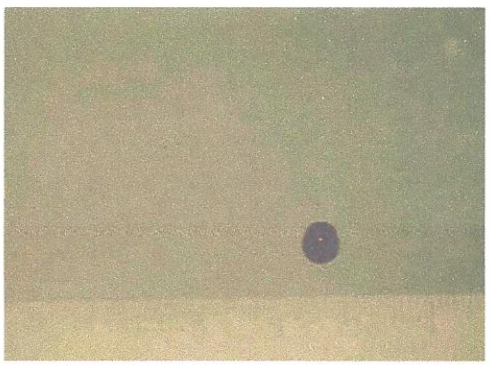
The success or failure of any criminal investigation often depends on the recognition of physical evidence left at a crime scene and the proper analysis of that evidence.
Crime scenes that involve bloodshed often contain a wealth of information in the form of bloodstains. The pattern, size, shape, and the location of such stains may be very useful in the reconstruction of the events that occurred.
William G. ECKERT and Stuart H. JAMES

Bloodstain Pattern Analysis:
The examination of the shapes, locations and distribution patterns of bloodstains in order to provide an interpretation of the physical events by which they were created that is based on the premise that all bloodstains and bloodstain patterns are characteristic of the forces that have created them.

The interpretation of bloodstain patterns found at the scene or on exhibits such as the clothing of the principles of the occurrence can be used to:
Confirm or refute assumption concerning events and their sequence:
Postion of victim (standing, sitting, laying)
Evidence of movement (blood smears, flow patterns and drip trails)
Confirm or refute statements made by the principles in the case:
Are the stain patterns on a suspect's clothing consistent with his reported action?
Are the stain patterns on a victim and/or at the scene consistent with accounts given by the witnesses, victim or the suspect?

Properties of Blood:
Blood Volume
On average accounts for 8% of total body weight
5 to 6 liters of blood for males
4 to 5 liters of blood for females
A 40% blood volume loss, internally and/or externally is required to produce irreversible shock (death)
A blood loss of 1.5 liters internally/externally is required to cause incapacitation.

Surface Tension in Blood:
The elastic like property of the surface of the liquid caused by the forces of attraction between the molecules of the liquid that makes it contract and assume the smallest possible shape *i.e. a blood droplet in flight will possess the shape of a sphere (ball).*



Target Surface Texture:

Bloodstains can occur on a variety of surfaces such as carpet wood, tile wallpaper, clothing and the list goes on.....

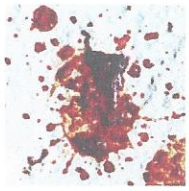
The type of surface that a blood droplet strikes affects the amount of resultant stain distortion and satellite (secondary) blood spatter.

Blood droplets that strike a hard smooth surface, like glass, will have little or no distortion on their peripheral edges.

Blood droplets that stirke linoleum flooring will take-on a slightly different appearance and may tend to have "scalloping" on their peripheral edge.

Surfaces such as wood or concrete will be distorted to a much greater extent, sometimes producing satellite (secondary) blood spatter droplets and stains.



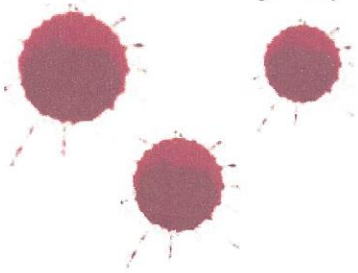


***General* Categories of Bloodstains:**

SWIGSTAIN (Scientific Working Group for Bloodstain Pattern Analysis) - Recommended Terminology

Drip Stains/Patterns

(caused by the force of gravity only)

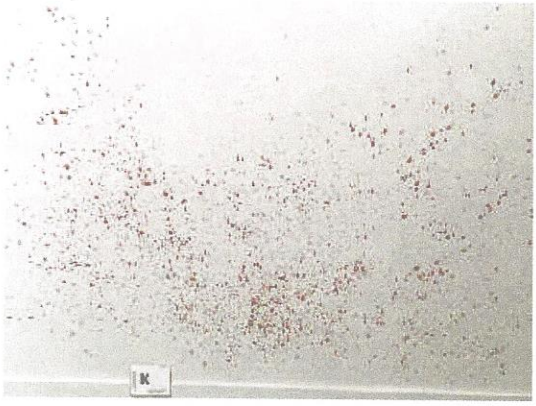


Transfer Stains/Patterns

(a blood contaminated object(s) contacting a surface)

Spatter Patterns (impact, cast-off, etc.)

(liquid blood, internally or externally, subjected to a force greater than gravity)



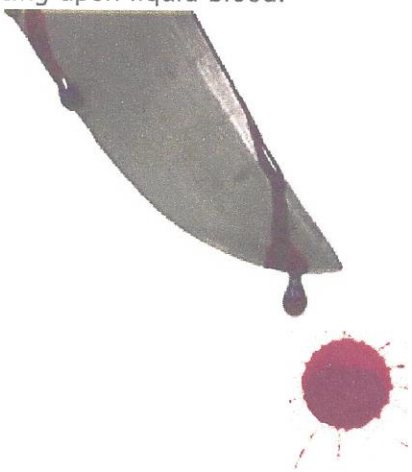
Transfer Bloodstains/Patterns:

A transfer bloodstain or bloodstain patterns is created when a wet, bloody surface contacts another surface. A recognizable image of all or a portion of the original surface may be observed in the pattern.

Transfer bloodstain can be further subdivided into: contact bleeding, swipes or wipes.

Drip Stains and Patterns:

Created or formed by the force of gravity acting upon liquid blood.



This category also includes drip trails and flow patterns.

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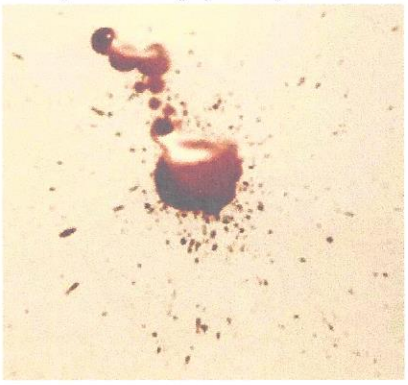
Large Volumes of Blood:

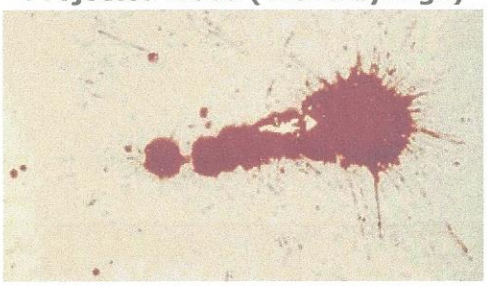
The following patterns were created by the same volume of blood and distance from the source to the target surface.

Blood Dripping into Blood

Splashed (Spilled) Blood



Projected Blood (with a syringe)

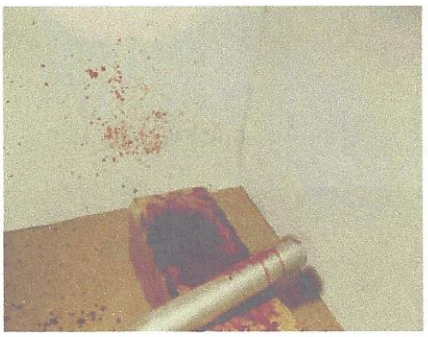


Blood Spatter Patterns:

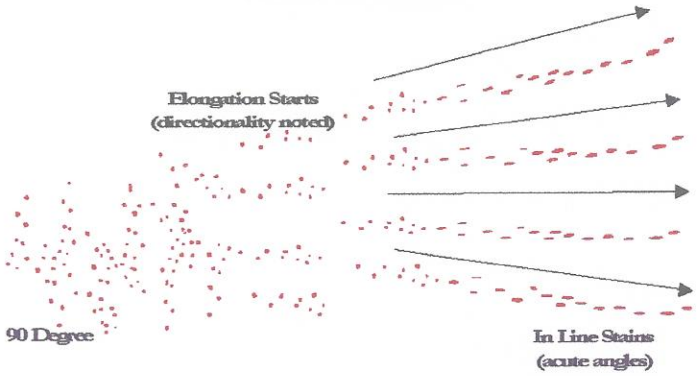
Blood spatter patterns are created when an exposed blood source is subjected to an action or force greater than gravity (internally or externally).

The size, shape and number of resultant bloodstains will depend *generally* on the amount of force applied to the liquid blood.

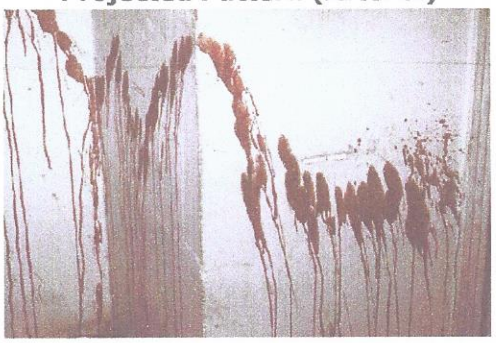
Impact Patterns



Cast-off Patterns



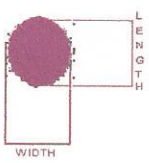
Projected Pattern (Arterial)



Directionality of Bloodstains:

When a droplet (spherical) impacts a surface at a perpendicular angle (90 degrees) the resulting bloodstain will appear circular i.e. the length a width of the stain are equal.

When a blood droplet impacts a surface at an angle less that 90 degrees, the resulting bloodstain with have an elongated or elliptical appearance. In addition, the tail of the droplet will indicate the direction of travel of the droplet when it contacted the surface i.e the opposite direction from where the droplet originated from.

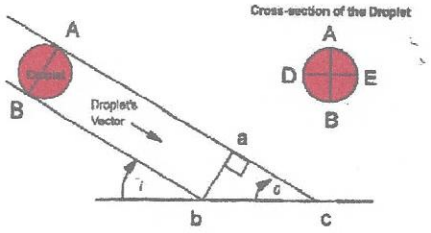


90 Deg Stain
No Direction noted

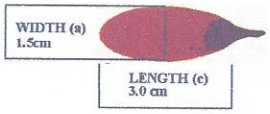
Direction of travel

Angle of Impact Determination:

The angle of impact can be mathematically determined based on the elliptical appearance of a spherical blood spatter stain.



By accurately measuring the length and width of a bloodstain, the impact angle can be calculated using the SIN formula below



SIN< = width / length

< = invsin (width / length)

e.g. < = invsin(1.5 / 3.0)

< = invsin(0.5)

< = 30 degrees

Therefore, the droplet originated from a source that was approximately 30 degrees 'out' from the plane of the target surface.

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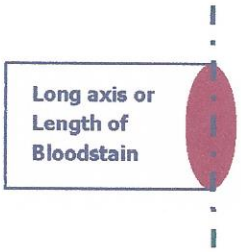
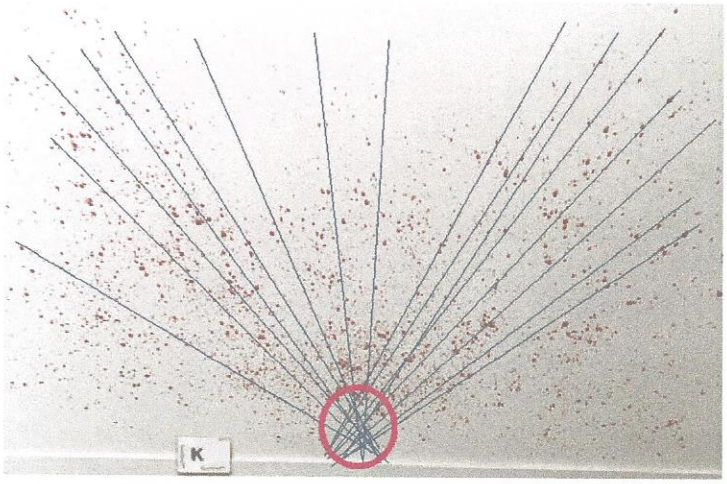
Area of Convergence and Area of Origin Determination:

The common area of convergence can be determined based upon the geometric appearance of the bloodstains within a blood spatter pattern

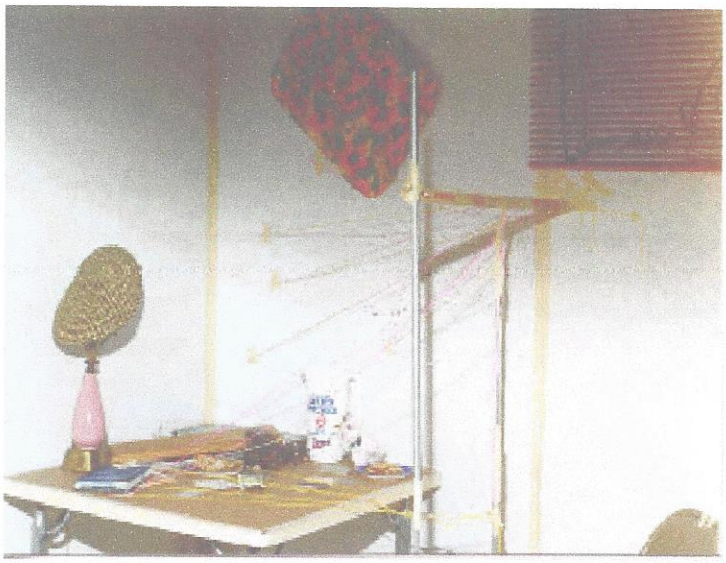
By drawing a line through the long axis of a group of bloodstains the point of convergence can be determined. Where the lines of the group of stains intersect one another the convergence point can be established



The line drawn through the long axis of each individual bloodstain can then be extended back to common **area of convergence**.



By calculating the **angle of impact** each individual bloodstain, a 3-dimensional **area of origin** can then be determined mathematically or physically using strings.



A software program such as BackTrack or HemoSpat can also be used to determined the **area of origin(s)** of the blood spatter.

3- DIMENSIONAL [TOP VIEW] POINT of ORIGIN