13

"BLOOD SPATTER ANALYSIS"

by

T. Paulette Sutton

(The outline for this section is under Event 12.)

NCDA

BASIC BLOODSTAIN PATTERN ANALYSIS

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DISCUSSION NOTES AND DETAILED OUTLINE

The value of bloodstained evidence is, too often, only considered in terms of the serological identifying characteristics such as the blood type and DNA patterns. Bloodstain pattern analysis adds another dimension to the information left at the scene of a crime. By analyzing the physical pattern of the bloodstains, additional information such as: how the crime was conducted, who was or was not present, how many blows were struck, and even positioning of the individuals involved in the crime. Proper training combined with careful study and observation can provide a replay of the events which took place frame by frame.

This presentation will provide some basic principles of bloodstain pattern interpretation. Case studies will be used to demonstrate the various types of information which can be developed from bloodstain pattern analysis, and how the information is applied to the judicial process.

I. History of Bloodstain pattern interpretation

A. 1894--First recorded references by a German scientist noting pattern differences

B. 1939--Dr. Balthazard (French): first looked at physical interpretation of stains

1. Ratio of width to length of a stain and it's angle of incidence

2. "Stringing" to determine the point of origin

C. 1950's--Dr. Paul Kirk (United States)

1. Recognized the value of bloodstains in crime scene reconstruction

2. Defense witness in the Dr. Sam Sheppard trial.

D. 1970's--Herbert MacDonell (United States)

1. Brought bloodstain pattern interpretation into the modern day practice of criminalistics

2. LEAA research grant

3. Publications:
   a. *Flight Characteristics and Stain Patterns of Human Blood* (1970)
   b. *Bloodstain Pattern Interpretation* (1982)

E. 1983--The International Association of Bloodstain Pattern Analysts was formed.

II. Bloodstain pattern interpretation

A. Common sense applied to bloodstain pattern interpretation

1. Order of Events
   a. Which stain was first in place?
   b. Does one stain lie on top of another stain or another substance?
   c. Has a spatter been skeletonized because it was partially dry and then something wiped or moved across it's surface?

2. Positioning
   a. Are there stains on the front, the back, etc.?
   b. Are there surfaces which are conspicuously lacking in stains, i.e. was the assailant or some other mass blocking their path?

B. Measurements and calculations applied to bloodstain pattern interpretation

1. Number of Blows

2. 3-Dimensional Positioning of Body, i.e. standing -vs- sitting -vs- lying down

III. Basic principle #1: **A free falling drop forms a sphere or ball**

A. The spherical shape is largely due to a force called "surface tension"

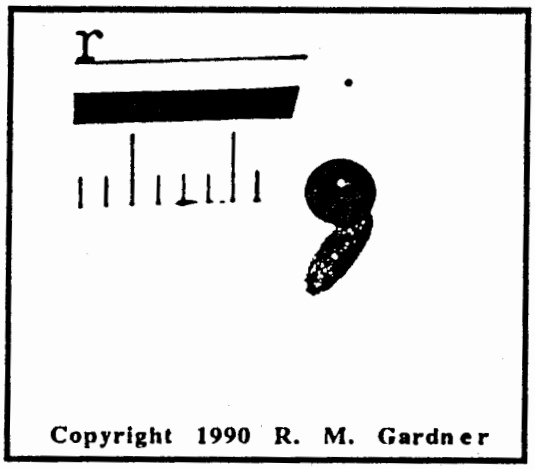
B. Surface tension is due to the molecular binding forces which are being applied on the exterior of the sphere exceeding those being exerted by molecules on the interior.

1. Reduces exposed surface area

2. Occupies least amount of space possible

3. Acts like a skin on the "ball of blood"

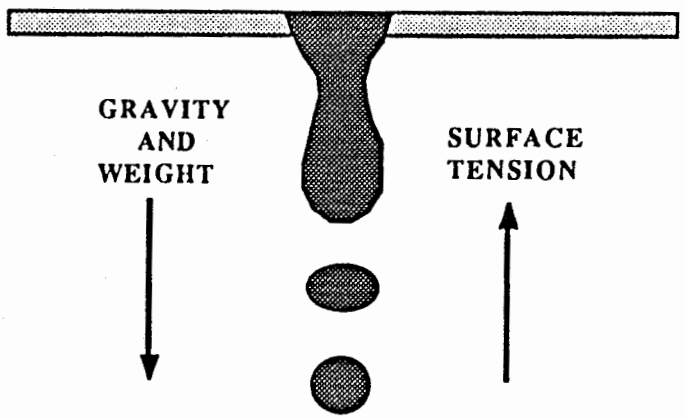
4. A drop will oscillate in flight, but surface tension causes it to return to its spherical shape.



C. A drop forming as the result of a passively accumulating pool is influenced from opposing forces.

1. Gravity and accumulating weight--pulling downward

2. Surface tension--pulling back towards the source



IV. Basic principle #2:

A drop will not break unless one of two things happens:

(1) It strikes another object or surface

(2) It is acted upon by some force

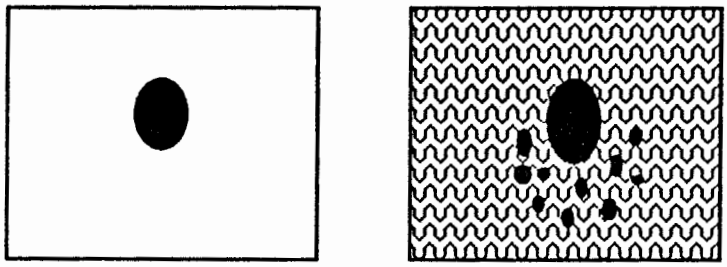
A. Striking another object or surface

1. Smooth target surface results in very little spatter

2. Very slight irregularities in the target surface can produce a great deal of spatter

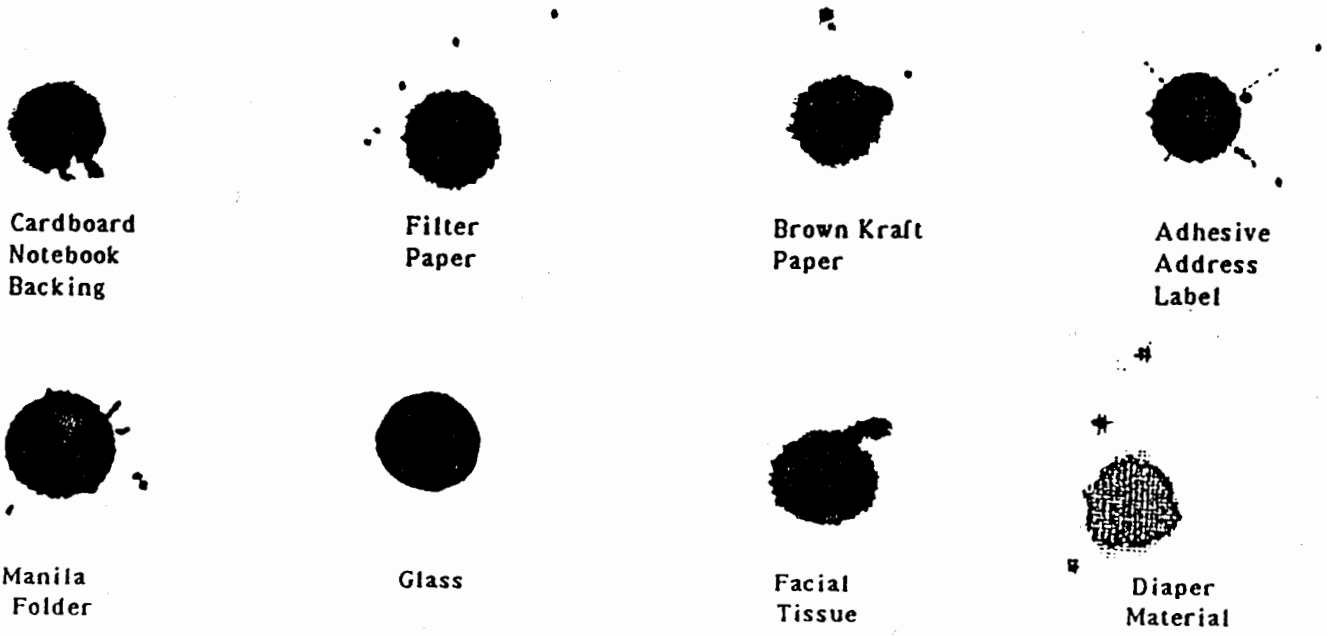
(1) Surface irregularities of the object or surface the drop hits will actually rupture the drop's "skin" formed by surface tension

IDENTICAL DROPS STRIKING A SMOOTH -vs- AN IRREGULAR SURFACE



SMOOTH SURFACE TEXTURED SURFACE

Even very slight surface irregularities can produce a great deal of spatter. All of the following patterns were produced by the same size drop of blood, falling the same distance and striking the various surfaces.



Cardboard Notebook Backing

Filter Paper

Brown Kraft Paper

Adhesive Address Label

Manila Folder

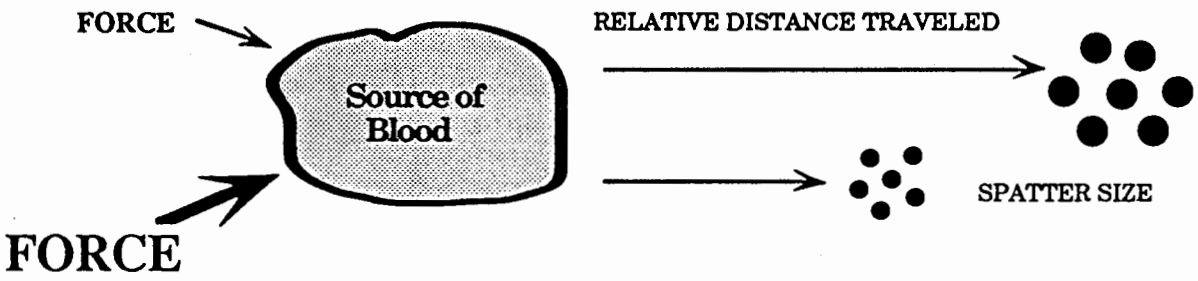
Glass

Facial Tissue

Diaper Material

B. Force acting upon a drop

1. The size of the resultant spatters indicate the degree of force that was applied
2. Velocity of the force applied is inversely related to the size of the spatter produced
   a. Smaller force (slower moving)---->>>> Larger size spatter results
   b. Greater force (faster moving)---->>>> Smaller size spatter results
3. This principle allows for examination of the spatter produced and extrapolating back to the type of force which was applied to cause it's formation.



FORCE VELOCITY AND SPATTER SIZE ARE INVERSELY RELATED

4. Spatters are categorized according to the velocity of the force causing their production as:

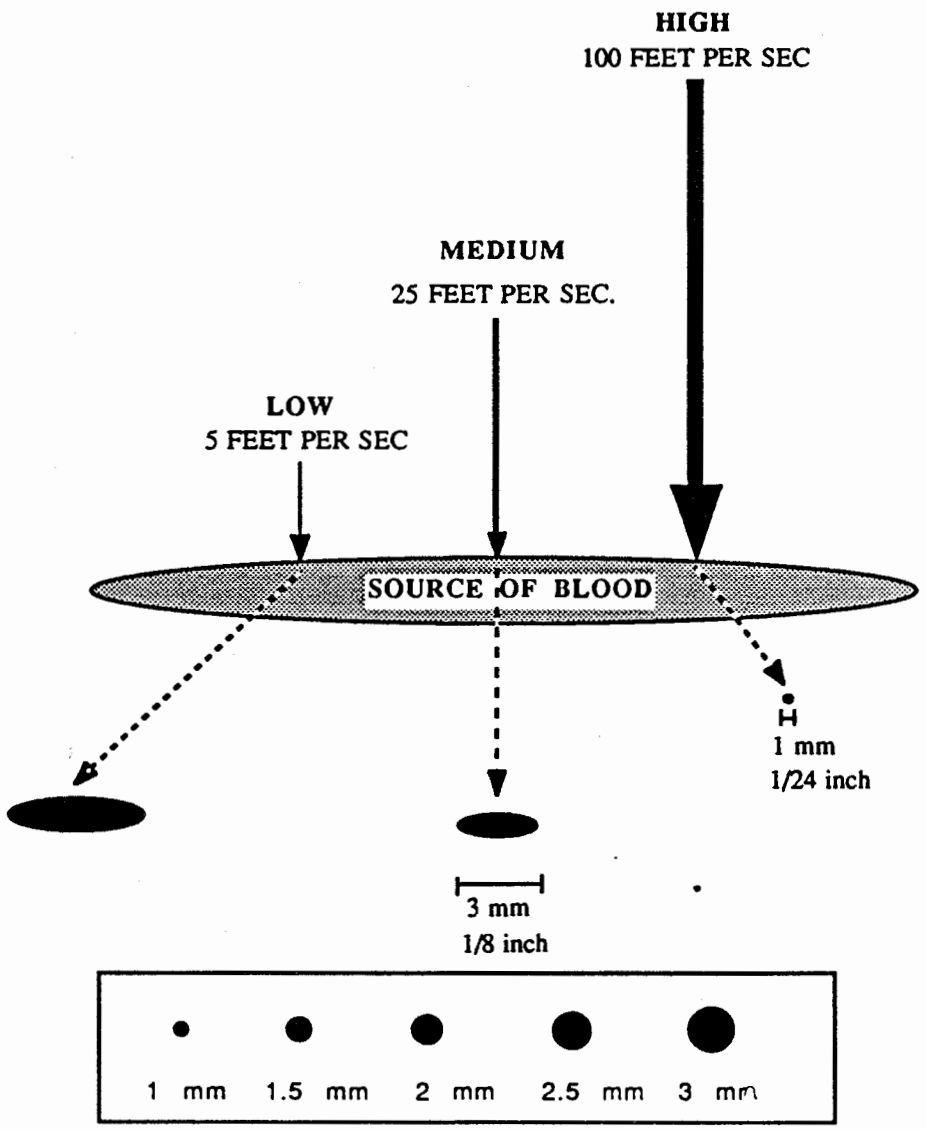
   a. Low Velocity Impact Spattering

   b. Medium Velocity Impact Spattering

   c. High Velocity Impact Spattering

**IMPORTANT NOTE:
ANY FORCE CAN PRODUCE SPATTERS LARGER OR SMALLER THAN WHAT IS CONSIDERED "CHARACTERISTIC SPATTER SIZE". INTERPRETATION MUST TAKE THIS INTO ACCOUNT. CLASSIFICATION IS BASED ON THE SIZE OF THE MAJORITY OF THE SPATTERS PRODUCED.

CATEGORIZING SPATTER PRODUCED AND THE VELOCITY OF THE FORCE APPLIED



V. Low Velocity Impact Spattering (LVIS)

A. Force ranges from gravitational pull (free-falling blood) to a velocity of approximately 5 feet per second or less

B. Events which will produce low velocity spatters:

1. Stepping into a pool of blood

2. Blood passively dropping into blood (coronal effect)

3. Cast-off stains from a bloody weapon or object
**Cast-off stains are not technically "spatters" since the blood itself is in motion as opposed to being static and then struck as in spattering.

C. Characteristics of Low Velocity Impact Spatters:

a. Relatively large size spatters result

(1) majority greater than 3 mm in diameter (~1/8 inch)

b. Long, spiny projections may be produced

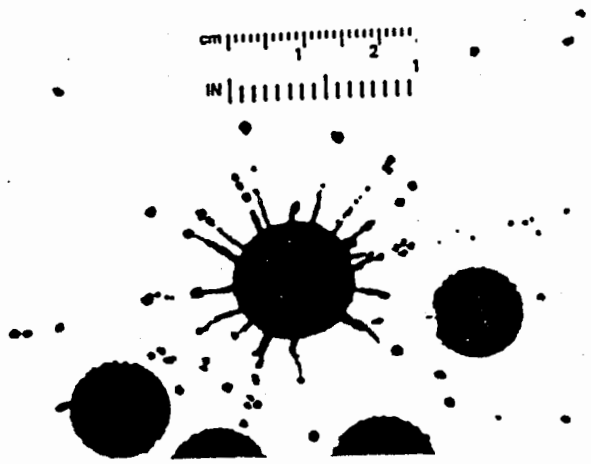
(1) Projected blood or stepping into blood

c. Tail of the spatter often points ***towards*** source ***instead*** of pointing toward the direction of travel.

(1) Drops formed as a result of low velocity impact have a high incidence of bumping into each other before they impact a target surface. This can change their direction of travel causing the resultant spatters to appear to have reversed directionality.

LOW VELOCITY SPATTERING
Stepping into a pool of blood.
Note very long, spiny spatters.

SCHEMATIC OF THE PROCESS



PATTERN PRODUCED

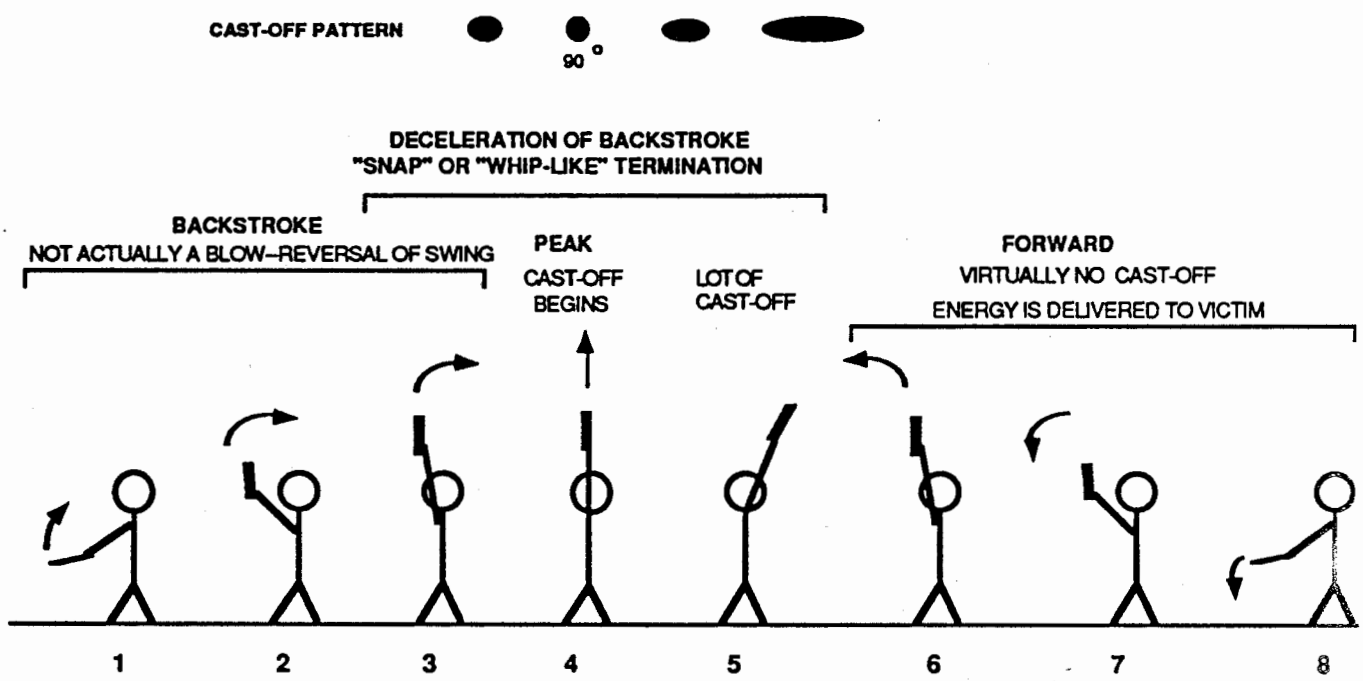
LOW VELOCITY SPATTERING

Blood passively dropping into a pool
Note coronal effect around original pool.

LOW VELOCITY SPATTERS

Note several spatters point towards the original pool of blood instead of in their actual direction of travel. Low velocity spatters have a high incidence of "bumping into each other" and reversing directionality in flight.

THE MECHANICS OF CAST-OFF AND PATTERN PRODUCED ON TARGET



VI. Medium Velocity Impact Spattering (MVIS)

1. Velocity of force applied ranges from > 5 feet per second to ~25 feet per second

2. Examples of medium velocity forces:

   a. Beating

   b. Blunt trauma

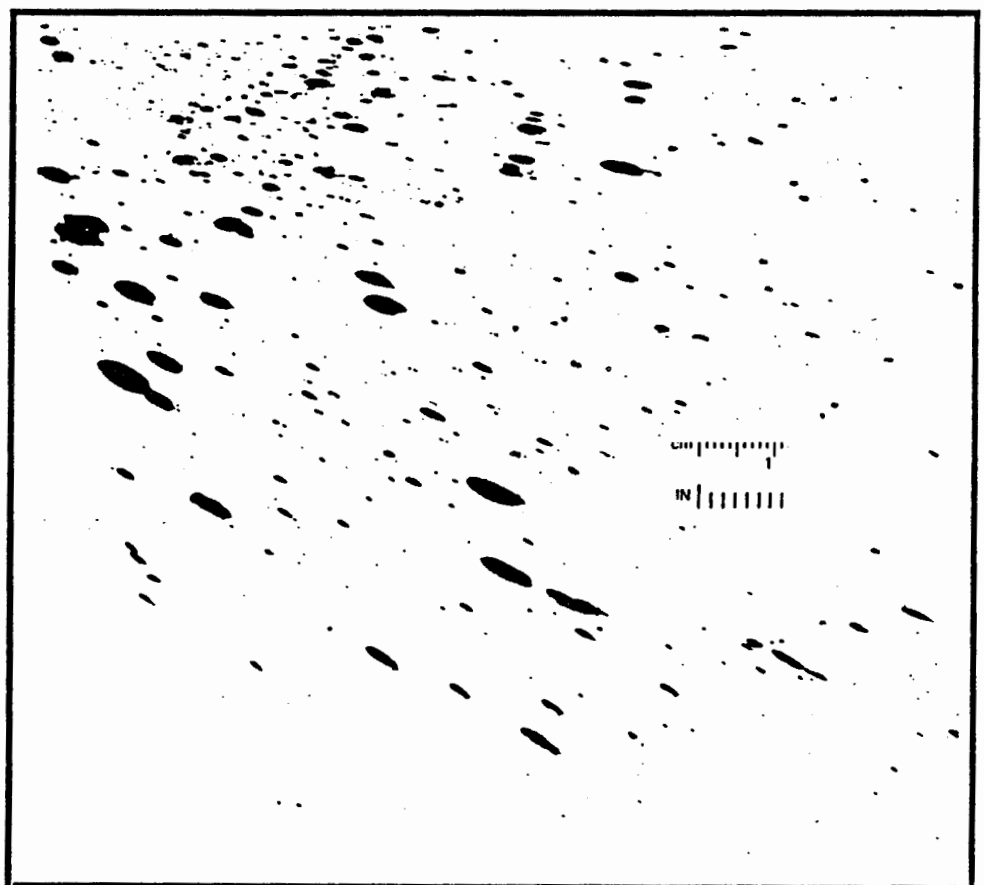
   c. Stabbing--equates to a beating with a knife in between

3. Characteristics of Medium Velocity Impact Spatters:

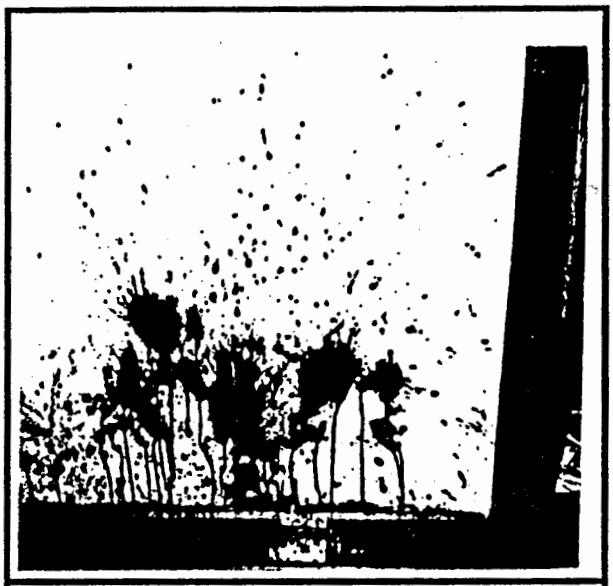
   a. Majority of spatters are 1/8 inch (3 mm) or less in diameter. (Range in size from 1/25 inch to 1/6 inch or 1-4 mm.)

   b. Spatters may travel great distances from their source.

      (1) MVIS are relatively large in size and it takes longer for gravity to push them down, therefore they travel a greater distance from their source or point of origin in comparison to a smaller spatter.



MEDIUM VELOCITY SPATTERING



MEDIUM VELOCITY SPATTERING

Victim's bloodied head was struck against the wall several times producing the impressions of bloody hair and medium velocity spattering around the periphery of the impressions.

VII. High Velocity Impact Spattering (HVIS)

1. Force applied is moving at a velocity of ~100 feet per second or more

2. Examples of high velocity forces:

   a. Gunshot

   b. Explosion

   c. Mechanical accidents, I.e. walking into airplane propeller

3. Characteristics of high velocity impact spattering:

   a. Atomized (misted) spatters--1 mm or much less in diameter

      (1) Travel only 3-4 feet horizontally from their source. Due to their small size, gravity can "push" them down quickly

   b. The ***larger*** drops produced are 1/8 inch (3 mm) or less in diameter

      (1) These drops can travel distances in excess of the 3-4 feet mentioned above.

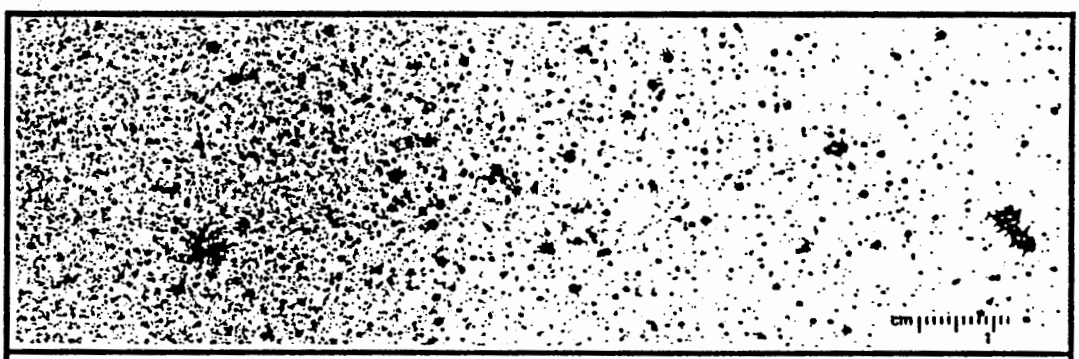
   c. Entrance wound: Spatter dispersed in a cone-shaped pattern from impact site in the direction of the original projectile. Back spatter--spatter directed from wound back towards the shooter--depends upon weapon, firing distance, position.

   d. Exit wound: usually produce more spatter (called forward spatter) than entrance wounds because blood is carried out with the projectile.

4. Atypical events associated with high velocity impact spatters

      (1) Spatter may be almost completely "captured" in bulky clothing (overcoat) or a lot of hair resulting in little spatter at a crime scene.

      (2) Victims which continue to breathe after sustaining injury to the mouth, nose, lungs etc. may produce expiratory blood stains. These can look very similar to the misted HVIS. Clues indicating expiratory blood include the presence of air bubbles or ruptured bubble outlines and diluted color from mixing with saliva or other fluids.



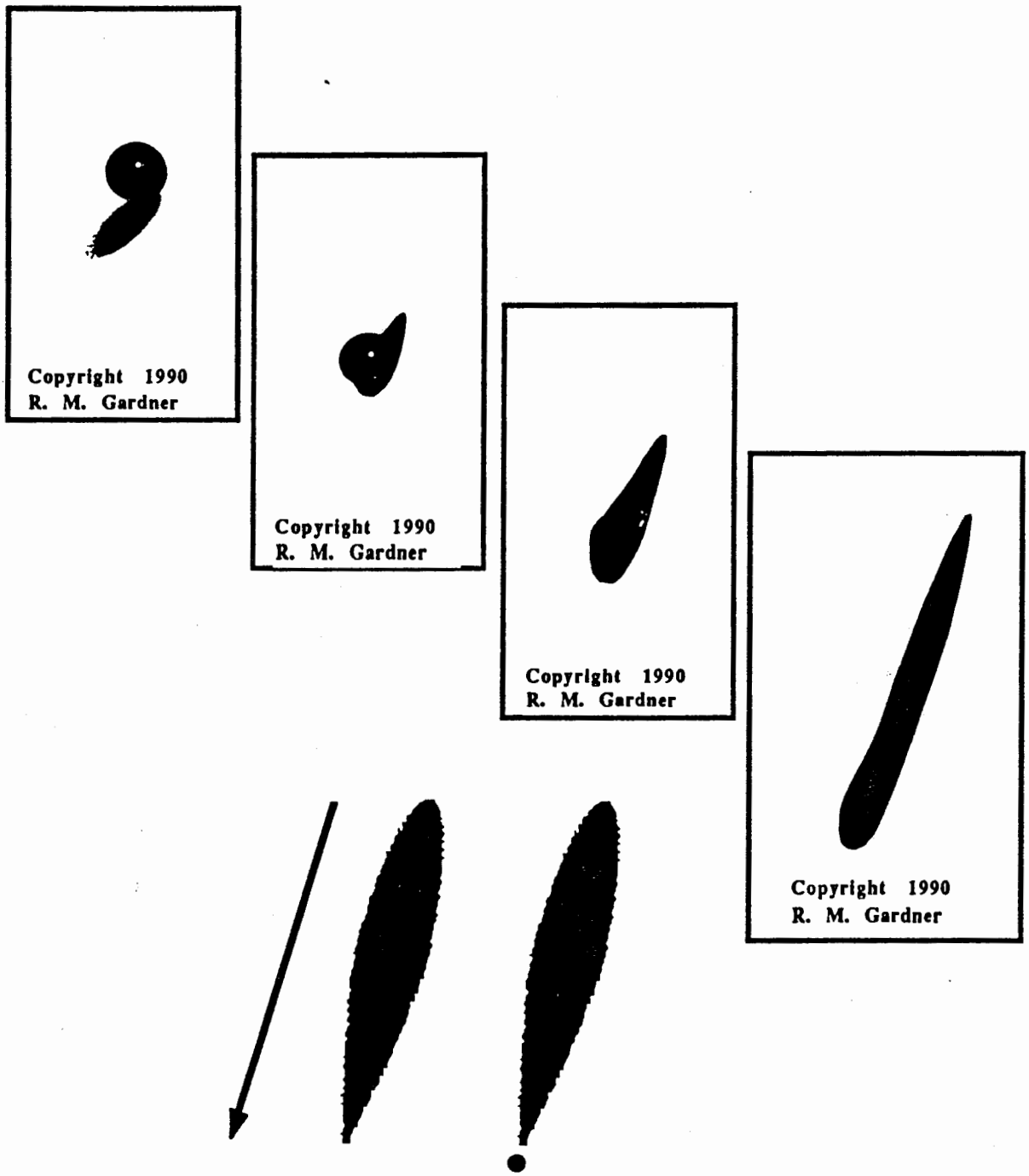
HIGH VELOCITY SPATTERING
Note the larger spatters have traveled further from the point of origin (the extreme left).

VIII. Direction of travel

A. Spatter anatomy will indicate the direction of spatter's travel.

B. The tail, the exclamation mark, or the more distorted edge of the spatter will **point in the direction of travel.**

C. The source of spatter (victim) will be "behind" the spatter



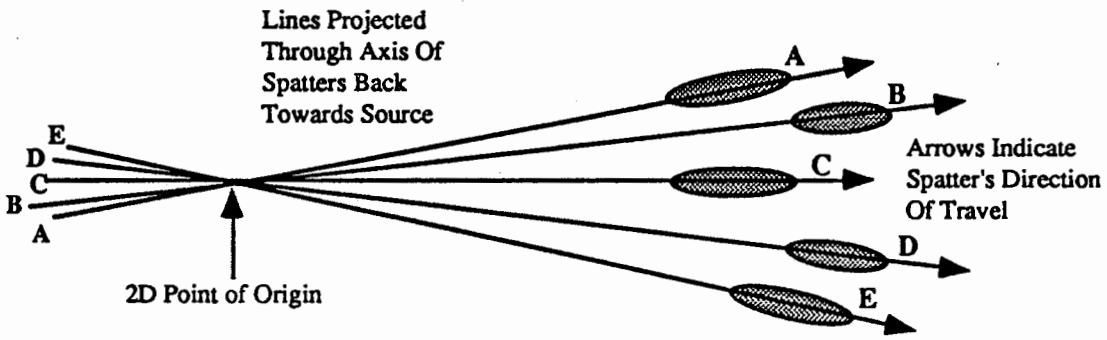
IX. 2-Dimensional Point of Origin (X and Y axis)

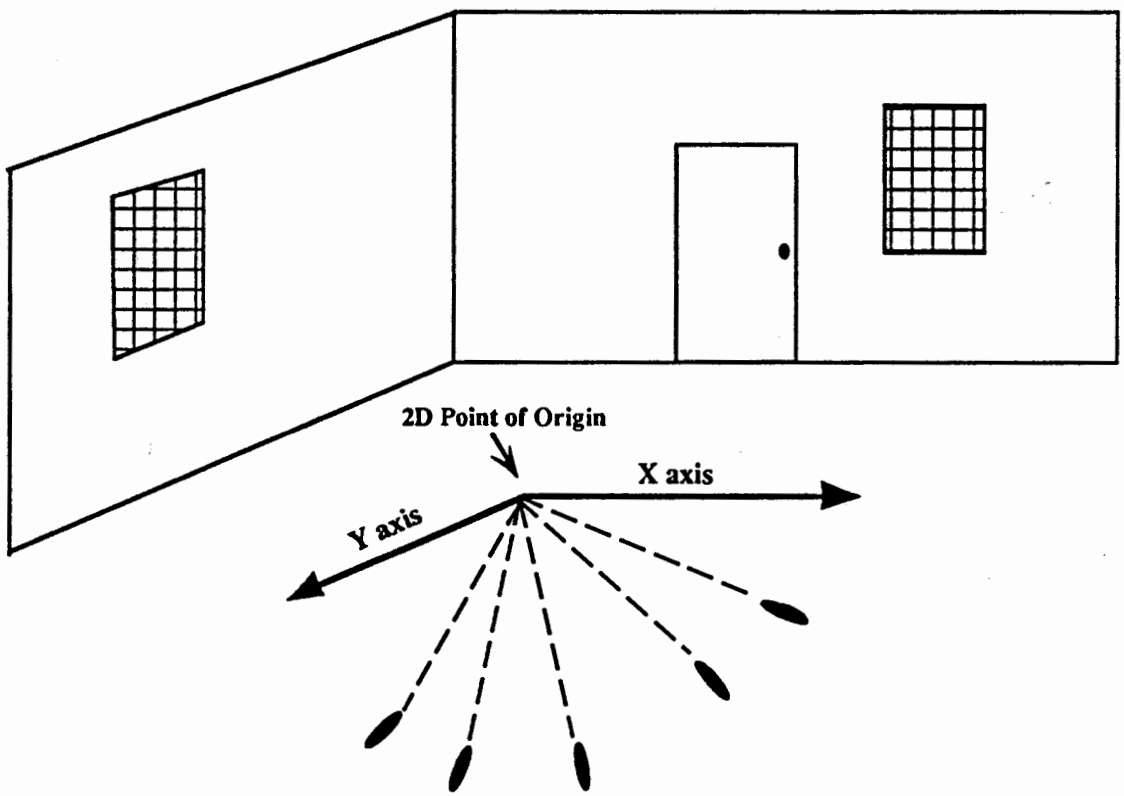
A. Locating the source of the blood along 2 planes--the X and the Y axis
Where, in the room, was the source of the blood or the victim?

B. Determining the 2-dimensional point of origin

1. Project lines through the axis of the spatter back towards the source

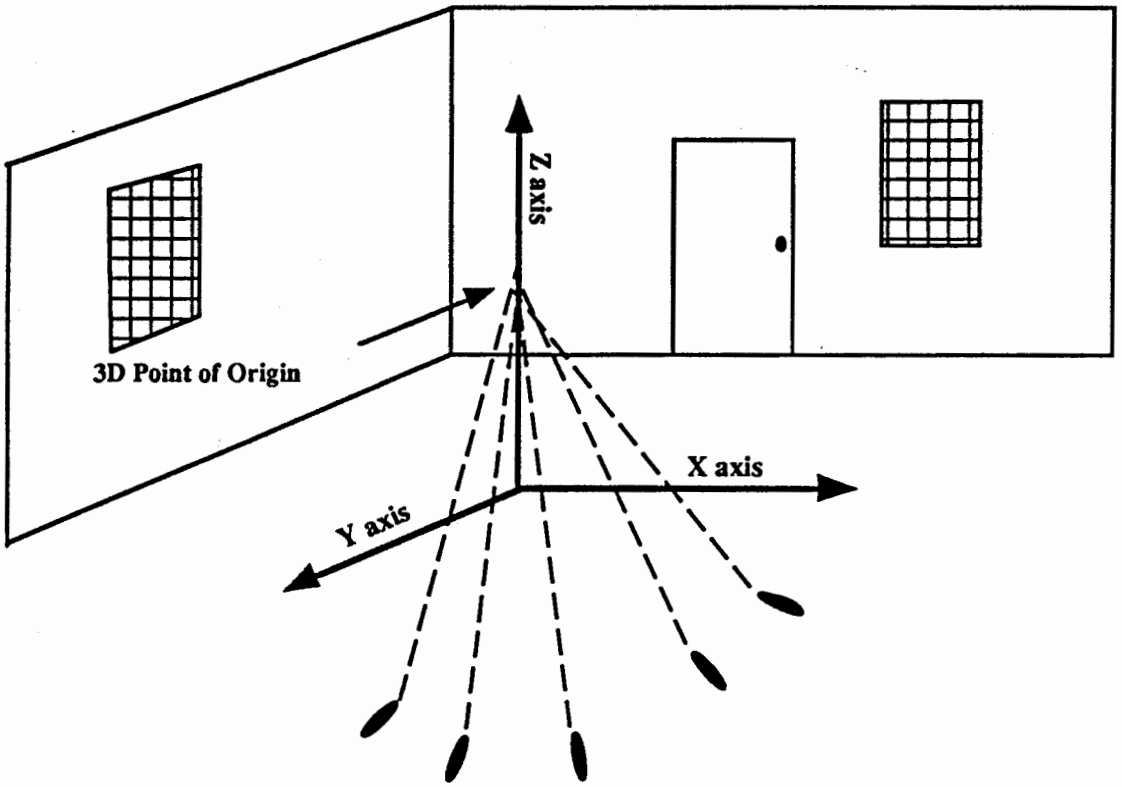
2. These projected lines converge at the 2-Dimensional point of origin





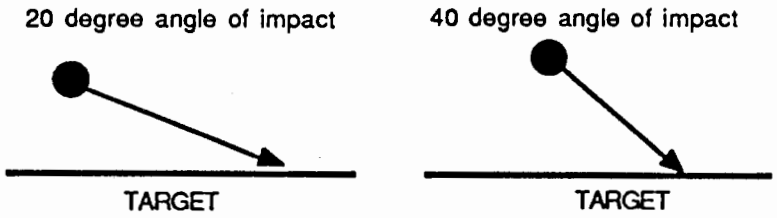
X. 3-Dimensional Point of Origin (X, Y, and Z axis)

A. Locating the source of the blood in space as well as along the X and Y axis
Where the victim was in the room and were they were sitting, lying down, or standing?



B. Methods of determining the 3-dimensional point of origin:

1. Must first determine the angle of impact of the spatter



XI. Angle of impact affects the extent of elongation of a spatter

A. More acute angle of impact results in a more elongated spatter

B. As the angle of impact progresses towards 90 degrees, the width of the spatter approaches the length (i.e. the stain becomes less elongated and more round).

1. At 30 degrees, the width is one-half of the length.

2. At 90 degrees, the width equals the length.

XII. Methods of calculating the 3-Dimensional point of origin

1. Physically project strings

2. Trigonometric determination

3. Graphic determination

(SEE ATTACHMENT AT THE BACK OF THIS OUTLINE FOR MORE INFORMATION ABOUT HOW THESE DETERMINATIONS ARE MADE)

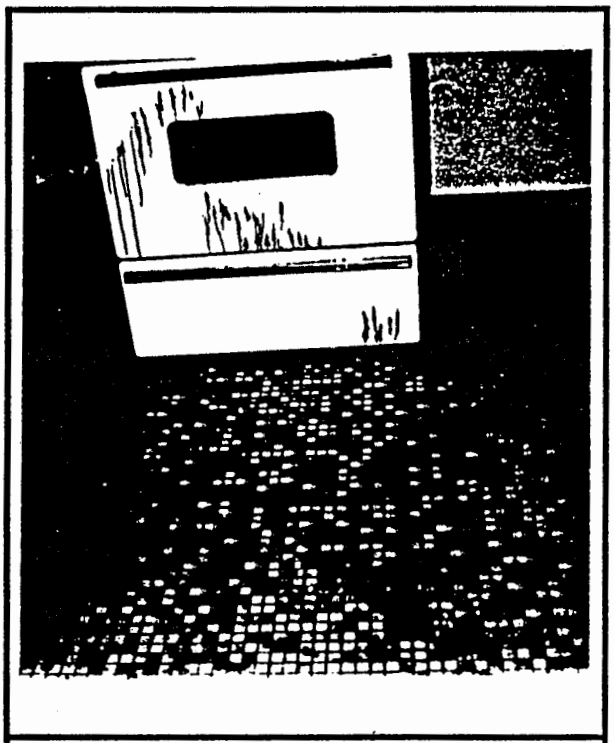
XIII. Case Histories

A. Point of origin -vs- defendant's version of the crime

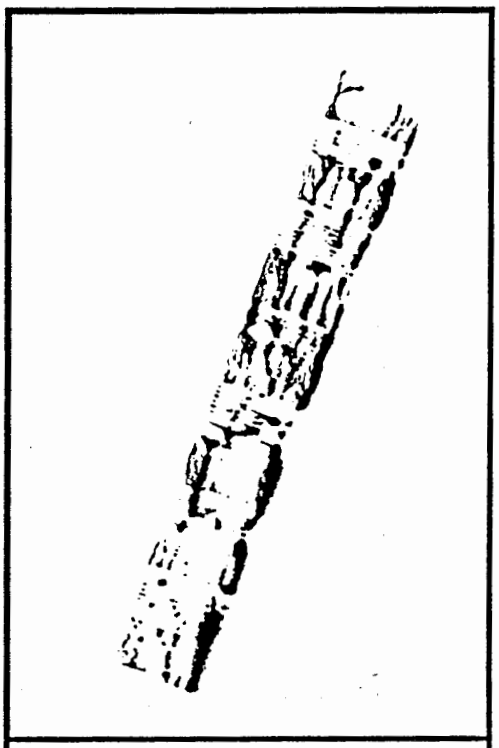
B. Medium Velocity Impact Spatter and Cast-off

C. Arterial Gushing
   1. "Straight line" trajectory
   2. May see heart beat (results from increasing and decreasing pressures)

D. Repetitive pattern -vs- Arterial Gushing



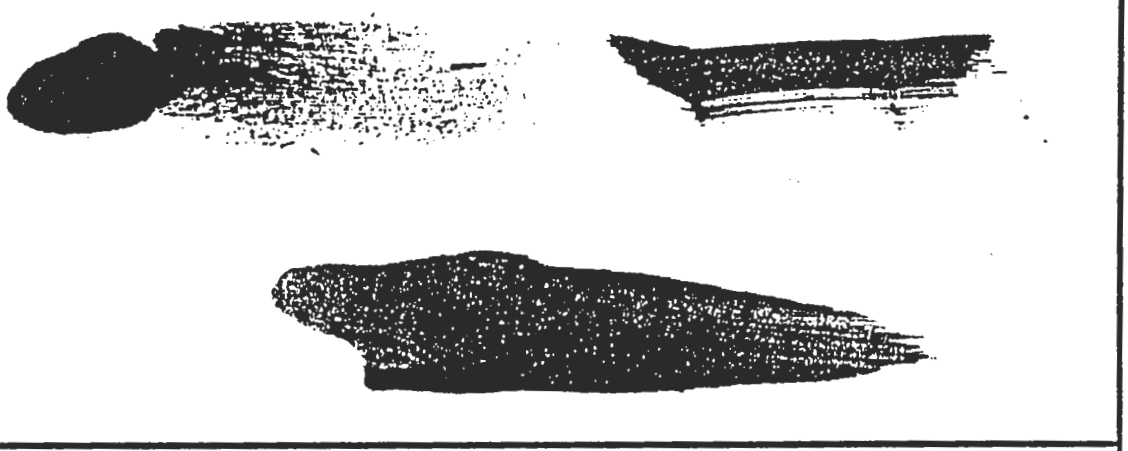
ARTERIAL GUSHING



REPETITIVE PATTERN

E. High Velocity Impact Spattering

F. Swipe-direction of travel

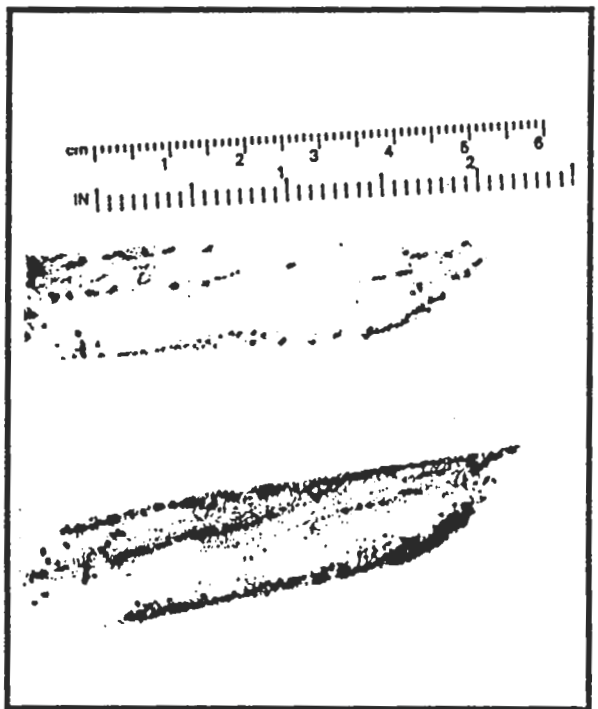


SWIPE OR SMEAR

The transfer of blood onto a surface not already contaminated with blood. The leading edge is usually feathered indicating the direction of travel.

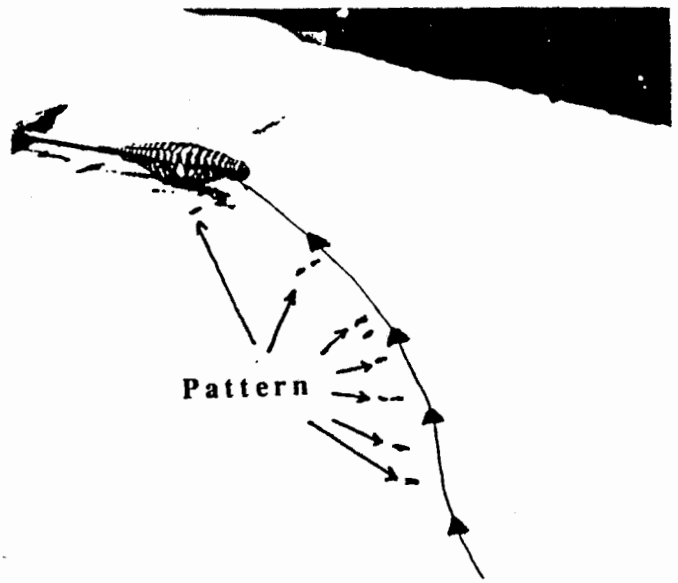
G. Transfer patter of weapon

1. Knife pattern transferred onto suspects slacks



KNIFE TRANSFER PATTERN

2. Weapon being tossed--A "Different" kind of transfer pattern



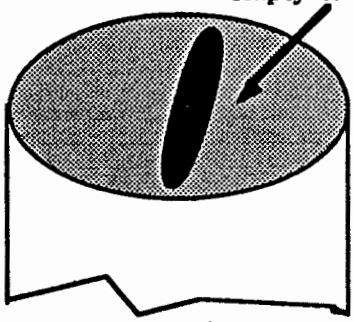
REPETITIVE PATTERN

The small hash patterns produced on this bedsheet resulted from the raised coil of this welder's chipping hammer (bloody) after the hammer was tossed onto the bed and it "skipped" across the surface. A skipping or dragging motion is indicated when a pattern repeats itself across the surface, but the distance between the repetitions varies from one to the next. The continuous line with arrowheads indicates the path of travel as the hammer "skipped" across the surface. At the peak of the path of travel, there was an impression which could be matched to the hammer head as it came to rest.

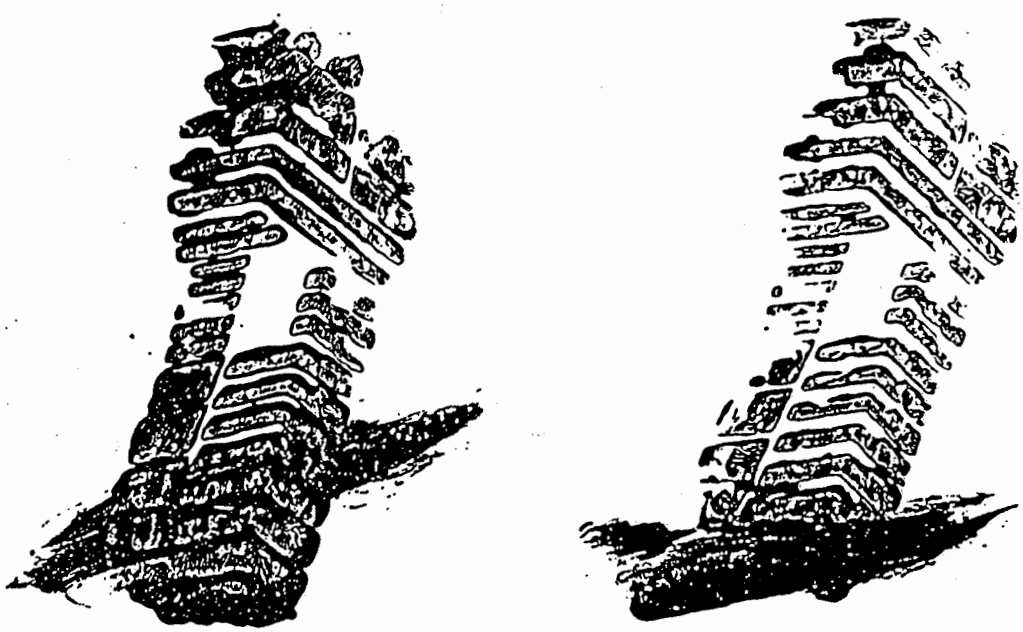
In order to enhance the visual presentation of this event for the jury without destroying or altering the bloodstains, a piece of mylar transparency film was laid over the pattern and drawing, etc. was applied to the transparency film instead of the sheet.

H. Medium Velocity Impact Spatter on suspect clothing -vs- passively having victim's blood on clothing

I. Sequence of events--What really happened versus the defendant's story.

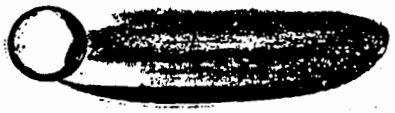


The bullet had to have been fired before the beating in order for a medium velocity spatter to be found inside the empty round.



Drag marks under shoeprint **Drag marks on top of shoeprint**

The suspect in a homicide remained inside the residence for several hours. Bloody shoeprints lying on top of drag marks (victim's body was drug into an inner hall) are consistent with the suspect walking through the house after moving the body.

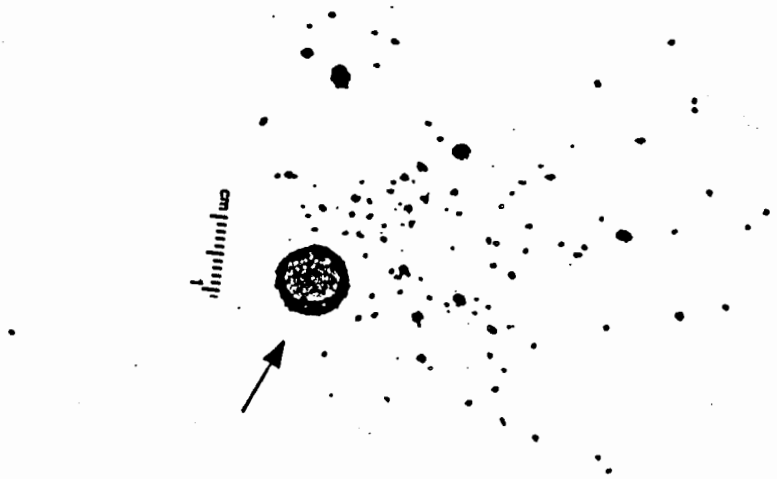


SKELETONIZED BLOODSTAIN

If a bloodstain has only partially dried before something passes over it's surface, the bloodstain will be skeletonized. This type of event indicates movement after a period of time has elapsed--how much time has elapsed, will depend upon the surface, temperature, humidity, etc. If all of these conditions are kept constant, there will be less skeletonization and subsequent swiping produced as time elapses.

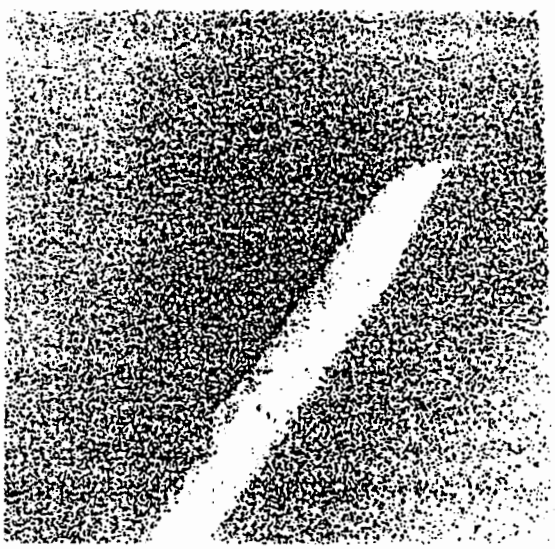
ELAPSED TIME ⟶

J. Miscellaneous patterns



EXPIRATORY BLOOD

Sneezes, coughs, chest wounds, sudden exhalation after injury or simply gurgling or blowing out of the mouth often produces bloodstain patterns which might be confused with high velocity spatters. Ruptured air bubbles or diluted stains are good indicators of expiratory patterns.



Cleared areas indicate that an object was blocking the blood spatters.
This clearing was produced by a knife blade lying on the target.

This pattern was produced by a suspect pivoting on the heel three times-- moving from left to right .
(The police were surrounding the house)

METHODS OF DETERMINING THE 3-DIMENSIONAL POINT OF ORIGIN

METHOD 1: PHYSICAL DETERMINATION

Step #1: Measure spatters' width and length (micrometer/"Micromike")

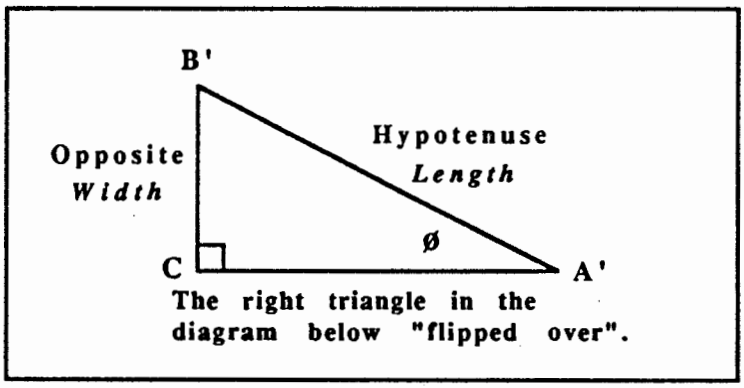
a) $\frac{\text{Width}}{\text{Length}}$ = inverse sine of the angle of impact

Step #2: Calculate the angle of impact

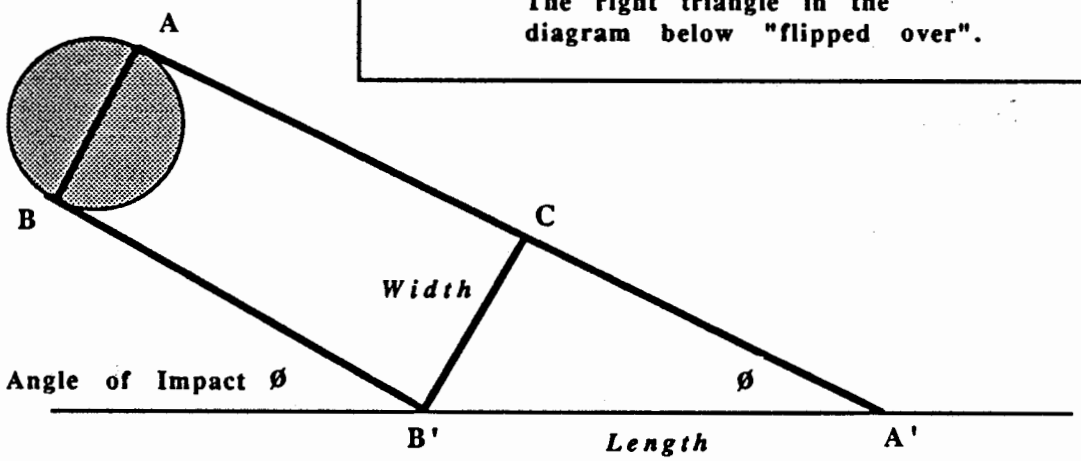
Example: Width=3 mm and Length=6 mm

$$\frac{\text{Width}}{\text{Length}} = \frac{3 \text{ mm}}{6 \text{ mm}} = 0.5 \text{ which is the sine of a } 30° \text{ angle}$$

By using a calculator with <inverse> function, you can take the <inverse> <sin> of the width divided by the length and read the angle of impact directly from the display.

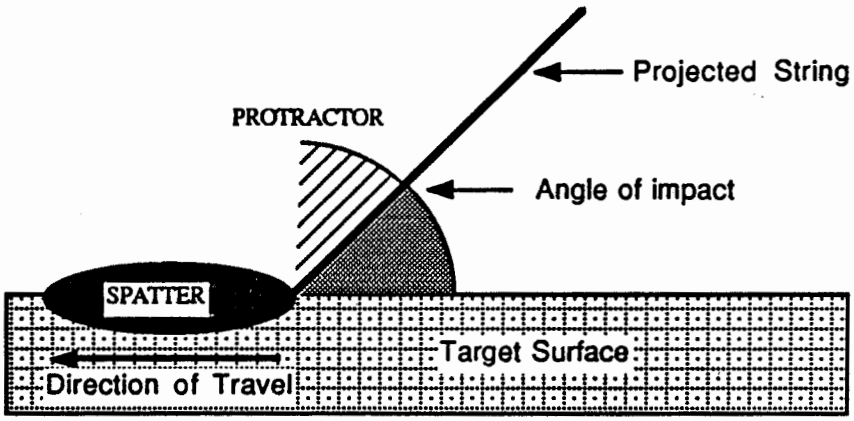


The right triangle in the diagram below "flipped over".

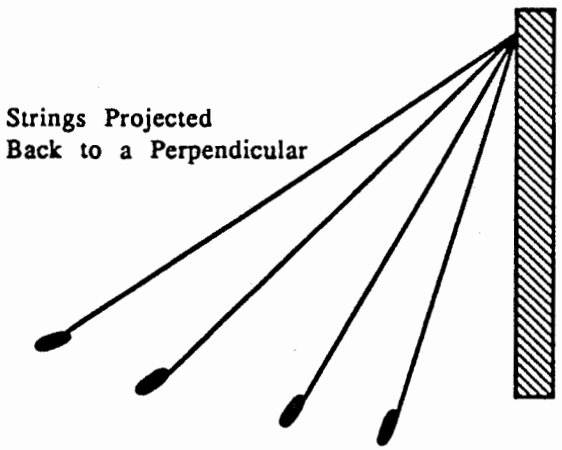


$$\text{sine} = \frac{\text{opposite (width)}}{\text{hypotenuse (length)}}$$

Step # 3: Affix a string at the base of spatter and, using a protractor, physically elevate the string to the calculated angle of impact .

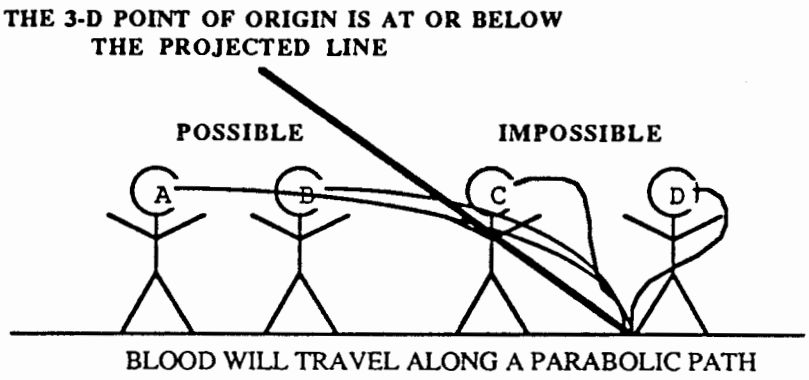


Step #4: Continue this process with all the stains being used.



The strings will cross or cluster ***at or below*** the 3-dimensional point of origin.

Projected strings depict a straight line path of travel for a drop of blood, but a drop of blood actually travels through space in a ***parabolic path not as a straight line.*** Hence the distinction that the point of origin is at or below the point where the strings cross.



METHOD 2: TRIGONOMETRIC DETERMINATION

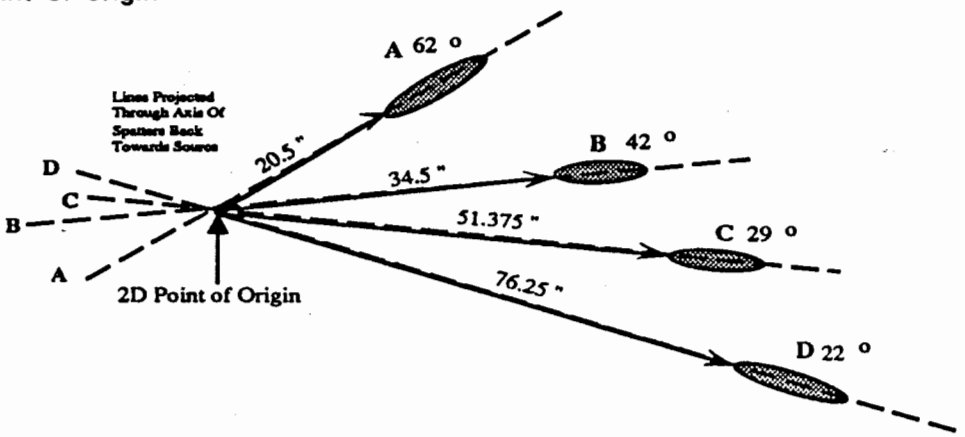
Step #1: Determine the angle of impact for the spatters

a) Measure spatters' length and width using a micrometer/"Micromike"

b) Width/Length = inverse sine of the angle of impact

Step #2: Determine the 2D point of origin by projecting strings through the axis of the stains back towards the source

Step #3: Measure the length of the various strings from the base of the spatter to the projected 2-D point of origin

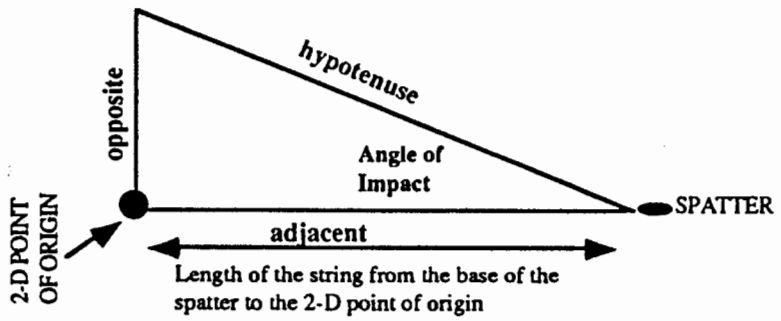


Step #4: Calculate the elevation in space (length of the Z-axis) using the following equation: (tangent of the calculated angle of impact) X (length of string from base of spatter to the 2D point of origin) = the elevation of the point of origin in space

If you can visualize each spatter as forming a right triangle, you already know two things about the triangle:

1. The angle of impact
2. The length of the adjacent leg of the triangle (length of the string from the spatter to the 2-D point of origin)

You want to find the length of the opposite leg (the 3-D point of origin or the elevation in space).



$$\text{tangent of an angle} = \frac{\text{opposite}}{\text{adjacent}}$$

Rearranging this equation, you will derive the formula you need to determine the length of the opposite leg og the right triangle (i.e. the elevation in space):

opposite = tangent of the angle X adjacent

Consider what you already know about spatter A in the example:

1. The angle of impact is 62 degrees
2. The length of the string is 20.5 inches

Substituting into the equation: opposite = tangent of the angle X adjacent
we now have: length of the opposite leg for spatter A= tangent of 62 degrees X 20.5 inches.

The tangent of a 62 degree angle is 1.8807265 (from trig table or conversion by a calculator), so the length of the opposite leg for spatter A = (1.8807265)(20.5 inches) = 38.56 inches

Continuing for the other stains:

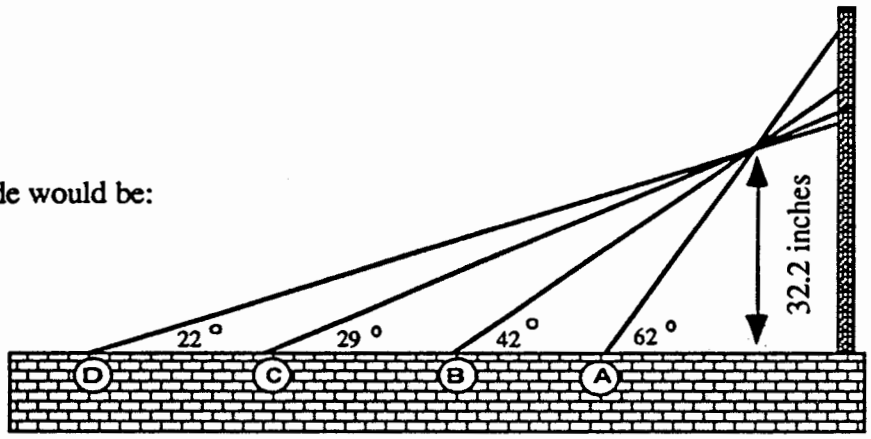
Stain B: opposite = tangent of 42 degrees X 34.5 inches
= (0.900404)(34.5 inches) = 31.06 inches

Stain C: opposite = tangent of 29 degrees X 51.375 inches
= (0.5543091)(51.375 inches) = 28.48 inches

Stain D: opposite = tangent of 22 degrees X 76.25 inches
= (0.4040262)(76.25 inches) = 30.81 inches

Averaging these values: (38.56 + 31.06 + 28.48 + 30.81) divided by 4 = 32.2 inches

This solution viewed from the side would be:

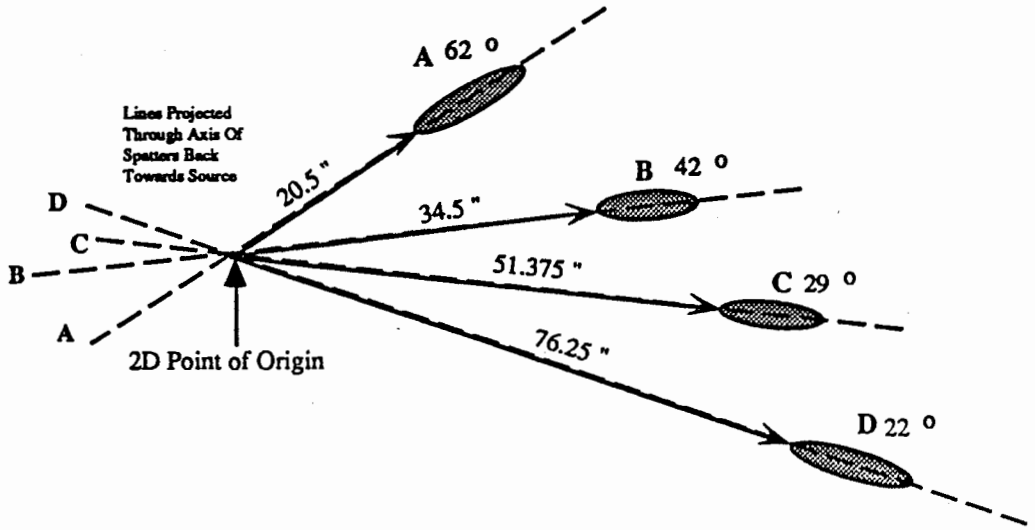


METHOD #3: GRAPHIC DETERMINATION

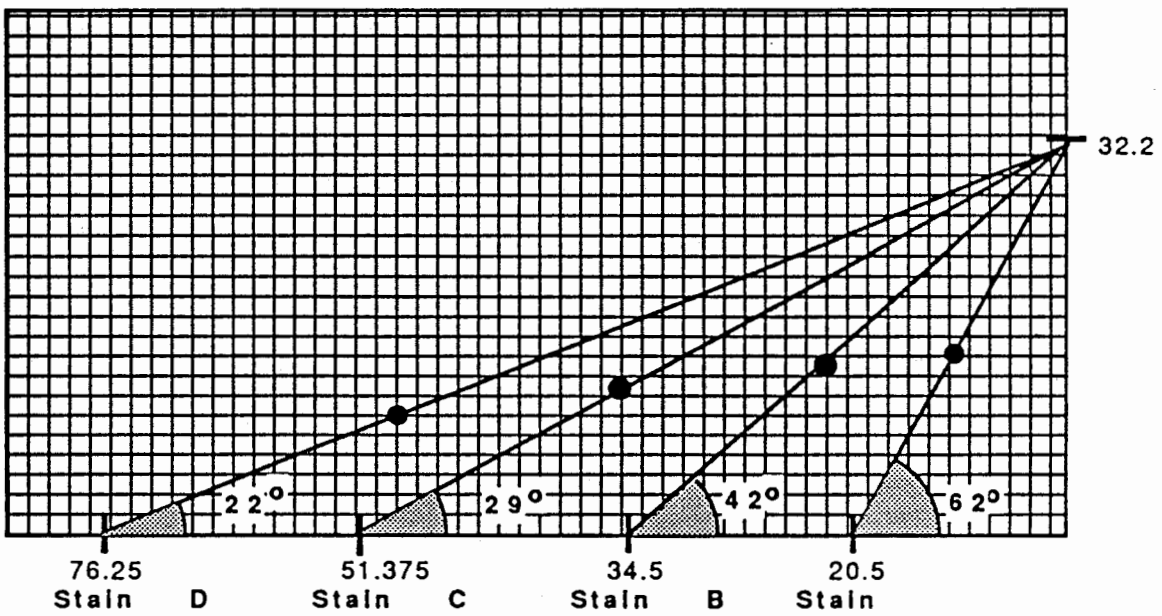
Step #1: Determine the angle of impact for the spatters.

Step #2: Determine the 2D point of origin by projecting strings through the axis of the stains back towards the source.

Step #3: Measure the length of the strings from the base of the spatter to the 2D point of origin.



Step #4: Use one axis of a sheet of graph paper to represent the length of the string from the base of the spatters to the 2D point of origin. Place a mark at representative distance. Using a protractor, place the second mark at the respective angle of impact. Using these two points, draw a straight line intersecting the perpendicular axis of the graph paper. These lines will intersect at the 3D point of origin, and the height of the axis can be read directly from the scale on the perpendicular axis of the graph paper.



RECOMMENDED REFERENCES

Bloodstain Pattern Interpretation Herbert Leon MacDonell
Available from: Laboratory of Forensic Science, Post Office Box 1111, Corning, NY, 14830
(The "Bible" for bloodstain pattern interpretation)

Interpretation of Bloodstain Evidence at Crime Scenes William G. Eckert, M. D. and Stuart H. James
Available from: Elsevier Science Publishing Co., Inc. 655 Avenue of the Americas, New York, NY 10010

Bloodstain Pattern Analysis, Theory and Practice--A Laboratory Manual Tom Bevel and Ross Gardner
Available from: John Anderson, CII, P.O. Box 7595, Colorado Springs, CO 80933
(This is technically a lab manual, but has a lot of good reference material and photographs.)

LABORATORY EXERCISES

Laboratory Manual for the Geometric Interpretation of Human Bloodstain Evidence
Herbert Leon MacDonell and Lorraine Fiske Bialousz
Available from: Laboratory of Forensic Science, Post Office Box 1111, Corning, NY, 14830.

Experiments and Practical Exercises in Bloodstain Pattern Analysis Terry L. Laber and Barton P. Epstein
Available from: Callan Publishing, Inc., 3033 Excelsior Blvd., Minneapolis, MN 55416

Bloodstain Pattern Analysis, Theory and Practice--A Laboratory Manual Tom Bevel and Ross Gardner
Available from: John Anderson, CII, P.O. Box 7595, Colorado Springs, CO 80933

SUPPLIES

ABFO No. 2 Scale: Use for photographs-- will allow the photo to be brought back into 90 degree angle of view.
Available from: Lightning Powder Co., Inc. 1230 Hoyt Street, SE, Salem, Oregon 97302 Catalog # 97320. Phone number: 800-852-0300

Micro-Mike Model 2020
Available from: Laboratory of Forensic Science, Post Office Box 1111, Corning, NY, 14830.
or DuMaurier Company, Inc., P.O. Box 4010, Virginia Beach, VA 23454

Micro-Lite Clip-on Accessory Light for Micro-Mike
Available from: DuMaurier Company, Inc., P.O. Box 4010, Virginia Beach, VA 23454

The Big Ruler for Crime Scene Photography. Flexible and self-adhesive rulers.
2 inch: 10 per pkg. Cat # 1-2330 $4.50 100 per pkg Cat # 1-2331 $25.00
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Ruler Tape for Crime Scene Photography
Adhesive, but removable English and Metric repeat every 12 inches
Rolls are 1 inch X 10 feet Catalog #1-2320
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PHOTOGRAPHS

The copyrighted photographs which were reproduced in this outline are available for purchase as slides or prints (8 X 10 and 16 X 20) from:

John Anderson, CII, P.O. Box 7595, Colorado Springs, CO 80933.
These are excellent, high-quality photographs and would be very useful for courtroom presentations.

BLOOD SPATTER TERMINOLOGY
Adopted in 1989 By:
INTERNATIONAL ASSOCIATION OF BLOODSTAIN PATTERN ANALYSTS

References

International Association of Bloodstain Pattern Analysts News, March 1990.
International Association of Bloodstain Pattern Analysts News, June 1990.

ANGLE OF IMPACT
The internal angle at which blood strikes a target

ARTERIAL GUSHING
Characteristic patterns resulting from blood exiting under pressure from a breached artery. These patterns, recorded on a target surface, are characterized by specific appearance and shape. In some cases direct fluctuations of arterial blood pressure may be identified by spurts within the pattern.

BACK SPATTER
Blood that is directed back towards its source of energy.

BLOODSTAIN
Blood that has come in contact with a surface.

CAST-OFF PATTERN
Blood that is projected onto a surface from other than an impact source. This bloodstain pattern is created when blood is thrown off a bloody object in motion, such as from a beating instrument.

CLOT
A blood clot is formed as the result of a complex mechanism involving the plasma protein fibrinogen, blood platelets, and other clotting factors. It is observed visually as an insoluble network of fibrous material (fibrin) and red blood cells. Subsequently, the blood clot begins to retract causing a separation of the remaining liquid portion of the blood which is now referred to as serum rather than plasma.

DIRECTIONALITY
Relating to, or indicating, the direction a drop of blood traveled in space from its point of origin.

DRAW-BACK
When blood is sucked back into the muzzle of a firearm due to the rapidly expanding gases in the firearm.

DRIP PATTERN
Blood that drips into blood resulting in characteristic, usually large (0.1-1.0 mm.), round satellite spatters.

FLOW PATTERN
A blood stain or pattern that results from the flow of blood on the surface of an object. This flow could be caused by gravity or the movement of the object.

FORWARD SPATTER
Blood that travels in the same direction as the force that caused the spatter.

HIGH VELOCITY IMPACT SPATTER
Bloodstain pattern, characterized by a mist-like appearance, that is caused by a high velocity force. This spatter travels only a short distance in flight. A high velocity impact is considered to be approximately 100 feet/second or greater. All gunshot wounds are characterized as high velocity.

IMPACT SITE
Usually that point on a body or a bloody object which receives some sort of blow or gunshot. In the absence of an impact which in some way causes blood to spatter, impact site could also mean that spot or area on the surface of a target which is struck by blood in motion.

LOW VELOCITY IMPACT SPATTER
Bloodstain pattern, characterized by size, that is caused by a low velocity force. A low velocity force is considered to be approximately 5 feet/second or less.

MEDIUM VELOCITY IMPACT SPATTER
Bloodstain pattern, characterized by spot size, that is caused by a medium velocity force. A medium velocity force travel at approximately 25 feet/second. A beating typically causes this type of spatter.

ORIGIN (POINT OF)
The location from which the blood that produced a bloodstain originated. This is determined by projecting angles of incidence of well-defined blood drops back to an axis constructed through the point of convergence.

PARENT DROP
A drop of blood from which a wave, cast-off, or satellite spatter originates.

POINT OF CONVERGENCE
A point to which a bloodstain pattern can be projected. This point is determined by tracing well-defined drops within the pattern back to a common point or source.

POINT OF ORIGIN
see Origin (Point of)

PROJECTED BLOOD PATTERN
A pattern created when a force, other than a low velocity impact, acts upon a quantity of blood of more than **approximately** 1.0 ml.

SATELLITE SPATTER
Small droplets of blood that are projected around or beside a drop of blood upon impact with a surface. A wave cast-off is also considered satellite spatter.

SECONDARY SPLASHING or RICOCHET
Large volumes of blood when impacting a surface may deflect off from the initial target to another target.

SERUM STAIN
A clear or yellowish stain with a shiny surface. This often results around a bloodstain after the blood has retracted due to clotting.

SMUDGE
A bloodstain that has been distorted to a degree that its history cannot normally be identified.

SPINE
The pointed edge characteristics that radiate away from the center of a blood drop. If spines occur, their formation depends upon impact velocity and surface texture.

SPLASH
A reaction created when a low velocity impact acts upon a blood quantity of more that **approximately** 1.0 ml. Examples of events that cause a splash are large volumes of blood striking a surface at an angle or stepping into a pool of blood.

SWIPE or SMEAR
The transfer of blood onto a surface not already contaminated with blood. One edge is usually feathered.

TARGET
A surface onto which blood has been deposited.

TERMINAL VELOCITY
The greatest speed to which a free falling drop of blood can accelerate in air. This speed is 25.1 feet/second.

TRANSFER PATTERN
A contact bloodstain created when a wet, bloody surface comes in contact with a second surface. A recognizable image of at least a portion of the original surface may or may not be transferred to the second surface.

WAVE CAST-OFF
A small blood droplet that originates from a parent drop of blood due to the wave-like action of the liquid in conjunction with striking a surface at an angle other than ninety degrees.

WIPE
Bloodstain pattern created when an object moves through an existing bloodstain, removing blood from the original stain and altering that stain's appearance.