Lab 4 – Blood Pattern Analysis

Lab Overview

This lab will build upon knowledge gained from the lectures that pertain to classifying particular blood patterns experienced at crime scenes. While it is difficult to classify blood patterns from images alone, each distinct pattern has specific characteristics that allow for classification. From the patterns collected, an investigator can calculate the angle of origin and height from floor. This lab will allow you to use standard operating procedures that are used in crime scenes currently.

Lab Objectives

- To be able to characterize the main blood patterns encountered at a crime scene
- To be able to calculate the angle of origin from measured blood pattern droplets.
- To be able to calculate the angle of origin from images of blood droplets.
- To be able to determine the sources of error when calculating angle of origin from blood.

Required Readings

- Lecture associated with blood pattern analysis from FOR106
- Blood pattern analysis chapter in required textbook for class.
- Watch blood droplet videos uploaded onto Canvas.

Average Time Needed to Complete

- **Part 1: 60 minutes**
- **Part 2: 80 minutes**

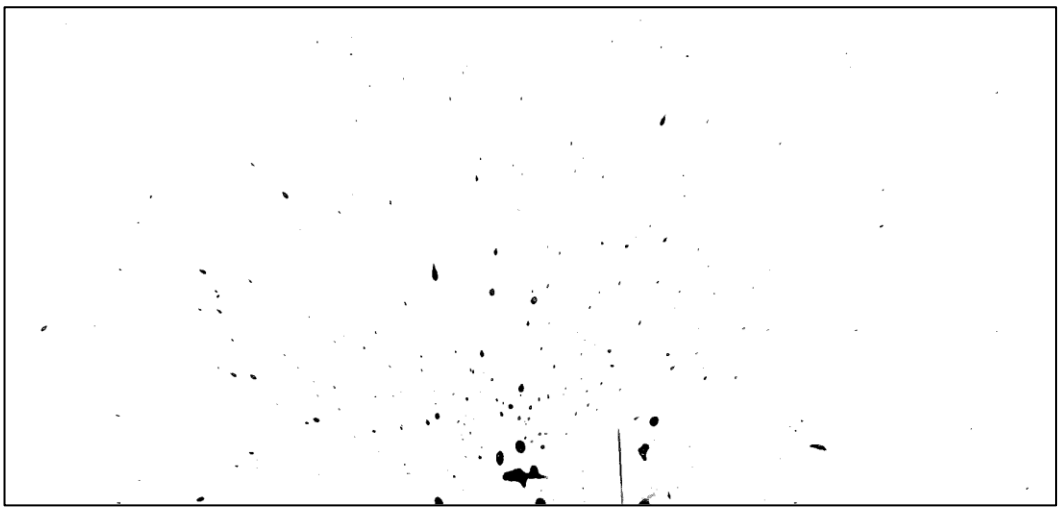
Laboratory Exercise

Part 1

1. Below are 5 images of blood patterns. Using your knowledge obtained from the lectures and videos on Canvas, identify the type of blood pattern. You are encouraged to make notes and draw on the images to explain/justify each of your answers.

[15 points available]

Image 1:



Answer:

A satellite blood pattern consists of small droplets that have separated from the main blood droplet upon impact with a surface.

Observation of Pattern: The central stain is observed to be larger and more defined, while the satellite stains are smaller and dispersed around the central stain. The distribution of these smaller stains helps identify the main point of impact.

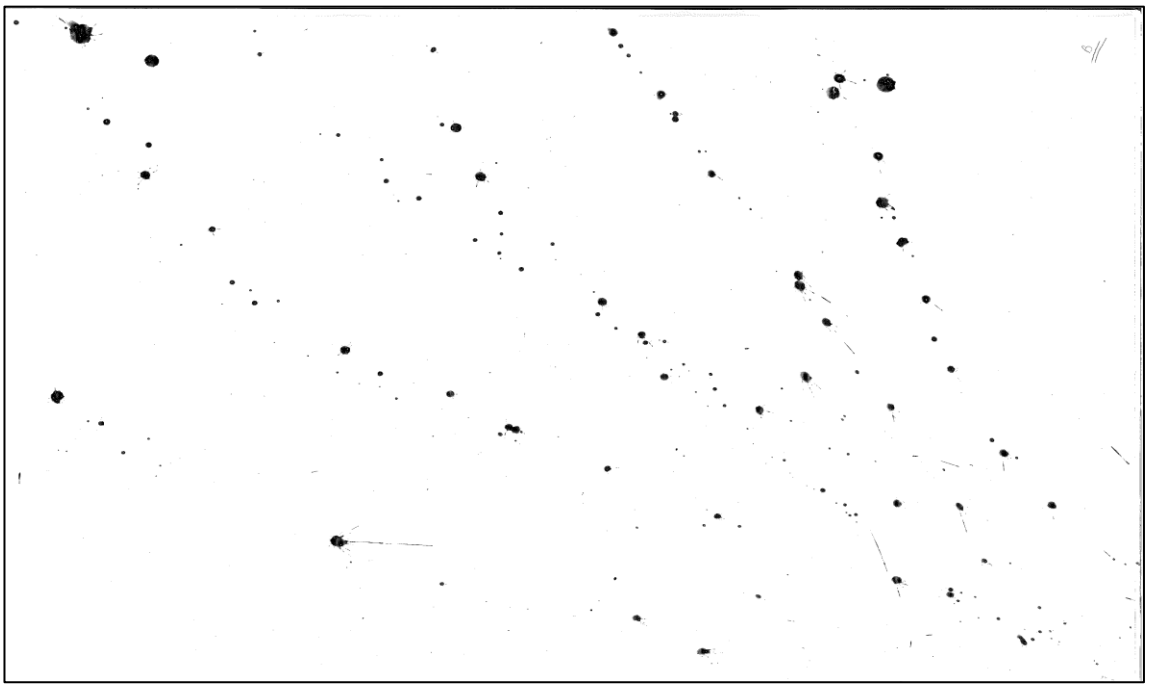
Shape and Distribution: Satellite stains are typically round or slightly elongated, and their distribution around the central stain can vary. The presence of these smaller droplets around a central bloodstain is a key indicator of a satellite pattern.

Impact Dynamics: When the main droplet hits the surface, the force of impact causes the liquid to disperse radially, creating the central stain. The force also causes smaller droplets to break off and land around the main stain, forming satellite stains.

Surface Texture Analysis: By analyzing the surface texture where the bloodstains are found, investigators can determine if the surface contributed to the formation of satellite patterns. Smooth surfaces tend to create more pronounced satellite stains compared to rough surfaces.

Angle of Impact: The angle at which the blood droplet hits the surface can also influence the formation of satellite patterns. A steeper angle might cause more pronounced satellite stains as the blood disperses more forcefully upon impact.

Image 2:



Answer: A **cast-off blood pattern** is identified by linear or arc-shaped lines of blood droplets, typically formed by the swinging motion of a bloodied object. The size, shape, and distribution of these droplets, along with the angle of impact and contextual clues, help forensic investigators determine the nature and origin of the bloodstains. This analysis provides insights into the events that led to the formation of the cast-off pattern, including the number of swings and the position of the assailant.

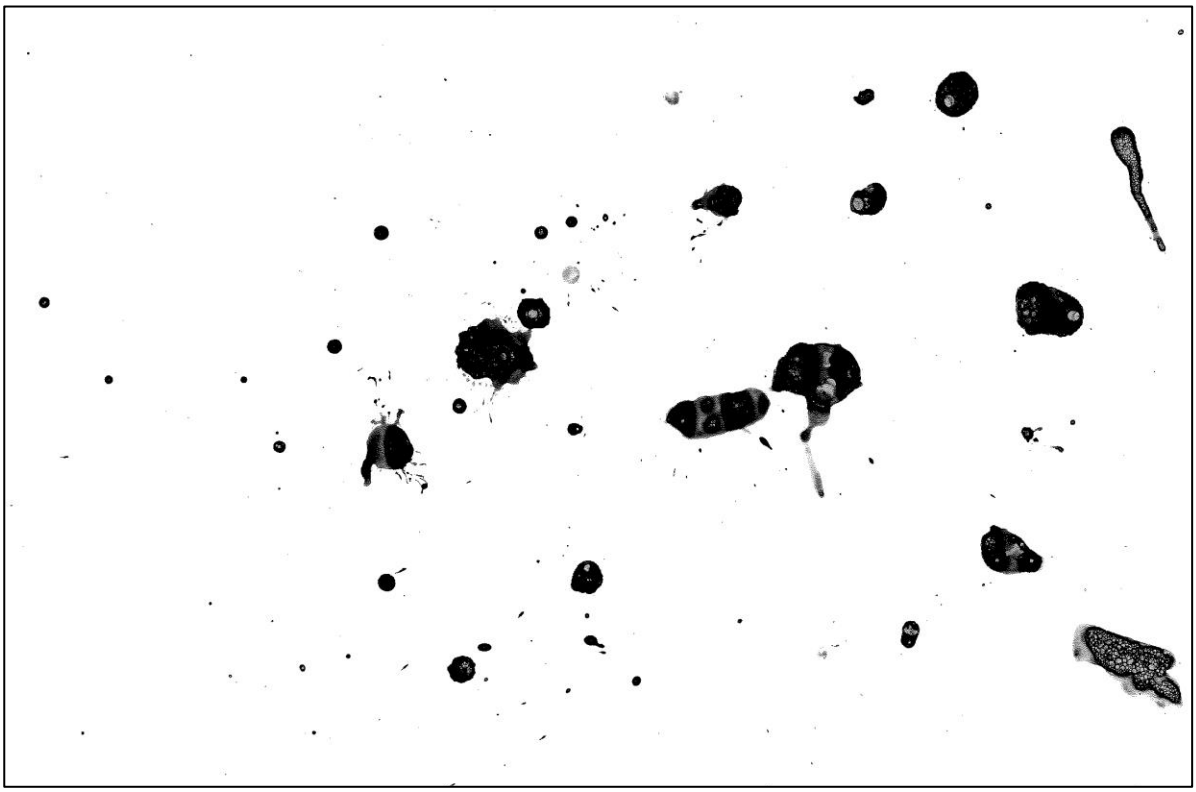
Linear Pattern Observation: Cast-off patterns are often observed as linear or arc-shaped lines of blood droplets. These lines are typically consistent in direction, indicating the path of the swinging object.

Droplet Size and Distribution: The blood droplets in a cast-off pattern are usually elongated, with the tails pointing in the direction opposite to the swing. This elongation occurs because the blood droplets are flung off with momentum, causing them to stretch before landing.

Repetitive Pattern: Multiple lines or arcs of blood droplets may be present, indicating repeated swings of the object. The distance between these lines can provide information about the number of swings and the speed at which the object was moved.

Angle of Impact Analysis: By examining the angle at which the blood droplets hit the surface, investigators can determine the position and movement of the person swinging the object. The droplets will form elongated stains with tails pointing back towards the source of the swing.

Image 3:



Answer: An **Expirated blood** pattern is characterized by fine mist-like droplets mixed with larger drops, often containing air bubbles. The location, presence of air bubbles, and contextual clues such as saliva or mucus help forensic investigators determine that the blood was expelled from the respiratory system. This analysis provides insights into the nature of the injury and the events that led to the formation of the expirated blood pattern.

Droplet Size and Shape: Expirated blood patterns often consist of fine mist-like droplets mixed with larger drops. The fine droplets are usually smaller and more dispersed than those from impact or cast-off patterns.

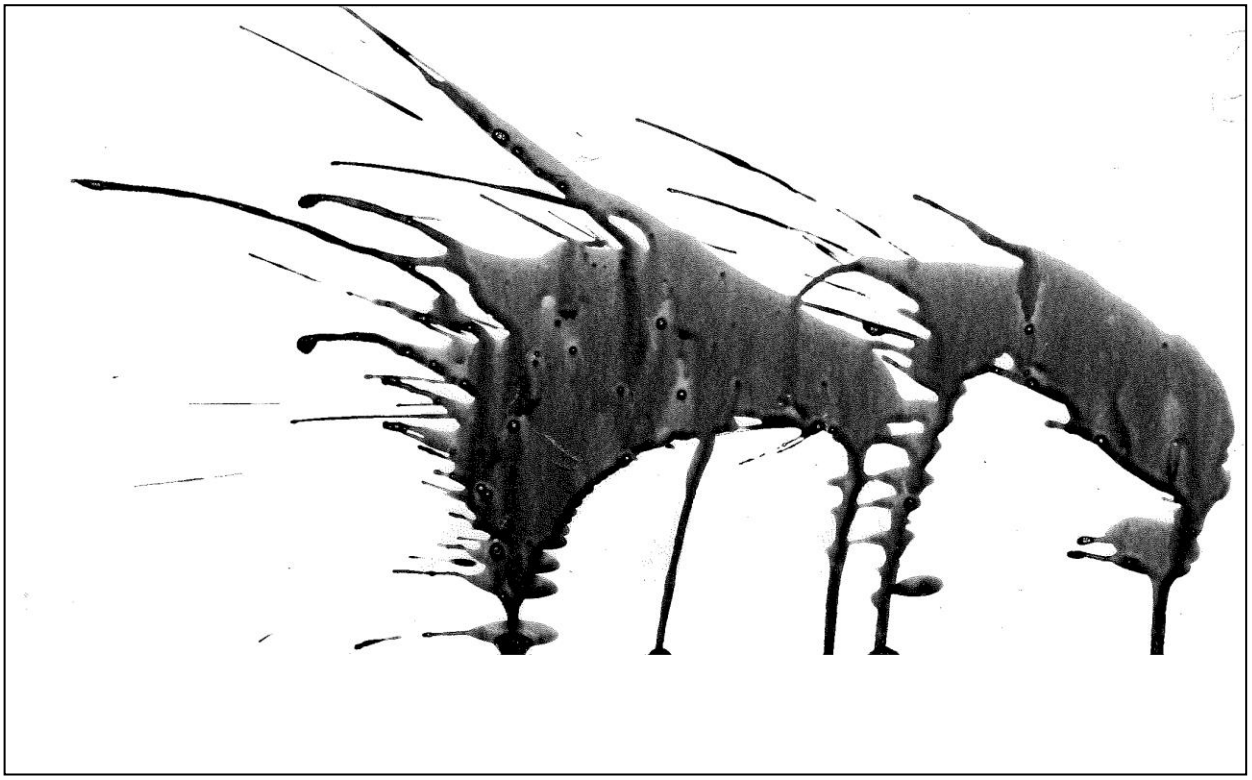
Presence of Air Bubbles: Blood expelled from the respiratory system can contain air bubbles. The presence of these bubbles within the bloodstains is a strong indicator of expirated blood.

Location and Context: Expirated blood patterns are commonly found near the victim's face or areas where the victim might have coughed or sneezed, such as on pillows, sheets, or surrounding surfaces.

Mixed Patterns: Expirated blood can sometimes mix with other types of blood patterns, such as passive drops from a nosebleed or impact spatter from an injury. The mixture of patterns and the presence of fine mist and air bubbles help distinguish expirated blood.

Saliva Presence: Expirated blood may contain traces of saliva, mucus, or other bodily fluids from the respiratory system. Chemical tests can sometimes detect these additional substances.

Image 4:



Answer: A **cast-off blood pattern** is identified by linear or arc-shaped lines of blood droplets, typically formed by the swinging motion of a bloodied object. The size, shape, and distribution of these droplets, along with the angle of impact and contextual clues, help forensic investigators determine the nature and origin of the bloodstains. This analysis provides insights into the events that led to the formation of the cast-off pattern, including the number of swings and the position of the assailant.

This was a little harder but I went with cast off due to the angle and looked like two similar patterns with the second being smaller but similar shape.

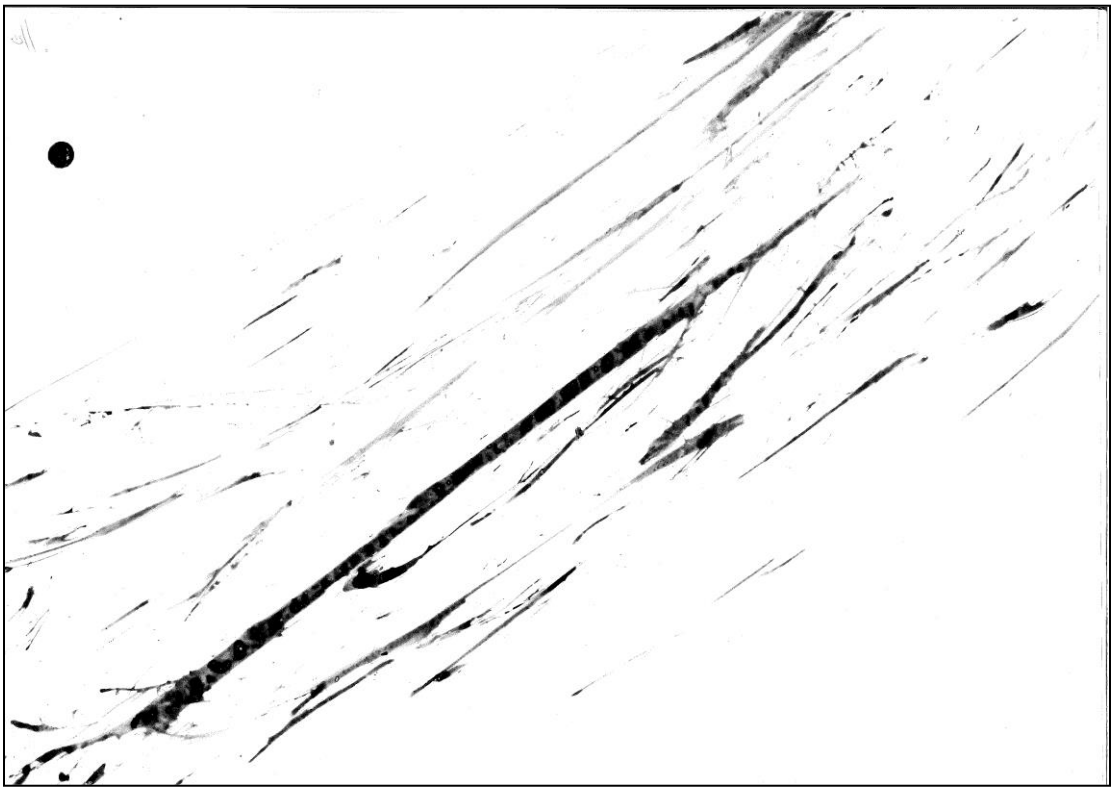
Linear Pattern Observation: Cast-off patterns are often observed as linear or arc-shaped lines of blood droplets. These lines are typically consistent in direction, indicating the path of the swinging object.

Droplet Size and Distribution: The blood droplets in a cast-off pattern are usually elongated, with the tails pointing in the direction opposite to the swing. This elongation occurs because the blood droplets are flung off with momentum, causing them to stretch before landing.

Repetitive Pattern: Multiple lines or arcs of blood droplets may be present, indicating repeated swings of the object. The distance between these lines can provide information about the number of swings and the speed at which the object was moved.

Angle of Impact Analysis: By examining the angle at which the blood droplets hit the surface, investigators can determine the position and movement of the person swinging the object. The droplets will form elongated stains with tails pointing back towards the source of the swing.

Image 5:



Answer: Arterial Blood Pattern

1. **Distinctive Spurting Pattern**: Arterial blood patterns are characterized by large, spurting arcs of blood. These arcs are created by the high pressure and rhythmic pumping of blood from the heart. The pattern often shows a series of lines or arcs, each corresponding to a heartbeat.
2. **Large Volume of Blood**: Due to the high pressure in arteries, the volume of blood in an arterial spurt is typically greater than other types of blood patterns, such as passive or expirated blood.
3. **Bright Red Color**: Arterial blood is often brighter red compared to venous blood due to its higher oxygen content. This can help distinguish arterial patterns from other types.
4. **Rhythmic Pattern**: The spurting blood creates a series of evenly spaced stains, reflecting the rhythmic nature of the heart pumping. The distance and shape of these stains can help identify the source and the severity of the injury.
5. **Location of Wound and Blood Path**: The location of the wound relative to the blood pattern can help confirm an arterial source. For example, a neck wound resulting in a high, arching pattern on a wall or ceiling suggests arterial spurting.

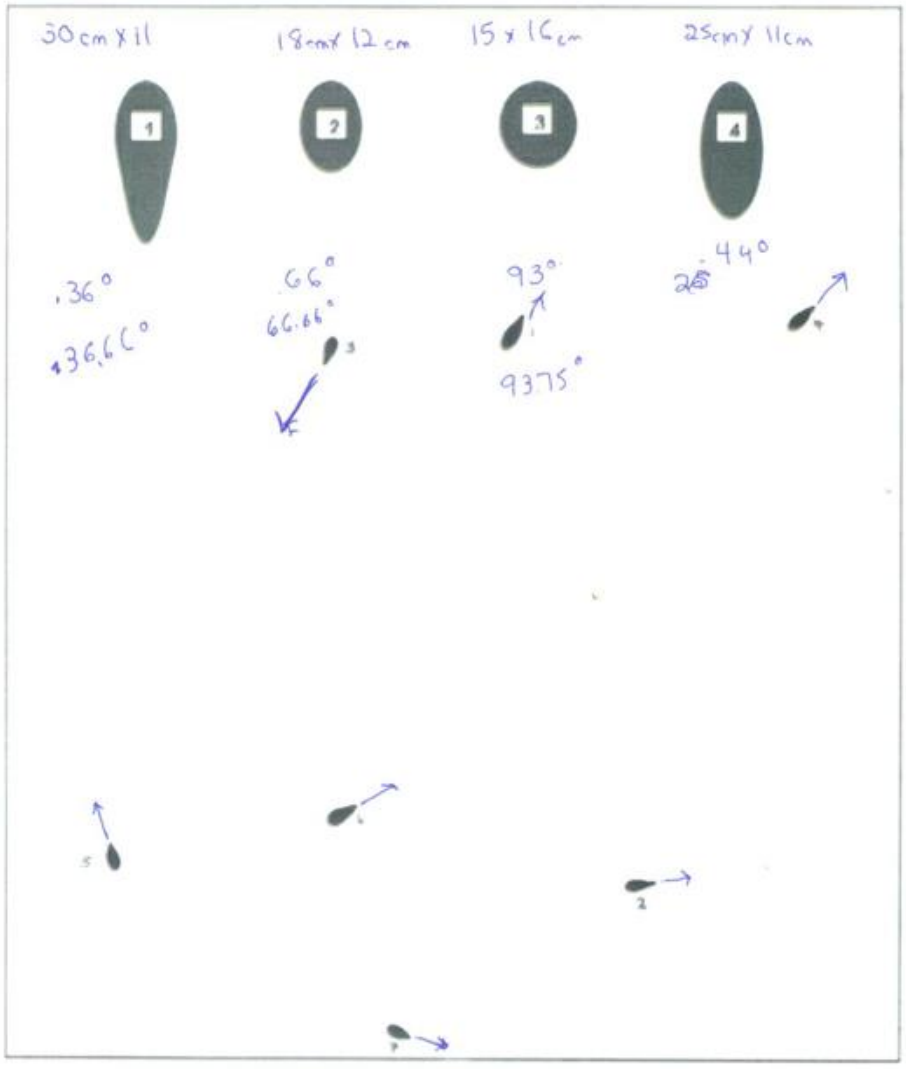
Part 2

1. Using the crime scene sketch below (Image 6), calculate the angle of impact for bloodstains 1 – 4.

   When calculating the angle of impact, use the large stains 1-4 at the top of the crime scene sketch for measuring your stain dimensions.

   Include your annotated crime scene sketch in your submission and show your working out, giving each value to 2 decimal places.

Image 6: [5 points available]



2. Given the values you have calculated, what factors could lead to any inaccuracies angle of impact values?

[5 points available]

Factor 1: **Surface Texture**: The texture of the surface where the bloodstain lands can significantly affect the shape of the bloodstain. Rough or porous surfaces can distort the stain, making it difficult to accurately determine the angle of impact.

Factor 2: **Volume of Blood**: The amount of blood in a droplet can influence the shape and size of the resulting bloodstain. Larger droplets may spread differently than smaller ones, leading to variations in the calculated angle of impact.

Factor 3: **Droplet Velocity**: The speed at which the blood droplet travels before hitting the surface can affect the shape of the bloodstain. Higher velocity droplets can create more elongated stains, which might lead to miscalculations of the angle of impact.

Factor 4: **Air Resistance**: The resistance the blood droplet encounters while traveling through the air can alter its trajectory and shape. Factors such as wind or air currents can introduce errors in the final bloodstain pattern analysis.

Factor 5: **Secondary Splatter**: Blood droplets may break apart upon impact, creating secondary splatter. These additional smaller stains can complicate the analysis and lead to incorrect conclusions about the primary angle of impact.