Diameter of a Bloodstain as a Function of Origin, Distance Fallen, and Volume of Drop.

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Introduction:

Many people in the field of bloodstain pattern analysis have been taught that a drop of blood is of a constant volume of 0.05 cc and that the height from which a drop of blood falls can be calculated from its diameters. Necessary in our laboratories show that there is no standard volume that can be assigned to a free-falling drop of blood. This has been confirmed by many other analysts who have attended workshops and have done experiments themselves. As outlined in "Bloodstain Pattern Analysis," the volume of a blood drop varies considerably depending upon the object from which it falls, the height from which a blood drop originates, and the impact from which diameter unless you also know the drop volume, which is rarely known in actual crime scenes.

Concluding the realization that constant volume cannot be assigned to a drop of free falling blood is not new. In 1949, McCarthy in 1 published the results of his experiments "Blood Dynamics Study of Projected Blood Flows of 2000 cc." These studies indicate that any correlation between diameter of stain and height of fall must be done with drops of a constant volume. In 1961, Kincheloe in 3 used various tube sizes to project drops of different volumes. In 1964, Francis in 4 wrote a thesis "Blood Dynamics: A Study of Projected Blood Flows of Different Volumes." This study indicates the volume of a drop of free falling blood.

Blood found at a crime scene is often the result of blood dripping from objects. These droplets can occur in a variety of ways. Blood can drip from a wound, a weapon, or from any other surface where sufficient blood has accumulated to form droplets.

The diameter of a bloodstain will depend upon the volume of the individual blood drop, the distance the drop falls, and the surface the drop strikes on impact. The volume of a blood drop will depend upon the object from which the drop originates. The stain diameter will increase with increases in drop volume. Therefore, other parameters are held constant.
The range in diameter of several bloodstains as a function of their source of origin is illustrated in Figure 1. All blood drops were allowed to fall from objects which were supported on a 100 cm high smooth white cardboard target. The range in stain diameters shown in Figure 1 is due to blood drop volume variation between objects. Since all drops fell from a height of 100 cm it is clearly illustrated that the height from which a drop originates cannot be determined from its stain diameter unless the volume of the drop itself is known. This volume certainly will not be known in most crime scene investigations.

**Diameter of Stain as a Function of Origin**

**All Drops Fell 100 cm**

- Screwdriver tip
- Wrench handle
- Knife handle
- Knife tip
- Cloth
- Hanger handle
- Hanger tip
- Horizontal pipe
- Vertical pipe
- Finger tip

Figure 1
The volume of blood drops falling from eight different objects was determined by volumetric means. The eight objects that resulted from blood drops falling into each of the eight objects were also measured (Table 1). Drops of blood from a single human donor, object #1, gave drop volumes of 0.035 ml/drop and had an average diameter of 0.35 mm. After falling 10 cm, these drops resulted in a drop volume of 0.030 ml/drop and had an average diameter of 0.30 mm.

**DIAMETER OF STAIN AS A FUNCTION OF DROP VOLUME**

<table>
<thead>
<tr>
<th>Tier</th>
<th>Volume of Drop (ml)</th>
<th>Diameter of Stain (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.012</td>
<td>0.15</td>
</tr>
<tr>
<td>2</td>
<td>0.035</td>
<td>0.35</td>
</tr>
<tr>
<td>3</td>
<td>0.060</td>
<td>0.55</td>
</tr>
<tr>
<td>4</td>
<td>0.085</td>
<td>0.75</td>
</tr>
<tr>
<td>5</td>
<td>0.120</td>
<td>1.00</td>
</tr>
<tr>
<td>6</td>
<td>0.160</td>
<td>1.25</td>
</tr>
<tr>
<td>7</td>
<td>0.200</td>
<td>1.50</td>
</tr>
<tr>
<td>8</td>
<td>0.250</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Table 1

The data in Table 1 clearly illustrate two things. First, there is no standard volume for a blood drop. The drop volume varies considerably depending upon the object from which the blood falls. Second, the diameter of a bloodstain with the same with increases in blood-drop volume providing other parameters are held constant.
The diameter of a bloodstain as a function of distance fallen and the diameter of a bloodstain as a function of its drop volume is shown in Figure 2. This figure illustrates the dependence of the diameter of a bloodstain on the distance the drop falls and the drop's volume:

**Diameter of Bloodstains**

As a function of distance fallen and drop volume

<table>
<thead>
<tr>
<th>Distance (cm)</th>
<th>0.0127 ml</th>
<th>0.0395 ml</th>
<th>0.0726 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 cm</td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
</tr>
<tr>
<td>25 cm</td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
</tr>
<tr>
<td>50 cm</td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
</tr>
<tr>
<td>100 cm</td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
<td><img src="image.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**Conclusion:** Blood drops cannot be assigned a standard or constant volume. Drop volume is a function of its source of origin and can vary from less than 0.1 ml to greater than 0.1 ml/m drop. At any given distance of fall, stain diameter will increase with decreasing drop volume, assuming a constant drop size; thus, the blow drop originated cannot be determined from stain diameter unless the volume of the drop is known. Since the volume of a drop that causes a particular stain deposition will vary for all practical purposes not be known, the height a blood drop originated from cannot be determined.
REFERENCES


PHOTOGRAPHIC LITERATURE

The following has been aimed at finding a rivet. Crime Scene, and CRIMELNTERISTICHE by Joseph.

Chapter 4, General diagram of camera with reference to teachin examples of crime, the theory of principi 2. Depth of field and reference for teachin photo examples of the same scene, i.e., The Crime Scene with object, angle lens, etc. Photo from Portrait Camera File.

3. CRIME SCENE (WEST) Co., "Detects if you check the following tab. Photos different place. A but new good guides to measuring full scale to be used in best techniques for crime information regardless of an indispensable.