Professor Dina Cirigliano / Plaza College / Forest Hills, New York

Blood Spatter: The History of Analysis

Blood spatter analysis is, at the present time, a well-established subcategory within the field of forensic science. In today's world of innovative technologies and highly-sophisticated equipment, attorneys can rely on the testimony of blood spatter experts in the form of forensic scientists, to make or break their cases. However, this was not always so. Blood splatter analysis was not always in existence, let alone as evolved as it is at the current time. The purpose of this piece is to highlight the major milestones throughout blood splatter analysis' historical timeline, specifically 1) its origin with Dr. Eduard Piotrowski, 2) its breakthrough into the American legal system as accepted scientific proof presented during trial, 3) its popularity among researchers enacting the establishment of the International Association of Bloodstain Pattern Analysts, 4) its introduction of Fred Carter's blood simulation software, and 5) its use of detection Luminol to reveal weaponry used along with the locations of the victim and offender.

"The pioneer of the scientific use of blood stains was Dr. Eduard Piotrowski of the Institute for Forensic Medicine in Krakow, Poland. Piotrowski conducted extensive studies on the distribution of bloodstains relating to head injuries and his work was published in Vienna in 1895." (Rooker, 2017). Dr. Piotrowski's publication was entitled, *Concerning the Origin, Shape, direction, and Distribution of the Bloodstains Following Head Wounds Caused by Blows*. While this medical doctor's methodology would surely end with him being charged with animal abuse in today's American society, this did not pose a problem in 1800's Poland. To conduct his experiments, the doctor "covered the corner of a room with white paper and beat rabbits to death to observe how their blood spattered" (Gupta, 2017). Putting the sociopathic nature of his actions aside, Dr. Piotrowski's research found that blood rarely showed until the second blow to the rabbits' skulls. He also found that when he took measurements of the angles of the splattered bunny blood, he was able to determine his own location as well as the direction he was facing

when the beating of the bunny occurred. Yes, rabbits and humans do indeed differ anatomically in many ways from skull density to skull thickness to blood consistency to blood pressure, but these variables aside, every forensic science subcategory has to start somewhere.

Time marched on, as it always does, and more and more scientific researchers were exploring the world of blood spatter analysis. Sixty-two years after the publishing of Dr. Piotrowski's work, thousands of miles away from where he experimented in Poland, "the Supreme Court of California affirmed that bloodstain pattern analysis is a proper area for expert testimony. The Court qualified Dr. Paul Leland Kirk, a scientist and criminalist, as a qualified expert in the field" (Chambers, 2022). Considering that Dr. Kirk was not only a renowned biochemist and participant in the Manhattan Project, but also a published author of over two-hundred-fifty research articles in academic science journals, his capability was unquestionable and he was the perfect professional to escort blood spatter analysis into the courts of America. It was at that very moment that "California led the country in accepting bloodstain pattern analysis as an acceptable form of evidence in criminal cases" (Chambers, 2022).

Again, time passed, and by 1983 there was such an influx of forensic scientists involved in the study of blood splatter that the International Association of Bloodstain Pattern Analysts (IABPA) was formed as a professional organization. The objectives of the IABPA have remained the same since its inception four decades ago and include the following: "To encourage and promote the science of Bloodstain Pattern Analysis, to standardize the scientific techniques of Bloodstain Pattern Analysis, to promote education and encourage research in the discipline of

Bloodstain Pattern Analysis, and to inform members of the latest techniques, discoveries and developments in Bloodstain Pattern Analysis" (IABPA, 2023). The founding members ranged from county sheriffs, to coroners, to crime laboratory supervisors, to attorneys from county prosecutors' offices, to chiefs of police. Current members are of the same and similar professions. Via IABPA, professionals collaborate and offer updates regarding the identification of blood spatter as passive bloodstains in the form of droplets, flows, and pools, transfer bloodstains in the form of wipes, swipes, footprints, shoeprints, handprints, glove prints, or body drag marks, and impact bloodstains in the form of cast-off or arterial gush (spurt) stains (IABPA, 2023). The IABPS is also responsible for offering forensic science professionals the Continuing Education Units (CEUs) they require in the form of workshops on topics including determining the direction of travel of attacker and victim according to blood spatter, determining the type of weapon used according to blood spatter, determining the category of trauma according to blood spatter, determining the bloodshed event as sharp-force injury, blunt-force injury, or gunshot injury according to blood spatter, and determining the trajectory of a projectile according to blood spatter (IABPA, 2023).

Only six years after the commencement of the IABPA, Dr. Fred Carter in 1989 released state-of-the-art software he had developed for forensic science professional which allowed for blood drop simulation and the ability to calculate the area of origin (Carter, 2001). This software, which he named BackTrack, was considered to be so reliable that not only was it utilized by scientific investigators in research laboratories, but it was also used by expert witnesses testifying in criminal cases to offer jurors, many of whom are visual learners, the concepts that they needed to make a properly informed decision regarding a verdict in many criminal cases.

Today, in the year 2023, BackTrack has advanced into an even more valid and reliable means of demonstrating blood splatter and its qualities. It even served as a foundation for bringing forth other forensic science software like HemoSpat and FARO Zone 3D which offers three-dimensional models of crime scenes containing blood spatter. Today's software is so accurate that it can even simulate the large, individual, arcing bloodstains that are present at crime scenes when blood is forced out of the ruptured vessel during an arterial gush (IABPA, 2023). Just as it is in reality, the software exhibits that with every pump of the victim's heart a new pattern is created.

Blood spatter can only be analyzed if it can be located, and offenders often attempt to clean up blood spatter after committing violent crimes. To combat this problem, Luminol was brought forth into crime scene investigations. Spritzing the whitish-yellow compound, whose chemical make-up is C8H7N3O2, offers a brilliant blue chemiluminescence when united with the iron within the hemoglobin in blood (Heiserman, 1998). It was already established that Luminol is rather nondestructive to the surfaces on which blood has spattered (doesn't cause corrosion or stains) and to the blood itself (doesn't foil succeeding identification tests) (Shakhashiri, 1983). However, in 1990, (only one year after Dr. Carter put forth his trailblazing software) during the very recent birth of millennials, the Federal Bureau of Investigation's Crime Laboratory Digest featured a research article by their very own forensic serologist, Dr. Robert Grispino, on the topic of Luminol. His research showed that with regard to blood origin determination tests, Luminol did not have any recordable effect. Not only did his study show that Luminol does not affect the integrity of the blood, but it also exhibited that Luminol's aerosol "spray application can develop a stain pattern which could be of interest to investigators or could

suggest a mechanism by which the crime took place" (Grispino, 1990). This was in incredible feat for the world of forensic evidence, as blood spatter that was thought to have been washed away, could be chemiluminescently reignited to show spurts, cast off, droplets, and the like. This, in-turn, can lead investigators to identifying the offender's weapon type, as well as the positions of the offender and victim.

Blood spatter analysis has come a long way since its meager beginnings. Experiments that happened one-hundred-twenty-eight years ago involving a man bashing in the skulls of hares in a faraway, Eastern European country has grown into an extremely well-respected field of expertise for forensic scientists on American soil in modern time. It has flourished to the degree that courts of law accept it as evidentiary proof. It has matured to the point of the presence of professional organizations dedicated solely to it. It has ripened technologically to the extent that computerized programs can mimic it. It has developed to the point that blood that has been seemingly washed away can be detected with the mere spritz of a crystalline compound that can reveal patterns of splatter, weaponry, and location of parties involved. Blood spatter analysis has proven to have an ever-growing momentum, and forensic science professionals look forward to what is to come in this particular field of study.

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