

Bloodstain Pattern Interpretation

Ontario Centre of Forensic Sciences — Biology Section

The field of bloodstain pattern interpretation has remained a somewhat under utilized area until recently, despite its importance and the recognition of its potential made over 90 years ago. Visits to scenes by Biologists from the Centre of Forensic Sciences were initiated in the early 1960's. Bloodstain pattern interpretation at the scene and on items submitted to the laboratory has been carried out continuously since that time.

Because a greater awareness of this field has grown in the last decade — the significance of bloodstain patterns has become more important to Ontario law enforcement agencies. For this reason, a decision was made at the Centre of Forensic Sciences in 1983 to extend our services in the area of bloodstain pattern interpretation:

- i) by providing training to law enforcement personnel regarding the recognition and photographing of important bloodstain patterns; and
- ii) by raising the awareness levels of investigators regarding the potential benefits of this kind of examination.

From the examination of bloodstain patterns it is sometimes possible to determine:

- i) the type of impact or action which produced the stains (eg.: splashing, beating or shooting),
- ii) the locations and possibly the positions of the victims and assailants; and
- iii) a probable sequence of events which resulted in the patterns at a scene.

SIZE OF BLOODSTAINS

The size of the bloodstain is an important factor in bloodstain pattern interpretation.

Passively falling drop — is a drop of blood falling only under the influence of gravity onto a surface.

Blood drops falling onto a non-absorbant surface result in stains greater than 8 mm. (5/16") in diameter. The size of stains produced on absorbant surfaces such as clothing, is dependent on the rate of absorption which is dependent on the surface texture, fabric type and weave. Bloodstains less than 8 mm. in diameter are usually the result of an impact or force applied to a bloodshedding source which overcomes the surface tension of the blood and results in blood droplets being projected away from their source. These types of bloodstains are termed as follows:

Low velocity impact spatter — caused by a low energy level impact by an object which was travelling at a velocity of approximately 1.5 m/sec (5.5 km/hr.), such as stepping into a pool of blood.

Medium velocity impact spatter — caused by a medium energy level impact by an object which was

travelling at a velocity of approximately 7.5 m/sec (27 km/hr.) such as beating or kicking.

High velocity impact spatter — caused by a high energy level impact by an object which was travelling at a velocity of approximately 30m/sec (108 km/hr.) or greater. Gunshot wounds are typically characterized as producing high velocity impact spatters.

The more energy or the greater the force that is applied to the bloodshedding source, the smaller the resultant stains. In addition, smaller droplets generally travel shorter distances than larger droplets.

MAXIMUM DISTANCES TRAVELLED BY PROJECTED BLOOD DROPLETS PROPELLED BY MEDIUM AND HIGH ENERGY IMPACT

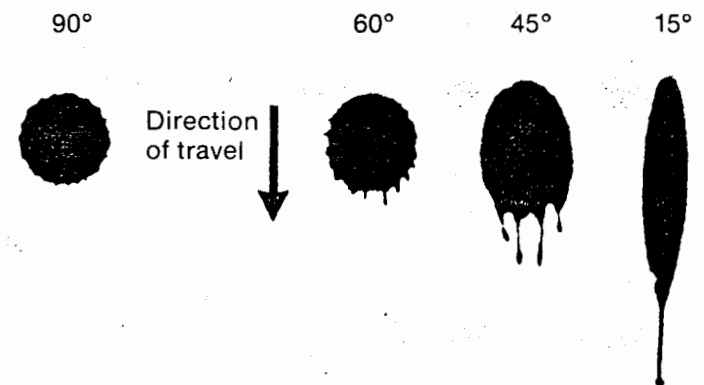
Diameter of stain	Maximum Distance Travelled
2.38 mm (3/32")	272 cm (107")
0.79 mm (1/32")	170 cm (67")
0.40 mm (1/64")	114 cm (45")
0.30 mm (1/85")	99 cm (39")
Approx. 0.05 mm (1/500")	10 cm (4")

NB: While a 2.38 mm (3/32") diameter stain could be found as close as 10 cm. (4") from the impact site, the same sized stain could also be found as far away as 272 cm. (107").

SHAPE OF BLOODSTAINS

Bloodstains may range from circular to elongate in appearance and their shapes are dependent on the angles at which the blood has struck the target surface.

BLOOD DROPS FALLING 60 CM ONTO A NON-ABSORBANT SURFACE



Circular bloodstains indicate that the droplets have struck the surface at approximately right angles (90°) either as a result of falling onto a horizontal surface from above; or as a result of projection onto a vertical surface from that level, or directly below as the blood "arced" up to the target location.

Elongate and oval shaped bloodstains can be "tadpole" shaped with the "tail" pointing in the direction of travel. Taking into account the effect of "arcing", it is possible to determine from which direction the blood originated.

Walking or running while dripping blood results in near circular stains due to the relatively large angles of impact, with "spines" (spiked edge characteristics that radiate away from the centre of a blood drop) that point in the direction of travel. In this way it is possible to trail and determine the movements of a bleeding subject (see below).

Shoulder level dropping of blood at walking speed



Direction of travel



OTHER TYPES OF BLOODSTAIN PATTERNS

Cast-off Pattern

Cast-off stains are produced when blood is projected onto a surface from other than the primary blood-shedding source. Cast-offs are usually thrown off a bloody object in movement (such as a beating instrument) and can range from fractions of a centimeter up to 3 cm. in diameter. Under normal conditions, stains on a ceiling will almost always be the result of cast-off. By studying the pattern it is usually possible to determine the positioning of the person wielding the bloody object.

Backspatter

Blood that is directed back towards its source of energy is termed backspatter, and this often results from high velocity gun shot impact. Backspatter occurs under the following conditions:

- i) contact or near-contact gunshot wounds,
- ii) second shots to, or in close proximity to a first shot (where blood is present); and
- iii) a shot to a large blood source, such as the heart (where the blood pressure of the heart contributes to this effect).

Backspatter can occur under other conditions which are dependent on the calibre of the weapon and whether obstructions such as clothing or hair are present which can minimize or eliminate this type of bloodstain pattern.

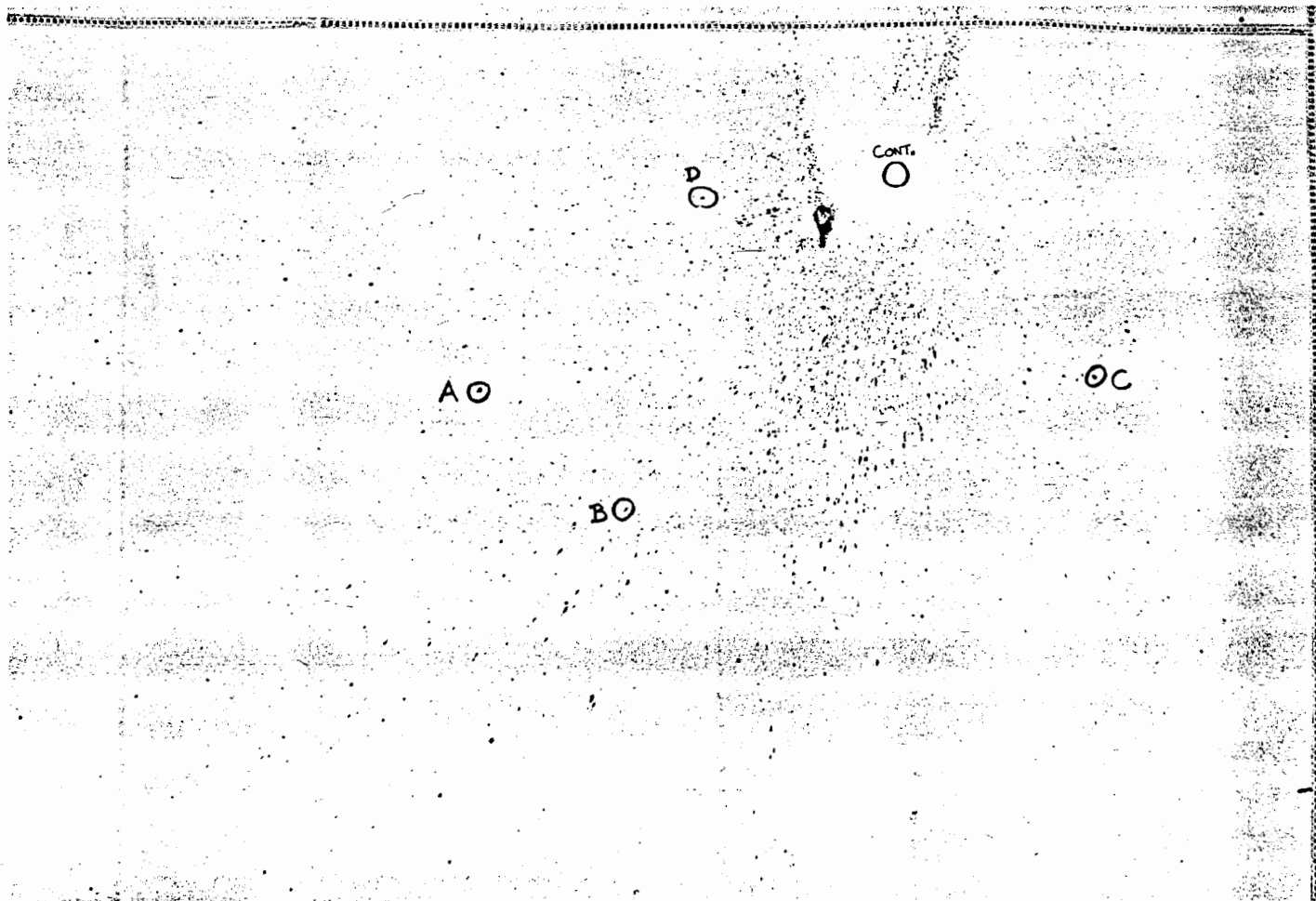


FIG. 1 Overall photograph of the bloodstain patterns.

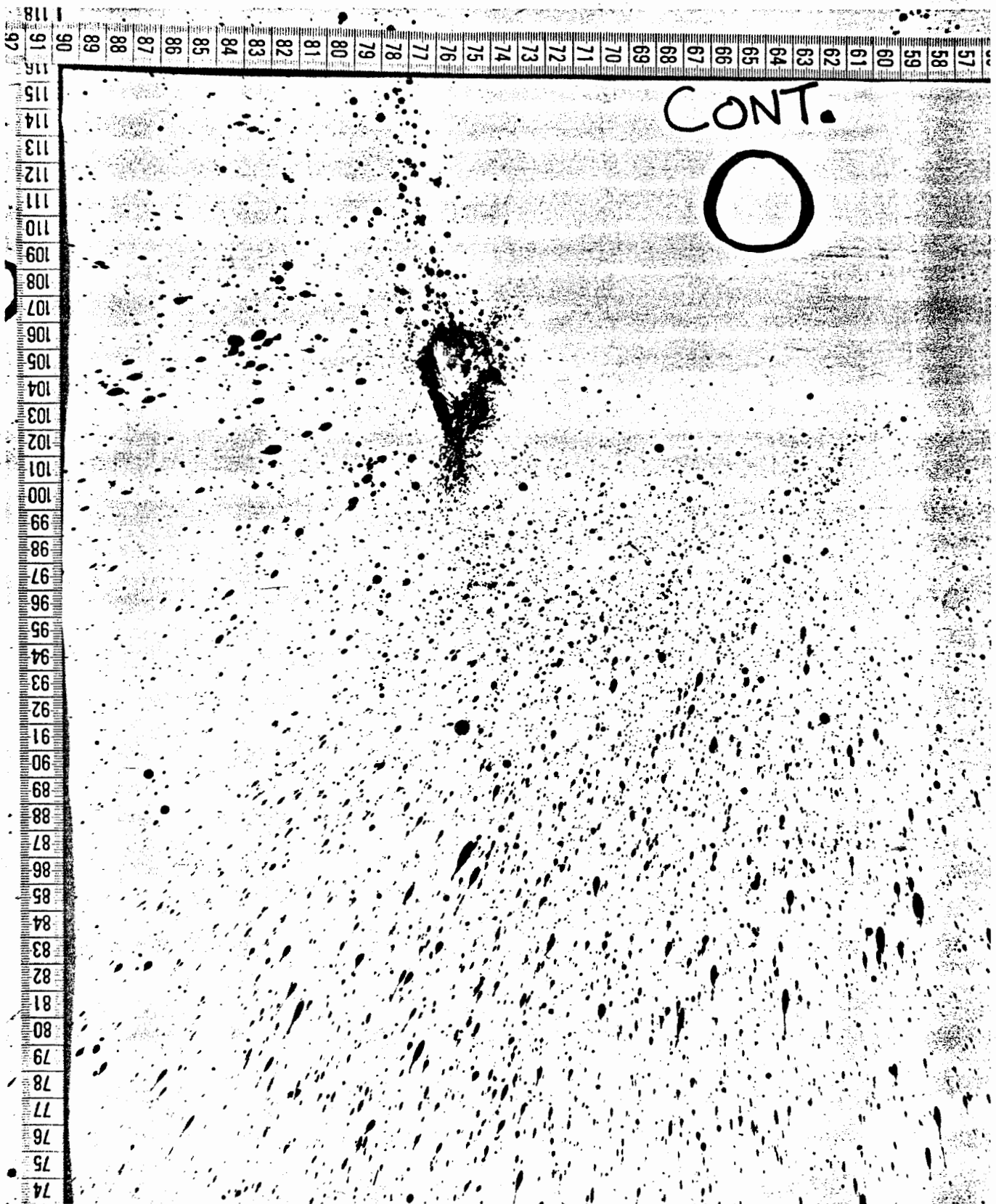


FIG. 2 Close up photograph of a bloodstained area.

NOTE:

In instances where a large number of photographs are available, standard size prints, such as 12.5 cm. x 17.5 cm. (5" x 7"), can be submitted. The prints

should be numbered or marked to be readily recognizable to both the submitter and the person examining the prints. 20 cm. x 25 cm. enlargements of specific photographs could then be made available if requested.

Smears

Blood smears are commonly encountered and are the result of one of two actions, either:

- i) an object moving through a wet bloodstain, removing blood and altering that stain's appearance; or
- ii) the transfer of blood onto a surface not originally contaminated with blood with a simultaneous or subsequent lateral movement.

Transfer pattern

This type of pattern is sometimes seen and results from a 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.

SCENE VISITS

Biologists from the Centre of Forensic Sciences may attend scenes when a serious bloodshedding incident (such as a homicide) has occurred and if circumstances warrant it. This would usually be as a result of a request by the chief investigator to the Director of the Centre of Forensic Sciences or the Biology Section Head. After consultation with the investigating officers and if it was determined that we could contribute significantly to the case so that potential important evidence would not be inadvertently omitted, we would attend the scene. However, often examinations of carefully taken photographs with accompanying floor plans are sufficient for bloodstain pattern interpretation of scenes.

Following are instructions for photographing bloodstains at scenes. The same information is contained in "Laboratory Aids for the Investigator" (fourth edition, 1984).

PHOTOGRAPHY

1. In cases where bloodstain pattern interpretation may be necessary, all bloodstain patterns which appear to have resulted from a beating, kicking, splashing, wiping, shooting etc., should be photographed in COLOUR, and 20 cm. x 25 cm. (8" x 10") enlargements submitted.
2. All submissions of such photographs should be accompanied by a DIAGRAM of the scene, indicating the location of the individual photographs.
3. All photographs should be taken at 90° (PERPENDICULAR) to the stained surfaces and include METRIC scales.
4. OVERALL photographs of the bloodstained surfaces, such as wall, floor, ceiling etc. should be submitted. These photographs should include a vertical scale extending from a reference point such as the floor, and a horizontal scale extending from another reference point such as the edge of a wall or a door frame (Fig. 1). Seamstress tape measures with large numerals can be used for this purpose.
5. Representative stains and control areas to be collected for subsequent laboratory testing must be identified by circling and labelling before photographing (Fig. 1).
6. CLOSE UP photographs of bloodstained areas should also be submitted. Included in these photographs should be the adjusted horizontal and vertical scales. The scales can be adjusted by moving them so that the horizontal and vertical scales appear in each close up photograph (see Fig. 2). The starting points of these scales should remain at the same reference points used for the overall photograph. In the event the details on the tape measures are not clear enough, a 15 cm. ruler also included in each photograph would be of use.

Cover Photos

Cover photographs, courtesy of Nepean Police Force, show Tom Collins and Wayne Levere as they make physical comparisons. Police work in the City of Nepean is modern and progressive. The Identification Section shows the modern progressive support of Chief Wersch. Identification Canada would like to portray the work of the many identification officers who are members of our Society. Please give some thought to a section/unit project that hopefully would include case work and the research conducted.

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