Bloodstain Pattern Analysis

Third Edition

With an Introduction to Crime Scene Reconstruction

Tom Bevel
Ross M. Gardner

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Editor's Note

This textbook is part of a series entitled "Practical Aspects of Criminal and Forensic Investigations." This series was created by Vernon J. Geberth, New York City Police Department Lieutenant Commander (Ret.), who is an author, educator, and consultant on homicide and forensic investigations.

This series has been designed to provide contemporary, comprehensive, and pragmatic information to the practitioner involved in criminal and forensic investigations by authors who are nationally recognized experts in their respective fields.

Foreword

Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction Third **Edition** in full-color by Tom Bevel and Ross M. Gardner is long overdue. This completely revised and enhanced edition is a practical and concisely written text. It is the most complete and comprehensive handbook to date from the perspective of the criminal investigator and forensic scientist on the subject of bloodstain spatter analysis.

The authors have provided the reader with an eloquent and practical guide for the analysis of bloodstain patterns and crime scene reconstruction based on many years of practical experience. Their original lab manual published over 24 years ago was entitled *"Bloodstain Pattern Analysis: Theory and Practice."* This manual eventually became the framework for the first edition of ***Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction,*** which challenged some of the subjective interpretation systems of bloodstain pattern assessments.

This new edition is based on a true taxonomy. The future of bloodstain pattern analysis will be based on description. Building on well-established classifications ideas in bloodstain pattern analysis (**BPA**) the authors have refined an objective classification system based on a taxonomic approach. ***Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction*** Third **Edition** is the basis for standardization of blood spatter analysis and establishes the need for universal rules that define this discipline by stressing the underlying scientific basis and how best to objectively apply this knowledge to cases in the field.

Ross Gardner first brought the idea of taxonomy to the attention of the SWGSTAIN GROUP in 2002. Bevel and Gardner introduce a new Chapter 3 to clarify and present a taxonomic classification system, which clearly describes the characteristics of different patterns. A taxonomy is simply a defined set of rules for classification. It establishes criteria against which the analyst can compare the scene stains to. The idea of taxonomy is derived from biology where organisms are classified by shared characteristics. These characteristics create a hierarchical relationship between the various groups. Although other authors have previously provided the hierarchy, Bevel and Gardner are the first to clearly describe the supporting characteristics for that hierarchy.

In addition to elucidating the classification system, the authors have included within the text, a full-color foldout of a Bloodstain Pattern Decision Map, which can be used for ready-reference in reaching a classification decision no matter what classification system they use. They also provide a detailed methodology for bloodstain pattern analysis, which is described in Chapter 4

Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction Third **Edition** provides specific details on Crime Scene Analysis/ Reconstruction in explaining a proven methodology involved in the process. This methodology is built upon scientific method and provides focus and structure to the analyst as they conduct the analysis.

The authors provide an excellent historical perspective to acquaint the reader with the significant chronology of the application of this technique. The authors provide excellent

information on distinguishing crime scene analysis from behavioral analysis and discuss the many considerations involved in the reconstruction of the crime.

Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction **Third Edition** explains the complex mechanics of blood spatter analysis with a new chapter which addresses the medical examiner and the anatomical issues related to bloodstain pattern analysis, which includes a discussion of blood and the circulatory system and the nature of bleeding associated with various traumatic and non-traumatic injuries. Other new chapters include bloodstain pattern analysis associated with clothing and fabric issues as well as a chapter that describes presumptive testing in detail. All of the existing chapters have been revised and updated to address taxonomy.

The most significant improvement in this third edition with the exception of the revised chapters is the inclusion of almost 400 photographs, three hundred and seventy of which are in full-color, which graphically illustrate the dynamics of bloodstain pattern analysis.

The authors bring over 50 years of practical experience to this text especially with their respective backgrounds in actual criminal investigations. Tom Bevel, my friend and colleague for many years, is a retired police captain from Oklahoma City, Oklahoma. Tom Bevel is the owner of TBI, LLC a forensic education and consulting company. He is also an adjunct professor in the Masters of Forensic Science program at the University of Central Oklahoma. Captain Bevel (Ret.) holds a master's degree in Criminal Justice and has extensive training in the area of criminal investigation both in the United States and Europe. Tom Bevel has numerous professional affiliations including; The Association for Crime Scene Reconstruction (ACSR, a distinguished member of the International Association of Bloodstain Pattern Analysts (IABPA), and the American Academy of Forensic Sciences. Tom has acted as a police consultant in over forty-six different states and eleven foreign countries. He has personally participated in more than 3300 criminal investigations in which bloodstain spatter evidence was the issue and has testified in numerous trials as an expert witness.

Ross M. Gardner, served for The United States Army Criminal Investigation Command (USACIDC) for over twenty-four years as a felony criminal investigator, served four years as a chief of police for a small suburban Atlanta police department.

He retired from public service in 2003. He holds a Master's Degree in Computer and Information Resource Management and has extensive training in the area of criminal investigation through the United States Military. He served as an adjunct professor for Central Texas College in the Police Science program. He is also certified as a senior crime scene analyst with the International Association of Identification and has published as a recognized expert in the field of bloodstain pattern analysis. Special Agent (Ret.) Gardner, who now consults in crime scene analysis, bloodstain pattern analysis and crime scene investigation, also has also has numerous professional affiliations.

He is the former president of the Rocky Mountain Association of Bloodstain Pattern Analysts (RMABPA) as well as the Association for Crime Scene Reconstruction (ACSR) and served as chairman of the education committee for both the RMABPA and the International Association of Bloodstain Pattern Analysts (IABPA).

In my textbook *Practical Homicide Investigation: Tactics, Procedures, and Forensic Techniques Fourth Edition,* I point out that; "Solving homicides, especially those without witnesses are extremely more difficult to solve because your main witness, the deceased, is dead. One must develop the ability to "absorb" the crime scene, and be able to read the uncollectible nuances of the event." The classification and analysis of bloodstain patterns

within the crime scene oftentimes provides the investigator with the critical information to reconstruct the crime. Used properly, bloodstain pattern analysis can help establish specific events associated with the crime.

I personally believe that without practical scene experience there is a deficiency in crime scene reconstruction. Seasoned practice necessitates that the practitioner have that ability to "absorb" the crime scene, and be able to read the uncollectible nuances of the event. This is what we refer to as "scene experience" as opposed to a strict "laboratory" mentality. Tom Bevel and Ross Gardner both have this "scene experience" as well as the necessary knowledge to evaluate and apply the scientific methodology to the reconstruction process.

Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction Third Edition is a masterful blend of "Practice and Theory" with practical crime scene knowledge and the application of scientific methodology to the process of crime scene reconstruction. The new edition follows a logical path throughout the text, highlighted with excellent color examples starting with an explanation of what bloodstain pattern analysis is, the terms used, the basic classifications, a methodology for BPA and then a discussion of the various skills utilized in BPA. It is organized in such a manner to allow the reader quick and easy references into specific areas of blood spatter which includes the full-color foldout of the Bloodstain Pattern Decision Map.

Vernon J. Geberth, M.S., M.P.S.
Author of Practical Homicide Investigation
Series Editor

Preface

The goal of forensics and crime scene reconstruction is simply to seek the truth. The analyst has no other agenda. In pursuing this end, we revisit what we hope is a not too distant past and attempt to recreate the events that unfolded. This task is anything but simple and the tools employed are all of the forensic disciplines.

Each area of forensics provides insight and a glimpse back into this past. Each has its place in evaluating the aftermath of crime — the physical evidence. In the most classical sense, the majority of the forensic disciplines provide us knowledge as to the "who" of crime. Fingerprints, serology, and trace and fiber evidence all give us the ability to associate people or objects with a crime scene. Forensic pathology, on the other hand, has always been a primary link to the "what" of crime, providing insight to some of the events that occurred during the incident.

Bloodstain pattern analysis is a discipline that serves a significant role in answering the question of "what" happened. Used properly, bloodstain pattern analysis helps establish specific events associated with violent crimes. In this capacity, bloodstain pattern analysis acts as a critical bridge between classical forensics and crime scene reconstruction.

Although certainly not a young discipline, bloodstain pattern analysis is just beginning to recognize some of the universal rules that define it. We still see aggressive discussions between analysts over what they can or cannot infer from a specific stain. More often than not, these arguments consume our objectivity. These arguments lead us to a darker side of forensics, where subjective analysis reigns. To fight this tendency, our continuing goal must be to understand the discipline, its underlying scientific basis, and how best to objectively apply this knowledge to cases in the field. The investigator's mission is to always illuminate the truth, not shroud it in shadows.

The authors of this book come to you from two distinctly different backgrounds, though both have a high level of experience in "on scene" crime scene evaluation. One is a career civilian law enforcement officer, and the other is a retired criminal investigator for the U.S. Army. Both are nationally and internationally respected in their fields. Two very different roads led them to the same destination. Interestingly enough, those roads crossed outside the city of London, at the Metropolitan Police Detective Training School. There both authors, although several years apart, attended the Scenes of Crimes Officer (SOCO) Course.

The British approach to scenes of crime is, at the very least, one of the most methodical in the world. The SOCO course teaches the students to understand and incorporate all forensic evidence in the evaluation of crime. It places responsibility for understanding the interrelationship of that evidence on none other than a generalist, the crime scene investigator.

Perhaps then it is the SOCO course that serves as the wellspring of the authors' shared passion and belief: conduct crime scene evaluations using a holistic approach. Inherent in this thought is that case resolution is critically dependent upon proper crime scene analysis. However, case resolution is not just a matter of proving someone guilty. The investigator

seeks to establish the truth, no matter what it may be. This demands a consideration of all evidence available, and the correlation of such evidence in an attempt to identify reasons for contradictory results when they happen to occur. Crime scene reconstruction as a discipline offers an avenue to this goal. Crime scene reconstruction (or crime scene analysis) provides proven methodologies that allow objective snapshots of the crime to be established, and in many instances, sequenced. This information, although not defining an absolute truth, is always effective for helping the criminal justice system define its concept of what that "truth" may be.

In the criminal justice system, it is not uncommon to encounter a lawyer who adamantly believes, no matter what the nature of the testimony, that the investigator established in his or her own mind the innocence or guilt of a subject before completing the crime scene evaluation. It appears incomprehensible to counsel that the investigator can take the often subjective information reported and conduct an objective investigation. Such a reaction should not surprise us because the idea of objectivity is relatively foreign to trial law. No matter what the underlying truth, lawyers (both the prosecution and defense) highlight the information that best serves their position, and attempt to diminish or ignore that which works against them. Law professors refer to science as a smorgasbord, where the lawyers can step up to the table and take from science what they want. Anything that looks unappetizing is simply ignored. This is the actual mindset of those who claim criminal investigators are subjective!

The crime scene analyst, however, can ill afford to pursue his or her end with the same mindset. Choosing what evidence one will or will not consider in the analysis is heresy. Unfortunately, that trap is far too easy to fall into.

Within the scene lies the evidence, which, if properly analyzed, provides everyone with an ability to define specific facts and certainly infer others. Based on the totality of this information, it may well be possible to determine the most probable events surrounding the situation. Even if unable to define the overall event, proper analysis still allows for the elimination of certain events, which alone adds clarity.

No single forensic discipline has the potential to provide as much clarity regarding the occurrences at a crime scene as does bloodstain pattern analysis. However, that cannot lead to an expectation that the bloodstain evidence will stand alone. But in the right hands, bloodstain pattern analysis is an extremely effective tool for defining the truth.

Bloodstain pattern analysis and crime scene analysis are not for the casual investigator who intends only to graze the surface, find a quick answer, and move on. The bloodstain pattern analyst is truly one who reconstructs crime scenes. As such, he or she must understand all of the forensic disciplines. The analyst must be able to objectively apply each category of evidence to the situation, inferring as little as possible, but recognizing the whole. In order to accomplish this task the bloodstain pattern analyst must also understand and apply proven crime scene analysis methods. In that fashion, the evidence establishes a knowledge base from which the analyst reaches the "truth."

In this third edition, we have significantly expanded the discussions of both bloodstain pattern analysis and crime scene analysis. Included are proven, practical, detailed methodologies to apply in the field for each discipline. We hope the student and practitioner find this book a single source document that can aid in teaching these disciplines or in maintaining or enhancing the practitioner's skills.

As we stated in previous editions, the business of investigations and forensics is about defining truth as effectively and objectively as possible. In part, the oath of office for a U.S. Army Criminal Investigation Special Agent states: "I shall at all time seek diligently to discover the truth, deterred neither by fear nor prejudice..." We dedicate this newest edition to everyone, analysts and investigators alike, who recognizes and understands the importance of their roles as objective truth seekers.

Acknowledgments

In considering a project of this nature, the effort of the authors alone rarely ensures success. We would like to offer thanks and acknowledgment to the following individuals for their support and efforts:

Our editor, Vernon Geberth, for his continued support over the years and editions.

Phillipe Esperança, for his significant contributions in formulating and refining the decision map explained and presented in Chapter 3. Phillipe's background in entomology, as well as his understanding of bloodstain pattern analysis, were instrumental in our efforts to build a functional decision map.

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Please note. Solely for the purpose of readability, we used male references throughout the book. In no way should this be construed by the reader as ignoring the many female analysts in our profession.

Introduction

Bloodstain pattern analysis and crime scene reconstruction are distinct forensic disciplines. Bloodstain pattern analysis seeks to define "what" caused the bloodstains in the scene. In pursuing this end, the bloodstain pattern analysts cannot help but reconstruct crime. Crime scene reconstruction, also referred to as crime scene analysis, seeks to establish all of the actions associated with the crime or incident in question and, when possible, to order those actions. Thus, crime scene reconstruction is concerned with the "what" of crime as well.

The purposes of both disciplines are so intertwined that it is often difficult to see a distinction between them and, as we will see, the two disciplines share clearly common threads and methodologies.

Crime scene reconstruction demands that we evaluate all physical evidence to derive some conclusion as to what occurred. As Geberth reminds us, for homicide investigations, case resolution hinges on *"careful and intelligent* [italics added] examination of the scene."[1] Much as a reporter does, the criminal investigator attempts to define the who, what, when, where, how, and why of a crime to assist in understanding what really happened. There is an unfortunate problem associated with this process: there is no standard by which we can test our ultimate conclusions. An archaeologist once made an analogy about this difficulty — discussing a dig and the conclusions drawn from it, he said, "It's something like putting together a jigsaw puzzle without having access to the box. You really don't know what the picture is supposed to look like."[2]

The crime scene investigator shares the archeologist's dilemma, because the investigator's box top is not available either. Despite this limitation, crime scene analysis attempts to define the nature of actions that are so dynamic that even if we had a videotape of the incident, they might not be fully understood. It should not be surprising that we share in the archeologist's dilemma, for, as we will explain, archeology and crime scene analysis also share common purposes and methodologies. We will call upon some of the established principles of archeology to help define crime scene reconstruction methodologies.

The crime scene analyst's primary goal is to identify those actions that make up the crime or incident being evaluated, as well as the order of those events. Thus, identifying specific actions associated with the crime, i.e., the "what" of a crime, is of significant concern.

In their most classic use, the majority of forensic disciplines provide the investigator with information regarding the "who" of the crime. Blood typing, DNA evaluations, fingerprint evidence, and hair examinations help us decide who was or was not present at the scene. In this concept of who, we also include areas such as forensic chemistry, biology, geology, and trace evidence examinations, as they help associate items with our players and with the scene. This, too, ultimately serves the function of defining the "who" of the reconstruction.

Our answers to "what," the actions that occurred during the crime, are sought quite often through the application of forensic pathology. As Dr. James Luke stated, "From the standpoint of forensic pathology, the two major parameters that form the basis of any case investigation are (1) identification and documentation of the postmortem findings present, and (2) interpretation of those findings in the context of the circumstances of death."[3]

In the past few decades, the discipline of bloodstain pattern analysis has reawakened to its role in documenting these circumstances. Bloodstain analysis brings to the investigation the ability to define those events which could or could not have occurred during the course of bloodshed. Once identified, these facts are considered in light of all other evidence as a means of corroborating or refuting statements, confessions, or investigative theories.

Bloodstain pattern analysis in many ways mirrors the role of forensic pathology. Once again quoting Dr. Luke, "It is the responsibility of the forensic pathologist finally to construct a scaffolding of factual information against which witnesses' and suspects' statements can be evaluated."[4] Bloodstain evidence in this role (acting as a scaffolding or part of the lattice) cannot stand apart from other evidence.[5] Reconstruction demands that we consider all evidence. Viewed from a holistic approach, all the evidence available should preferably lead those who view it to a similar conclusion.

This concept of a generally agreed-upon conclusion should not be a foreign thought, particularly when considering bloodstain patterns. They are, after all, graphically oriented. For example, in describing a pattern transfer as "consistent with" something, any analyst should be able to point to some physical characteristic of the stain and then to the correlating item that created it. The analyst should then be able to create some generalized reproduction of the pattern using the item. Having done so, another analyst cannot simply ignore this information. Granted, we may discover a secondary method of stain creation, but this simply adds a responsibility to discover which of the two represents the best explanation. If a stain is observable and reproducible, it is difficult for two analysts to rationally argue their beliefs from mutually exclusive positions. When this occurs, it is very likely the result of subjective analysis on the part of one or both. Unfortunately, subjective analysis in both bloodstain pattern and crime scene analysis is a fact of life. To help preclude subjectivity, the analyst should attempt to achieve several things.

First, the analyst must understand all areas of forensic science and have been directly exposed to crime scenes. Tom Griffin of the Colorado Bureau of Investigation often remarks that analysts need a "scene sense." This sense gives the analyst a more rounded perception, taking into consideration the many subtleties and interrelationships found at scenes. Evidence viewed from the confines of a white-walled laboratory is far too sterile. It leaves the viewer lacking a realistic perspective of crimes and crime scenes. It is this perspective that makes up "scene sense." As the SOCO course at the Hendon Detective Training School teaches, we gain much from viewing evidence *in situ*. This is true not only from a case perspective, but also for the long-term development of the investigator.

Do not construe the necessity for understanding these disciplines as meaning the analyst is an expert in all of them. Far from it, crime scene analysts are generalists. They have, much like a manager, the knowledge to take the experience and expertise of the other team members and put them all together. This process is at the heart of crime scene reconstruction.

Second, analysts must understand their discipline. Bloodstain pattern analysis in particular is far from being a static field. Our understanding changes every day due to research efforts. But as we base bloodstain pattern analysis on the application of physical laws on blood, there are certain universal rules we can apply. These rules are as true today as they were when first observed.

In the third edition, we have introduced three significant additions to bloodstain pattern analysis. First, we have presented a true taxonomic bloodstain pattern classification system in which the criteria that the analyst should judge a bloodstain are written out and (hopefully) clear. With the assistance of Phillipe Esperanza, we have also included a decision