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No Strings, No Computers

NO MORE STRINGS, NO MORE COMPUTERS,

JUST SIMPLE MATHEMATICS, THAT'S ALL IT TAKES

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In a criminal case it can be highly significant to establish whether a victim was shot or beaten while standing, sitting or kneeling, or lying on the floor or a bed. Information as to the location and posture of an accident victim, or a suicide, is also important to achieve a better understanding of spacial relationships at the time of any prior event. When bloodshed results from an injury, it is frequently possible to reconstruct the mechanism of the injury when blood is projected away from the area of impact. Bloodstain origin should always be expressed in three dimensions as a sphere, a ball, or a volume from which blood spattered outward in a radiation pattern. One conventional practice to determine the location of bloodspatter is to use a protractor and strings.

The first step is to establish the two dimensional origin. This is accomplished by tracing lines or taping string through the long dimension of bloodstains that exhibit good directionality. If there was a single origin of bloodspatter, the lines or strings should form a general area of convergence. This identifies the two dimensional origin. Elastic string should be used as it maintains a straight line configuration with only slight tension. The origin is taken as a point that represents the center of convergence of the strings. Diagram 1 shows a perspective view of how the two dimensional origin (O) is established on a flat surface.

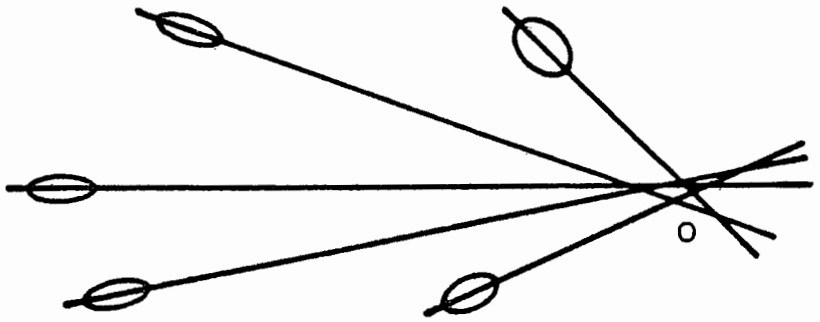

DIAGRAM 1

The second step to establish the three dimensional area is to determine the internal angle of impact of several blood drops. This is easily accomplished using trigonometry. Everyone working in the field of bloodstain pattern interpretation should know that if you divide the width by the length of an elliptical bloodstain, you have the sine, which is usually expressed as *sin*, of the angle of impact. A scientific calculator can provide the angle of impact by pressing the arc sin, $\sin^{-1}$, or, with many calculators, the 2nd function key, followed by pressing the sin key. Any trigonometry textbook could also be consulted for this information.

The third step is to secure one end of an axis, such as a wooden dowel, normal to the bloodstained surface at the two dimensional origin. This axis should be well supported. Next, each string that has been stretched through the long dimension of an elliptical bloodstain is raised up the axis (dowel) until it reaches its angle of impact. It is then tied or securely taped to the axis. This is repeated for each string. The strings should now intersect the axis at a point of general convergence which represents maximum height of the origin of bloodspatter.[1]

Using impact angles and distances from the two dimensional origin, bloodstain trajectories may also be plotted back to their origin on graph paper using a protractor.

Computer programs are available that allow determination of the origin of bloodspatter. One was developed by Dr. A. L. Carter of the Forensic Computing of Ottawa, Canada. These programs, *TRACKS* and *BACKTRACK/STRINGS*, is interesting and has excellent graphics. Another computer program which has recently become available is *NO MORE STRINGS™ • V3* offered by Miller Forensic Software of San Jose, California. It is claimed that this program is superior to older ones as it allows the user the option to individually evaluate each bloodstain's effect on the overall origin. Also, the user can "walk around" the origin for perspective viewing. It is suggested that the "string method" is slow, awkward and less accurate. This is not necessarily an unbiased, fair, or accurate assessment.

Jon Lofgren, a graduate of the Bloodstain Evidence Institute, has suggested the use of a scanner to reduce measurement errors as well as to enter data directly into a computer program.[2] Such programs tend to establish a point in space rather than a more realistic volume from whence the spatter originated. After all, large wounds do not emit blood from a point source but an area source.

There is another technique that does not require either strings or computers. It uses basic mathematics, specifically trigonometry. This method for obtaining the distance of bloodspatter away from a surface was first discussed with students who attended the forty-second Bloodstain Evidence Institute held in Corning, New York in May 1995. Bengt Aspergren and Thomas Palmgren, who are both Police Inspectors and teach at the Swedish National Police College, felt that the so-called *Tangent Method*, which they use in Sweden, was the method of preference as it did not require two investigators or a protractor at the crime scene to determine the area of origin of bloodspatter. Although this method is discussed in the Laboratory Manual written by Bevel and Ross[3] in 1990, it apparently does not enjoy wide-spread publicity. For that reason, the *Tangent Method* is reported here to allow it to receive more attention by those who may find it to be of value.

After the angle of impact of a bloodstain has been determined using the width/length sine method, it is elementary to establish the height over the floor, or the distance from a wall, of the origin of spatter using another trigonometric function; the tangent of that angle. Measurement of the distance of the bloodstain from its two dimensional origin, and calculation of the angle of impact, allows the height of the origin of bloodspatter to be accurately established.

The tangent method allows quick and accurate calculation of the height of the origin of bloodspatter and eliminates the necessity of having to string the scene. All that is required at the scene is to establish the two dimensional origin on, for example, the floor, and secure a vertical axis, such as a wooden dowel, above it. The next step is to calculate the angle of impact, Theta (θ), for a bloodstain, such as (BS) in Diagram 2, in this case, 37°, and measure its distance (A) from the two dimensional origin (O), in this case, forty-seven and one-half inches.

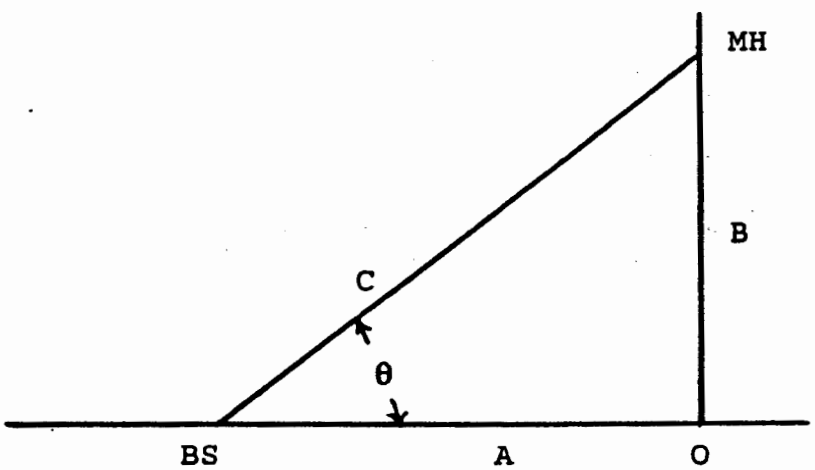

DIAGRAM 2

Using a scientific calculator, simply enter 37, press "tan" and obtain the tangent of 37°, which is 0.753554. Multiply this number

by the distance of the bloodstain from the two dimensional origin, 47.5", and the result, 35.79", is the maximum height (MH) of blood-spatter origin above the floor.

After several calculations have been made to determine the maximum height of the origin of spatter above the floor, these values must be averaged. The final conclusion as to height should be expressed as a range which reflects the agreement of individual measurements. Consideration must be given for any gross difference that might be apparent. Close inspection of a bloodstain that gives a peculiar result will usually disclose dirt, wood grain, or an inaccurate measurement of either its width or length.

This method of establishing the origin of spatter is based on the simple trigonometric relationship that the side opposite an angle, in this example the height (B), divided by the side adjacent (A), in this example the distance of the bloodstain from its two dimensional origin, is the tangent of that angle.

REFERENCES

1. MacDonell, Herbert Leon, BLOODSTAIN PATTERNS, Corning, New York, Laboratory of Forensic Science, 1993, p. 35-42.

2. MacDonell, loc. cit., p. 41-42.

3. Bevel, Tom, and Ross Gardner, Bloodstain Pattern Analysis, Theory and Practice, A Laboratory Manual, 1990, 104 p.