CASE REPORT

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A Bloodstain Pattern Interpretation in a Homicide Case Involving an Apparent "Stomping"

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ABSTRACT: A New York City homicide case was investigated at the request of the District Attorney's office. The deceased had been violently beaten about the face, neck, and chest area. The bludgeoning left the victim unrecognizable, and produced bloodspatter patterns at the scene that attained heights over nine feet. The suspect claimed that he reacted in self-defense to the victim's attack with a table leg at which point he "knocked him down" and possibly "kicked him a few times." Our investigation was intended to determine whether the bloodspatter patterns observed at the crime scene were consistent with the statements made by the defendant. Conclusions were drawn from an analysis of the crime scene, autopsy photos and report, physical evidence submitted to the laboratory, and reconstruction experimentation performed at the Office of Chief Medical Examiner (OCME). The spatter patterns observed at the scene were found to be consistent with those that would be produced from a "stomping" incident.

KEYWORDS: pathology and biology, criminalistics homicide, bloodstains, pattern interpretation, "stomping"

The evidentiary value of bloodstains found at crime scenes has markedly increased with the advent of DNA technology. In some cases, however, the capability to individualize bloodstains may not be as probative as a determination of the circumstances that caused the blood deposition.

One of the first studies in the area of bloodstain pattern formation was conducted by Balthazard et al. [*1*] in 1939. Their study dealt with the aspects of bloodstains and bloodstain pattern formation and represented a milestone in the area of bloodstain pattern interpretations. They first demonstrated that the ratio of the major and minor axes of a bloodstain could be related to the angle of incidence that a blood droplet impacted on a surface. They also suggested the use of strings in conjunction with the angle of incidence to determine the approximate point of origin of a blood droplet.

In 1967, Kirk [*2*] stated that the dynamics of blood droplets in flight had received little attention. To date, only one group of researchers has examined this aspect of bloodstain pattern formation. In studying the dynamics of blood droplets in flight, Pizzola et al. [*3,4*] demonstrated a correlation between blood droplet impacts on moving target surfaces to that of impacts on inclined stationary surfaces.

A number of studies and publications in bloodstain pattern interpretation have appeared since the early 1970s. Some of the topics covered have been bloodstain patterns on skin [*5*], on cloth [*6*], those resulting from gunshot wounds [*7–9*], and other variables [*10,11*]. A recent work by Carter and Podworney [*12*] used a scientific calculator in a very simplified form of bloodstain spatter analysis.

The following case study is an example of this area of criminalistics. The cited case, although not a complete crime scene reconstruction, undertakes the analysis of selected bloodstain patterns found at the scene in an effort to aid the evaluation of the veracity of the defendant's statement. This New York City homicide case was investigated at the request of the Brooklyn District Attorney's office. The deceased had been violently beaten about the face, neck, and chest area. The bludgeoning left the victim unrecognizable and produced bloodspatter patterns at the scene that attained heights over nine feet. The suspect claimed that he reacted in self-defense to the victim's attack with a table leg at which point he "knocked him down" and possibly "kicked him a few times." Our investigation was intended to determine whether the bloodspatter patterns observed at the crime scene were consistent with the defendant's statements. Several pieces of information concerning the case were examined in order to form a conclusion.

Materials and Methods

Examination of Physical Evidence

An examination of the sneakers found at the scene and the defendant's pants revealed large bloodstained areas present on these items (Figs. 1*a–c* and 2*a–b*). Both bone and tissue were removed from the sneakers (items at arrows "#3" and "#4" in Fig. 1*b* were fibroadipose tissue). Ultraviolet light was used to better visualize the bloodstaining on the defendant's pants (Fig. 2*b*). The majority of bloodstaining on the pants was in the lower leg area near the ankles of both pant legs (arrows in Fig. 2*b*). These stains were fairly large and irregular. A small amount of spatter was noted on the upper portions of each leg although the texture and color of the material made this observation difficult. Genetic marker analysis of this blood indicated that it was consistent with

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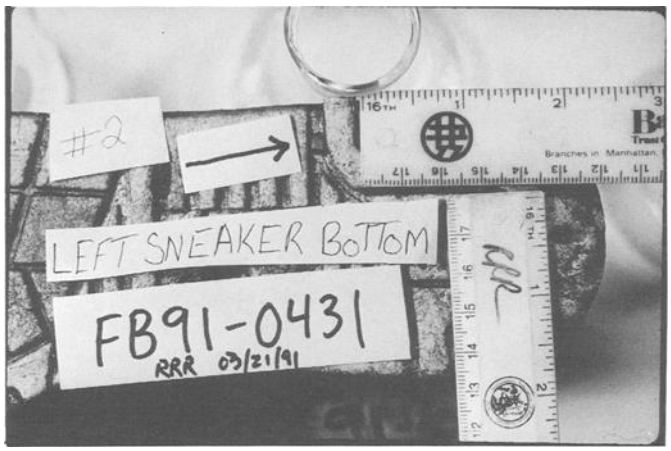

FIG. 1*a*—*The sole of the left white leather sneaker found at scene in kitchen trash can. Arrow points to piece of thin lamellar bone.*

FIG. 1*b*—*The left side of the right sneaker. Arrows point to pieces of fibroadipose tissue.*

FIG. 1*c*—*The right side of the right sneaker. Arrow points to piece of thin lamellar bone.*

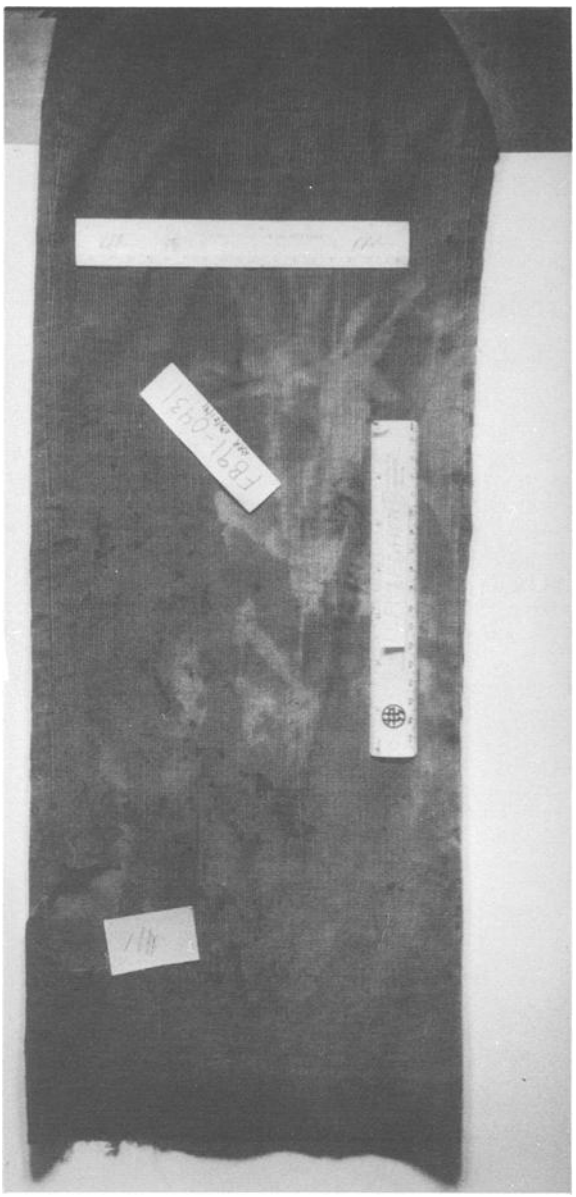

FIG. 2*a*—*The front left leg of defendant's brown corduroy pants.*

that of the deceased. Small pieces of tissue were also noted on the pants but were not examined.

Crime Scene Processing

One month after the initial processing of the crime scene by the NYPD Crime Scene Unit, another examination of the protected crime scene was requested by the Brooklyn District Attorney's office. Blood had been spattered to a height of over 9 feet and to almost 6.5 feet away from the location of the victim's head (Figs. 3*a–b*—*Arrow* in Fig. 3*a*). Six individual bloodspatter stains representative of the overall pattern were analyzed using the string/angle of incidence method to determine their approximate point of origin (Fig. 3*c*). The selected stains were chosen based on their proximity to the location of the victim's head in order that the straight-line approximation assumed in the string/angle of incidence method remained valid.

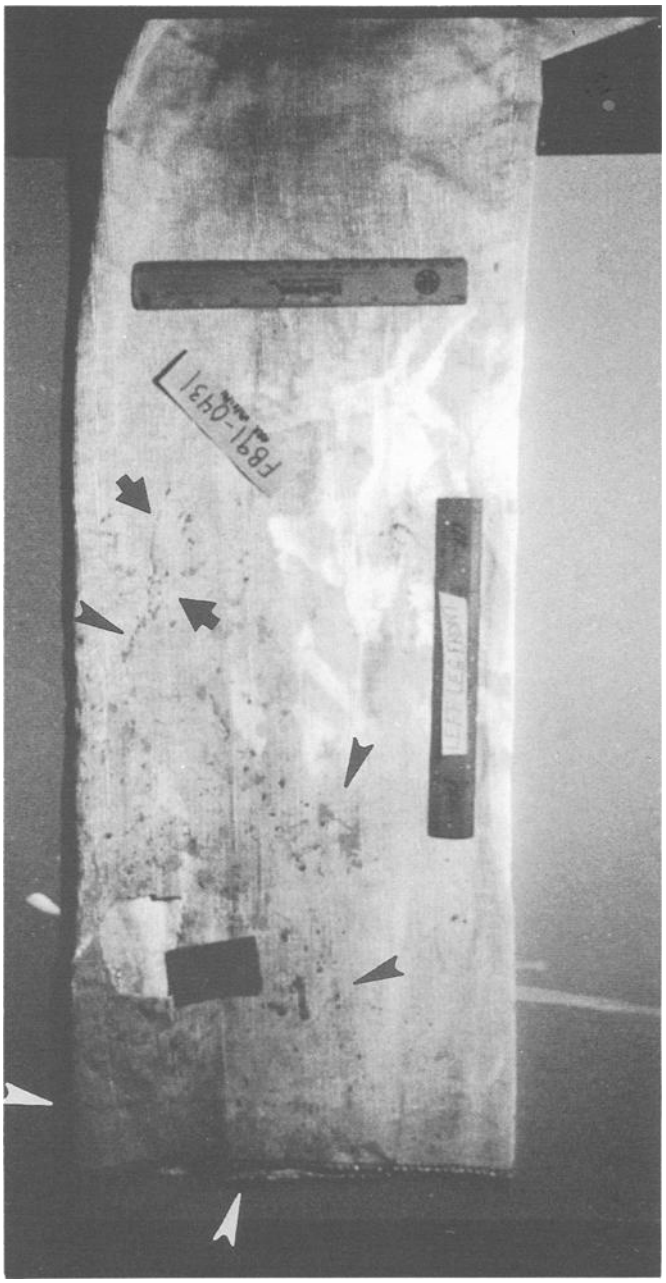

FIG. 2*b*—*The front left leg of defendant's pants photographed under ultraviolet light in order to visualize the bloodstains better.*

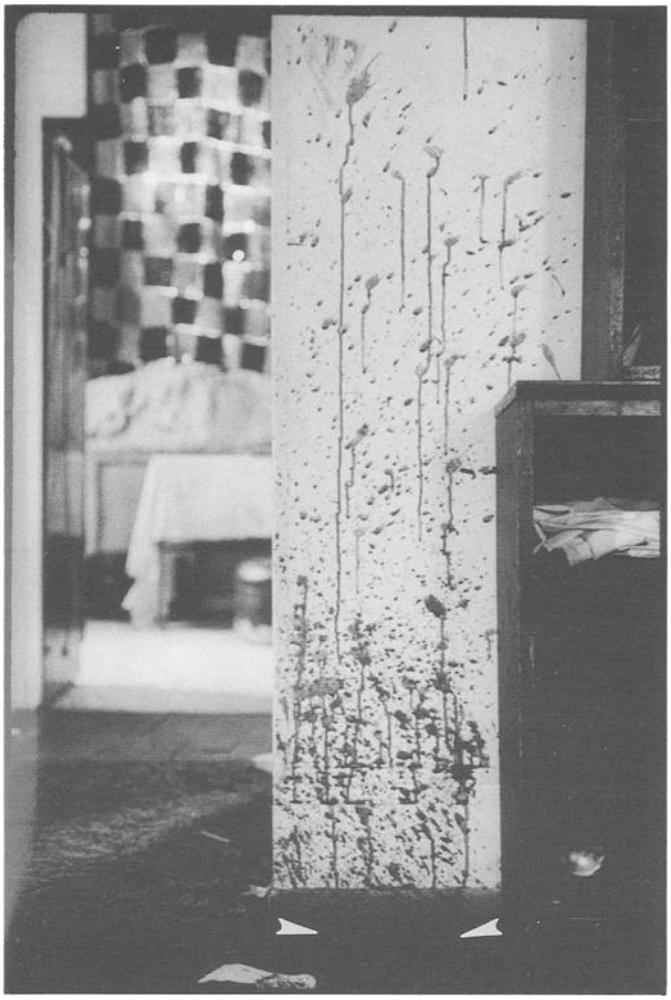

FIG. 3*a*—*Blood spattering on the wall directly behind the deceased's head (to the right of hallway entrance).*

Review of OCME Autopsy Report/Photos

The autopsy report and accompanying photographs were examined (Figs. 4*a–c*). Excerpts from the autopsy report state: "The upper half of the face is caved in . . . Fractures of the frontal bones . . . with exposure of the sinuses . . . fracture of the ethmoid bone . . . both maxilla are fractured . . . two fractures of the hyoid bone . . . fracture of the thyroid cartilage . . . fractures of ribs number 3 to 10 inclusively are noted on the right side . . . fractures of ribs number 6, 8, 9 and 10 are noted on the left side . . . lacerations of lungs, mesentery, eyeballs, soft tissues and muscles . . . on the right side of the chest and in the right flank there are two imprints which appear to be those of soles of shoes . . ." Figure 4*c* shows a series of linear contusions that may have been caused by the sole of a sneaker. The cause of death was simply stated as: "Blunt impact injuries of head, neck and torso."

Review of Crime Scene Unit Report/Photos

The body of the victim at the scene appeared to have footwear patterns in blood on the torso (arrows in Fig. 5). Footwear patterns were also noted on the floor near the victim. The footwear patterns noted on the body and floor resembled the tread patterns of the sneakers found at the crime scene although no measurements were taken to directly compare the impressions with the sneaker treads.

Experimentation

Construction of Mock Scene—The corner of the living room where the victim was found was reconstructed using the measurements taken at the crime scene. A wooden backing was used to support heavy brown packaging paper. The paper served to represent the walls and act as a receiving medium for the spattered blood, however, no attempt was made to duplicate the wall material at the crime scene. The brown paper also served as a floor covering.

Preliminary Experiments—These were conducted in order to ascertain an appropriate experimental model to recreate the "stomp-

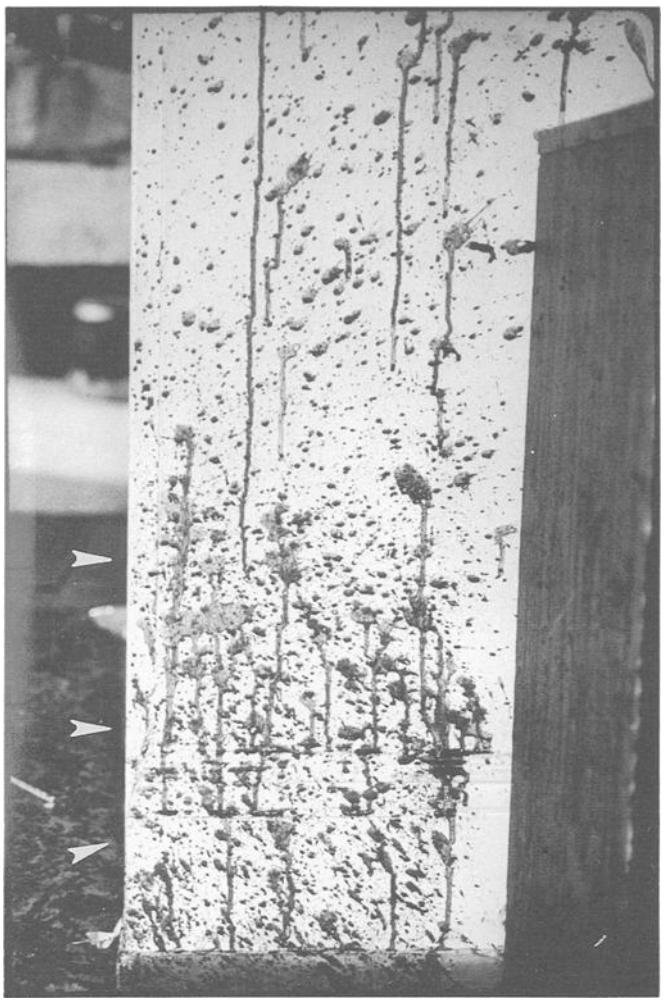

FIG. 3*b*—*Closer view of blood spattering on the wall directly behind the deceased's head.*

FIG. 3*c*—*Illustration of the use of strings at the crime scene to determine the approximate point of origin of a few selected blood spatters.*

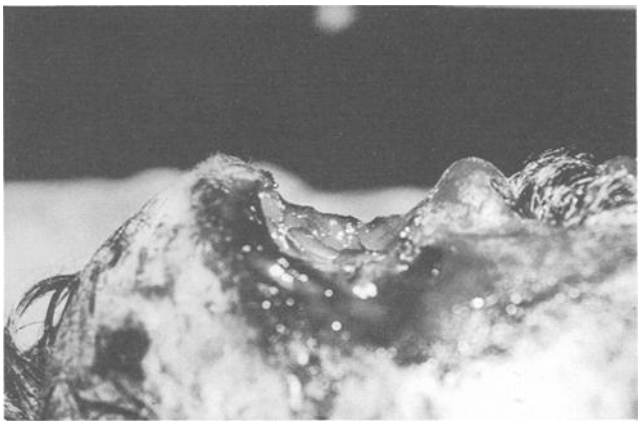

FIG. 4*a*—*Profile view of deceased's head.*

FIG. 4*b*—*Frontal view of deceased's head.*

ing" of a human head. Initially it was desirable to estimate the force required to get blood to spatter to a significant height and distance as observed at the scene, however, this could not be accurately determined. Red masonry bricks were dropped onto a piece of "spongy" styrofoam impregnated with water. The styrofoam did not hold the water uniformly and it sprayed out from the bottom in all directions except upwards. No significant spat-

FIG. 4c—*View of deceased's left arm showing series of regular contusions near shoulder area.*

FIG. 5—*The torso of the deceased at the crime scene. Note the vague footwear pattern on the deceased's chest.*

tering was observed with the "sponge." It was concluded that the sponge was an inappropriate model for a head.

The same bricks were then dropped onto a pile of wet paper towels (approximately 5.5″ by 8″ by 3.5″). Some upwards spatter was noticed but not to any significant extent. It was decided that more force would be needed to obtain the desired spatter. "Stomping" by foot was tried with the wet paper towels. Better spattering was obtained with this approach and human blood-impregnated paper towels were chosen as the model to simulate the action of a shod foot forcibly impacting an object of roughly similar dimensions and consistency as a head, that is, defined for this case as being semi-solid with pooled blood.

Stomping Experiments—HIV and hepatitis-free packed human red blood cells were obtained from a local blood bank. The cells were reconstituted with physiological saline to the approximate unit volume from which they were collected. The blood was allowed to reach ambient temperature before it was used to saturate a pile of paper towels (same dimensions as above). This "head" was then positioned in the mock scene in the approximate position that the victim's head was located. A total of 13 stomps were performed on the paper towels. The position of the "head" was changed once and the position of the "stomper" was changed twice. Although it is impossible to know what movement took place without having been present during the commission of the crime, this movement of "head" and "stomper" was done to simulate movement by either the victim or assailant during the incident.

The use of the bloodstain pattern point of origin determination ascertained from choosing representative stains from patterns occurring on different walls suggest that for the most part, they occurred from a single area. Also, since the stains originated from a single area but were located on at least three different walls suggest that the assailant changed position several times during the stomping. The experimental design incorporated a change in the stomping direction in order to provide access not bloodied by the assailant so that the spattered blood could reach the adjacent walls (Figs. 3*a* and 3*c*).

The following protocol was used:

1) Five stomps were performed in the initial position
2) The position of the "stomper" was changed slightly
3) Two more stomps were performed
4) The position of the "head" was altered slightly
5) Two more stomps were performed
6) The position of the "stomper" was again changed slightly
7) Four more stomps were performed

Results/Conclusions

At the crime scene, bloodstains were chosen for analysis based upon their being representative of overall patterns chosen for analysis. The patterns chosen for analysis were based on the location in the vicinity of the victim. The selection of representative stains from each area were used to ascertain whether the basic pattern originated from a single area. Five of the six selected stains were consistent with originating from the general vicinity in which the victim's head was located based upon crime scene photographs. The sixth appeared to have a different point of origin due possibly to a change in the droplet's velocity, for example, arcing downwards when it struck the wall. Alternatively, it may have originated from an entirely different action other than "stomping," that is, cast off droplet as from a kicking motion, etc.

The spatter droplet analysis used at the scene was also used in the experiment (Fig. 6*a*). The bloodstain patterns produced during the experiment were similar to those present at the crime scene in the immediate vicinity of the deceased's head (See arrows in Fig. 6*b*—compare with arrows in Fig. 3*b*). Although the amount of blood spatter produced in this study was much less than that observed at the crime scene, the overall patterns were similar and the point of origin determination gave similar results (Figs. 3*c* and 6*a*).

FIG. 6*b*—*Blood spattering on the wall directly behind "mock" head.*

Bloodstains found on the pants of the defendant were similar to those found on the pants used in this study, especially in the area of the legs near the ankles (See arrow in Fig. 7—compare with Fig. 2*b*). The stains near the cuffs were large and irregular. Spatter stains were noted on both legs with a very distinct pattern

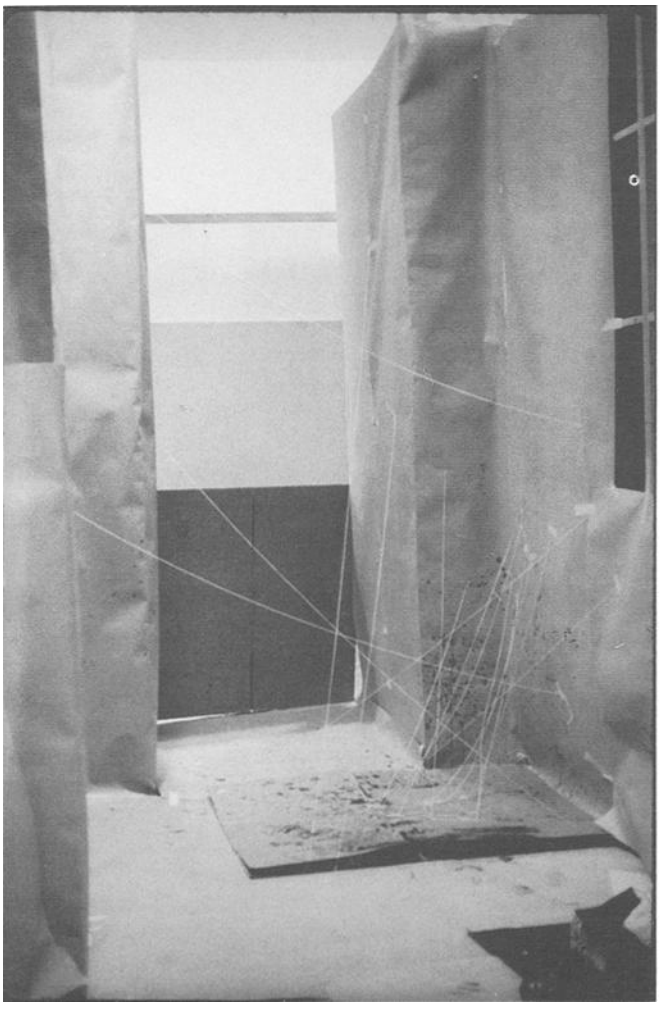

FIG. 6*a*—*Illustration of the use of strings at the mock scene to determine the approximate point of origin selected blood spatters.*

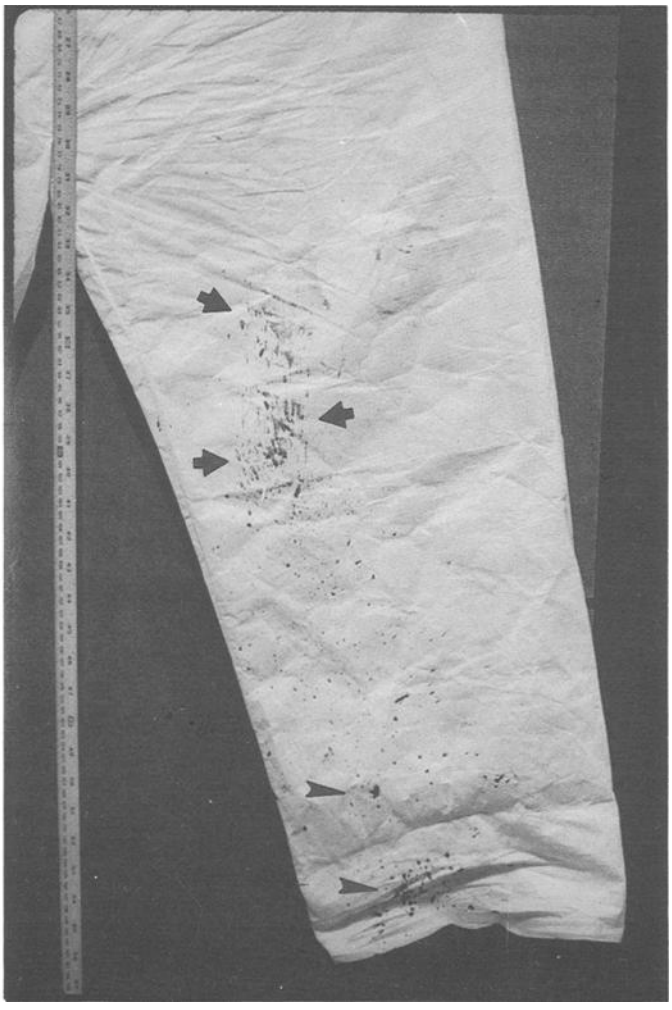

FIG. 7—*The front left leg of the pants worn by "mock" assailant in our study.*

noted on the left leg (Figs. 2*a* and 7—bold arrows in knee areas). The size and direction of these stains on the experimenter's pants were similar to those found on the defendant's pants.

The intent of this study was to show that generally, the largest overall bloodstain pattern present at the crime scene could have resulted from a "stomping." It is not to say that some could not have occurred by kicking. However, for blood to be cast off of a shoe it must first be wet and the expected patterns would not appear like those found at the scene or that were determined experimentally. Based on an examination of all the information available, it was concluded that the bloodstain pattern and spatters of interest observed at the crime scene are consistent with those that would be produced from a "stomping" incident.

The interpretations in this case illustrate one aspect of a crime scene reconstruction and demonstrate that bloodstain patterns can be an extremely valuable source of information if utilized properly. They must, however, be interpreted with caution using a scientific approach, all available case information, and a considerable wealth of prior casework experience.

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