to 0°, the stain patterns become **more elongated.**



FIREARMS AND BLOODSTAIN EVIDENCE

1. Back spatter usually occurs less than 3" from muzzle to target area when it is found inside the muzzle.
2. The larger the caliber or gauge, the greater the depth of blood penetration into the barrel.
3. Less penetraton and concentration of back spatter occurs in recoil autoloading weapons than weapons whose barrel does not recoil.
4. Higher energy loads (e.g. magnum) will produce more depth of back spatter penetration than standard ammunition.
5. When double barrel shotguns are discharged on body contact, considerable back spatter (up to 12cm) occurs in the **dormant** barrel.
6. The majority of bloodspatter patterns will be 1mm or less in diameter.

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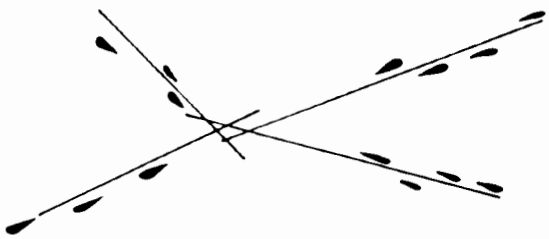
DOCUMENT

Successfully reconstructing the chain of events that occurred at the scene of a crime wherein sufficient bloodspatter is present, is directly proportional to the skill and care given the examination of the scene. The ultimate test of success is effective prosecution in a court of law. The successful presentation of this physical evidence can only be accomplished if proper documentation, collection, and preservation of the bloodstain has been accomplished. The aim of documentation is to show:

1. Location.
2. Direction.
3. Size.
4. Shape.
5. Surface deposited upon.
6. Angle.
7. Number of stains and/or volume.
8. Human blood and type.

Bloodstains are somewhat more stable than other physical evidence, i.e. hairs and fibers. Once bloodstains dry they will usually stay in place and will not be blown away by the wind and lost. Being careful not to disturb bloodstains, the scene should first be processed for the more easily lost or destroyed physical evidence. Once this has been accomplished, to include the proper collection, package, marking, and preservation, the bloodstain evidence should be documented. First, take overall photographs to show location and relationships. Then take close-ups of important stains. These must be taken with a scale of reference and at a 90° angle from stain to camera. Next, tape a string of contrasting color to the background beside the important stains to show directionality. Run all the strings parallel to the surface the stain is on, using the angle computed from the height to width ratios, and in the direction shown by the stains. At some point the strings should converge. An overall photograph should be taken showing this convergence and it should be measured and sketched (see diagram below).



If the stains are on a movable object, they can be transported to the lab for more detailed study. In most cases this is not necessary. If this is done, the stains should be covered for protection during transportation. Photograph, measure, and sketch the movable item before transporting; also mark east-west, north-south, top-bottom, on the item so that the direction of the stains can be reestablished. The actual stains can also be preserved by using fingerprint tape as in lifting latents. The stain is then placed on a contrasting colored cardboard background or on clear plastic, such as celluloid. The clear plastic can be used as a negative to contact print 1:1 photographs of the stains on high contrast paper such as Koladlith.

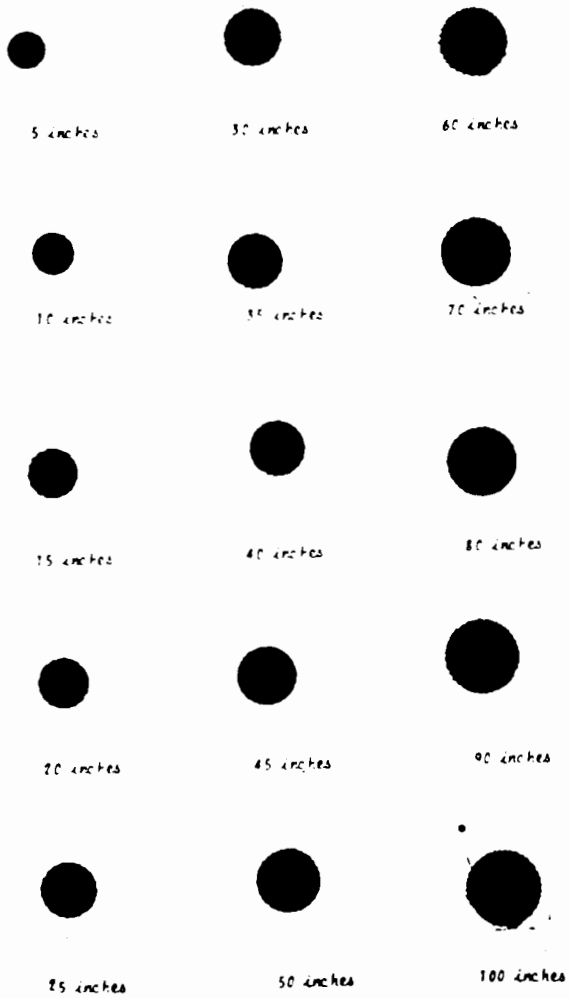
If the scene has been propertly documented by photographs, sketches, measurements, and removal or lifting of the important stains, evaluation by a trained investigator can be accomplished years later as shown in Cooper vs. Florida, 1977.

CLOTHING EXAMINATION

A careful examination of the clothing the suspect was believed to be wearing during the commission of the crime should not be overlooked. Again, location, size, and shape may help prove or refute his/her story of what occurred. For example, if the victim was kicked repeatedly by the suspect, medium velocity spatte should be found on the lower front portion of the clothing coverin the ankle and leg that was used in the assault. This will ofte include some upward spatter on the inside of the pants cuff. Also b sure to examine shoes and socks. Likewise, if an instrument i swung with the arm, medium velocity spatter might be found o the clothing that covers the wrist and arm area. Again, on long sleeve shirts, spatters may be found on the inside of the cuff.

The graph on page six shows the changing diameters of bloo stains dropped from varying heights onto white cardboard at a 9 degree angle.

If you have any questions or need information on bloodstai evidence workshops, contact Sgt. Tom Bevel, Oklahoma City Polic Department, 701 Colcord Drive, Oklahoma City, Oklahoma 7310 or call 405/232-5311, extension 494.



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