

Practical Shooting Scene Investigation

*The Investigation and Reconstruction
of Crime Scenes Involving Gunfire*

by

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Preface

This book is for crime scene investigators who work shooting cases. It is not for detectives, whose job it is to interview witnesses and interrogate suspects. It is not for police officers, whose job it is to keep the peace, maintain order, arrest criminals, and secure crime scenes. It is not for attorneys (prosecution or defense) whose job it is to persuade a jury that their position is the right one, whether or not it actually is. It is a book for the crime scene investigator, whose job it is to record and collect evidence and generally figure out what happened at the scenes of shootings. Detectives, cops, and lawyers could learn a thing or two from this book, but it is not *for* them.

As in all criminal cases, the really important work takes place in the first few hours. Years later, attorneys argue about what the crime scene investigator did in those first moments, whether everything was done, if it was done right, and what might have been done differently. Judges have to hear motions and render opinions about routine crime scene photos. Jurors, many of whom have never been touched by crime, gape and squirm as they look at pictures that are nothing more than standard practice for the crime scene investigator. A crime scene processed carelessly or improperly has far-reaching effects, both in crippling a criminal case and in falsely implicating innocent persons.

As any crime scene investigator knows well, everyone is an expert. Every lawyer, every supervisor, and every private citizen who ever watched a cops'n'robbers movie or television show or ever read a paperback mystery

knows exactly how crime scene work should be done . . . and they will tell anyone who will listen their personal opinion about their vast knowledge of the field. Crime lab people, many of whom do nothing more than open evidence envelopes, operate microscopes or chromatographs, and type reports, have very definite opinions about how crime scene people should behave. Professors of forensic science, some of whom have never been any closer to a bloodstain than their last nose bleed, will talk (and write) at length about how crime scene investigation should be run. As any crime scene investigator knows, the only people who seem to know nothing whatsoever about crime scene work are the police administrators who are supposed to provide the budget, personnel, and training for crime scene investigation.

This text was written in the United States by an American (*North* American), but I trust that other investigators will find it helpful. I know I have found a great deal of useful information on the subject of shooting investigation from authors in India, Germany, and Britain. I know that investigators in Scotland and Canada have utilized some of my research. I have found that the British spend a lot of time on gunshot residue analysis, the Israelis reenact and videotape shooting crimes, the Canadians spent a lot of time on poaching cases, and the Japanese experience fewer shootings annually in their nation than do most U.S. cities. While America has tried to shed its cowboy image and its gangster history, we remain the gunfight capital of the world. Investigators from other countries don't encounter in a lifetime the number of shooting cases that most American crime scene people work in a single summer. Most of what we all know about shooting investigation and reconstruction naturally (and unfortunately) comes from the United States. So it is with this book and its author. I hope the international readership will forgive the occasional "Americanism" in my words and the references to the peculiarities of the American legal and criminal justice systems.

This book is designed and intended as a very nuts and bolts practical guide to crime scene investigations involving shootings. It is not meant to cover the subjects of gunshot wounds, bloodstain analysis, general homicide investigation, crime laboratory procedure, or interview and interrogation techniques. It is a street guide. And I hope you find it useful.

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Introduction

The on-scene investigation of events and the reconstruction of those events almost always happen together. That is to say, reconstruction is a function of crime scene work. It is not laboratory work. At times, one needs to call out experts from the crime lab to come to the scene to figure out an event, but then they become crime scene people doing crime scene work. The term *reconstruction* has a mysterious ring to it, but all it really involves is the use of sound scientific thinking to figure out how an event occurred. Shooting reconstruction is a crime scene function, just like bloodstain analysis and traffic accident reconstruction. Only an idiot or an imposter would think of trying to reconstruct a shooting, an accident, or a crime without visiting the scene. Shooting investigation and reconstruction is often rightly associated with the firearm or “ballistics” sections of crime laboratories, although a person permanently buried in the depths of a crime lab, doing “bench work,” seldom has much time for real, everyday crime scene work.

Within the discipline of criminalistics there are three somewhat indistinct and kindred categories involving firearms. The first involves the function, safety, and mechanical operation of guns, or what might be called “firearms engineering.” The second is firearms identification, which is the determination that a particular

firearm did or did not fire a particular bullet or cartridge case. The third is shooting reconstruction, that part of crime scene reconstruction involving the examination of the circumstances and physical evidence from the scene of a shooting to ascertain how the incident occurred.

Back in 1970, Steve Molnar, Jr. of the Ohio State Bureau of Criminal Investigation wrote in the *Association of Firearm and Tool Mark Examiners Journal*:

“...we find ourselves being drawn into areas of firearms expertise that are removed from the microscopic comparisons of bullets and cartridge cases...like the function of the firearm, possibility of malfunctions, distance and angle of shots, where was the gun when it was fired, velocity of bullets, ricochets, etc. Even the police may question a version of a shooting.”

Barry Fisher’s *Techniques of Crime Scene Investigation* puts it this way:

“...the investigation should decide whether the statements of the criminal are consistent. In the first statement, a criminal often makes consciously incorrect statements about personal actions in order to create extenuating circumstances. Those who investigate the scene of a crime have an opportunity to produce such an accurate reconstruction of the actual course of events that such an attempt by the criminal cannot succeed.”

This then is essentially the realm of shooting investigation and reconstruction. It sometimes utilizes information about a weapon’s mechanical functioning or lab reports about which ammunition was fired in which weapons, but shooting reconstruction generally relies on physical evidence in the form of trajectory, deflection, penetration, ricochet; the interaction of a projectile with walls, vehicles, windows, or flesh; and is often dependent on the position, location, and condition of items within the shooting *scene*. It has also been termed “projectile trajectory pattern” reconstruction [see *Lee, Henry* in the **Bibliography**].

Information about firearms design and function is available in countless history books, magazines, owner's manuals, and gunsmithing texts. Information about firearms identification can be found in a few renowned texts (*Hatcher, Burrard*, etc.) and, of course, years of *Journals* from the Association of Firearm and Toolmark Examiners. However, shooting reconstruction as a category appears here and there in various criminalistics texts, technical articles, and non-fiction books about specific criminal cases. With that in mind, this book addresses the particular realm of on-scene shooting investigation and reconstruction.

As it turns out, if one processes a shooting scene properly, the shooting reconstruction can be done at a later time by others. Let's say that Evidence Technician Jack is a good technician, who has an interest in fingerprint evidence or bloodstain evidence, but is not particularly interested in shooting investigation. If Jack were to work a shooting scene and process the evidence according to the methods outlined in this book, someone else, Jill from the crime lab, for instance, with more interest and more knowledge in shooting investigation could take Jack's crime scene photographs, measurements, and evidence and, after visiting the actual crime scene, could conduct a shooting reconstruction. This, of course, assumes that there was a sufficient amount of physical evidence in the beginning to reconstruct the event. Jill might have all the interest in the world, but if the killer shot the victim in a thunder storm, which washed the blood away, and he used a revolver that didn't eject a case, and the bullet caused a through-and-through wound and was never found, because the victim ran to another location after the shooting, and the whole scene was overrun by a huge crowd of onlookers, none of whom saw anything. . . well there's not much that either Jack or Jill could do scene-wise. It would be up to Mutt, the medical examiner, to determine a bullet path through the victim's body, and Jeff, the detective, to locate the victim's estranged wife or the drug dealer he owed money or his current

girlfriend's ex-husband (or some variation). . .and hope for a tearful confession or, at least, a damaging admission. But, scene-wise, there is not much to reconstruct.

Conversely, if Evidence Tech Jack is a lazy goof and screws up the scene work all by himself, there's not going to be much that anyone can reconstruct anyway. This book assumes that the reader is already well grounded in the proper processing of crime scenes. [It is suggested that the reader should already have read Fisher's *Techniques of Crime Scene Investigation*, Geberth's *Practical Homicide Investigation*, and Osterberg & Ward's *Criminal Investigation: A Method for Reconstructing the Past*.] It is also assumed that the reader possesses enough interest and enthusiasm to recognize that this book is neither the beginning nor the end of his or her education on the subject. The truly interested reader should explore the bibliography at the back of this book.

* * *

Chapter One

Some Basic Terms and Pitfalls of Shooting Scene Work

The Words We Use

In the movies, they're called "slugs," but in real life they are called *bullets* or *projectiles*. The terms "bullet hole" and "ricochet" don't mean much once you leave the theatre and enter the courtroom. Human beings are not "winged" by bullets; they are *wounded*. The word "gun" doesn't mean much in a world of *derringers*, *revolvers*, *pump-action shotguns*, *semiautomatic pistols*, *submachine guns*, *assault rifles*, *anti-tank weapons*, and *deck cannon*. Part of overcoming the pre-conceived notions and outright myths that jurors typically bring with them into the courtroom is the language of shooting investigation. One needs to teach the attorneys, the judge, and jury the right terms for things. This does not mean that one should befuddle the trial record with overly technical jargon, which leaves the court reporter searching dictionaries and jurors scratching their heads. But one must speak accurately and clearly. And much of this involves using the proper terms.

A bullet flying through a window has *perforated* that window, not “penetrated” it. A bullet entering a wall has *penetrated* that wall and may have *perforated* a mirror on the wall. The difference between penetration (going *into* something) and perforation (going *through* something) is important. (I have heard it explained this way: “In romance, if you’re doing it right, no one gets *perforated*.”) The aforementioned wall is called a *target* (an object struck by a projectile), which in no way means that anyone really meant to hit that target, only that it was hit. If the wall is the last object struck, it might be called a *terminus* (the place where the bullet ends up) or can be termed a “final target.” The aforementioned mirror on this wall was struck by the bullet’s passage, so it is technically a “target,” but more precisely, it is an *intermediate target*. If the bullet path (which is not called a “trajectory”) lines up between the perforation of the window, the secondary perforation of the mirror, and the penetration of the wall, these marks, holes, and traces can be called *corresponding defects*; that is, they all appear to be the result of a single bullet’s path. If they cannot be aligned, they are just *defects*, and might be from separate shots. The hole on the outside of the window, where the bullet entered the glass, can be called an *in-shoot* or *entrance defect*, if one wants to discuss the differences between the small exterior in-shoot and the large interior *out-shoot* or *exit defect*. The elongated hole in the mirror that tells us the bullet had already started tumbling in flight from its encounter with the window is called a *keyhole* defect.

If the bullet is protruding from the wall, it is said to be *embedded* (or *imbedded*) in the wall. If the bullet penetrates the wall and knocks plaster off the opposite side without going through, it is said to have *spalled* the wall. If the bullet strikes the edge of a lamp on its way from the window to the wall, it may leave a *deflection defect*, such as a *skip* or *skid* (brief shallow marks), a *furrow* or *trench* (longer deeper marks), or *chunk-out* (where a piece of the lamp flies away). If that little piece of lamp, now called a

secondary projectile, were to strike a nearby candle and leave a mark on it, the mark on the candle could be called a *secondary projectile defect*. This is only important if someone else has confused the defect on the candle with the direct bullet path; then one explains to them, “No, that is not a bullet defect, it is a secondary projectile defect.” Many times these fine distinctions are only important (as was the case with the in-shoot and out-shoot on the window) when someone misunderstands or misinterprets the evidence. Someone may notice that the bulb on the aforementioned lamp is broken. The investigator examines the lamp and can see that the bulb was not broken by a direct strike of the bullet but by the bullet’s strike to the lamp; he knows that the bulb was cracked indirectly by what is called a *sympathetic fracture*. The most common site for sympathetic fractures (and it often leads novices astray) is a window frame or storm door. There is a defect on the window frame and the nearby glass is broken through sympathetic fracture, but the inexperienced observer attributes the broken glass to a second projectile.

If the bullet is recovered from the wall all in one piece, it is *intact*. If the bullet’s shape indicates some damage from its travels, it is *deformed*. If it is smashed all out of shape, one could call it *greatly deformed*. If a piece of the bullet is found on the floor, the piece is a *bullet fragment* or *jacket fragment* (in the case of stripped off bullet jackets). And jacket fragments should not gratuitously be termed “copper jackets.” If one finds a very small piece of some shiny metal at the scene of a shooting, but cannot tell if it’s a bullet part, the piece should be called a *metal* (or *metallic*) *fragment* (and let the crime lab figure it out). This is especially important in a scene where the fragment could be a tiny shaving from a lead bullet, a piece from an air-gun pellet, or a deformed piece of shotshell pellet.

Outside the shot-up house, one finds an ejected *cartridge case* or *casing*; the phrase “shell casing” is redundant but popular. The best description of the cartridge

case, in addition to the headstamp markings of caliber and manufacturer, is to call it “fired,” as opposed to “spent.” Some people mistakenly refer to fired bullets as “spent bullets,” when in fact a *spent* bullet is one that has lost all of its energy (i.e., fallen harmlessly to the ground). So it is better to go with “fired” and just leave the “spending” out of it.

In all of this language business, it is important to teach the attorneys (for both sides) what things are called and not called. It helps everyone involved if the lawyers stop referring to pistols as “revolvers” and pistol magazines as “clips” and cartridges as “bullets” and deflection sites as “ricochets” and sympathetic fractures from secondary projectiles as “four more bullet holes.” If the attorneys can’t comprehend the terminology well enough to formulate a question, how can we expect jurors to follow the testimony?

Pitfalls and Pratfalls for the Unwary

Several recurring problems (myths, gremlins, what have you) hound the crime scene investigator at a shooting scene. Some of these problems, gunshot sounds for example, come from the incident’s witnesses and participants. Other problems, such as bullet hole size information, come from the preconceived notions of police officers. Sometimes our own preconceived notions can get in the way of an effective investigation, just like the preconceived notions of jurors (from television, movies, or something Uncle Ralph once told them) can hinder their understanding of the evidence.

Gunfire Sound Information

One evening, after dark, the police are dispatched to a complaint of a shotgun being fired. A second caller reports shots being fired from a moving car. A third caller reports something “that sounds like a car backfiring.” A police

officer in a patrol car hears some of the shots north of the location. Another officer reports that the shots “sound more like .22s” and are coming from west of the initial complaint call. A police sergeant reports that he is behind the car doing the shooting. Other officers race to the scene. A felony stop is made on the suspect vehicle. With the driver out of the vehicle and handcuffed, the officers search the car. No weapons are found. Once things are calmed down, the suspect shows the officers how his engine backfires when the engine is revved. The officers relax a little; it’s only a backfiring car. During the demonstration, a neighbor calls to report police officers in the street having a gun battle.

In the above example, only the third caller, who reported sounds “like a car backfiring,” was correct. Everyone else jumped to conclusions. For the officers, these sorts of reports should be taken seriously for their own safety. However, depending on the neighborhood and its history of gunfire, some people will report gunfire “that sounds like a car backfiring,” some people will report a car backfiring “that sounds like gun shots,” and some will report “machinegun fire down the street.” It’s really a crapshoot, the variety of reports one gets in regard to gunshot sound. It’s important to notice that police officers are only slightly better than your average Joe when it comes to identifying and interpreting such sound.

If one gets 27 neighbors all reporting one gunshot, it is probably a single shot. If two or more shots are fired, the likelihood of 27 or even seven neighbors reporting the number correctly is next to impossible. Some hear one and others hear twelve. Sometimes a neighbor sleeps through the first three shots, wakes up during the next two shots, hears only the sixth shot, and calls the police, reporting that he “heard a shot.” People, especially children, sleep through gunfire all the time. Some people, while reporting they “didn’t hear nothin,” simply mean they are not going to tell *you* what they heard. Other people, desperately seeking attention and involvement in the police investigation, will

conjure up all sorts of useless sound misinformation. Young officers will sometimes do this, thinking about what they heard, processing that information along with the reports of others, and telling you what the results of what they think they heard, rather than what actually entered their ears. Consider the fact that experience police officers involved in gunfights, either as bystanders or shooters or intended targets, very, very often have wrong information when it comes to the actual number of shots fired. They're right at the scene; they have experience with guns and gunfire; they may even be in sight of the muzzle flashes. Yet they still get in wrong.

Some witnesses (and this includes some cops) will report the quality of a gunshot sound. A frequent scenario is an ear-witness who says something like, "I was in the Army, and I know what I heard was an automatic." People will say they *heard* a shotgun, and they *know* it was a shotgun sound, because they *own* a shotgun. Persons who are familiar with guns and gunshot sounds are sometimes helpful ear-witnesses, but are often as confused as anyone else; they just won't admit readily admit it. Some people will say they "heard a .38" or they "heard a nine (millimeter)," when they don't really mean actually weapon calibers; it's just their way of vaguely referring to handgun shots in general. People in violence-plagued neighborhoods will hear shots and say they "heard an AK-47" (assault rifle), while people in rural areas might report the same shots by saying that they "heard a .30-30." People bring their own histories and biases to bear on their ears in a shooting.

One thing that ear-witnesses seem to get right is the distinction between two very different weapons in a gunfight. They will report, "I heard pop, pop, pop, and then a boom." This could be the result of a shooter moving closer to their listening post or swinging the weapon in their direction or may involve two shots fired inside a vehicle with a third shot outside; but when one gets "pop and boom" reports from different ear-witnesses in different locations,

one should take note. The same can be said of reports wherein witnesses note a pause between several shots. They say, “I heard two and then nothing and then three more” or “I heard a bang and then a pause and then a two pops.” When multiple ear-witnesses are reporting a pause, it’s worth remembering.

Reports of the direction from which gunfire came can confuse an investigation. A neighbor can say that “It was right outside my house; I heard the window rattle,” while a homeowner down the block reports the same thing. Anyone who has stood on a street corner in a busy downtown intersection, listening to an approaching ambulance siren and trying to guess where it’s coming from and where it’s going, has seen that sounds and their echoes can be confusing. Imagine trying to make an estimate of direction with gunfire, where there is no sustained sound information (as with the siren example), but simply one quick shot. Because closer shots sound louder, people will report that louder shots occurred closer. How many times have police officers responded to sound of shots fired “down by the corner” only to look around and find nothing? They leave, write their reports, and get called back to a “man down with gunshot wound” a block and a half away. The direction of gunfire sound and its proximity are, at best, approximations. One should try to find the old lady witness who just happened to look out her window and see the muzzle flashes.

Bullet Defect Size

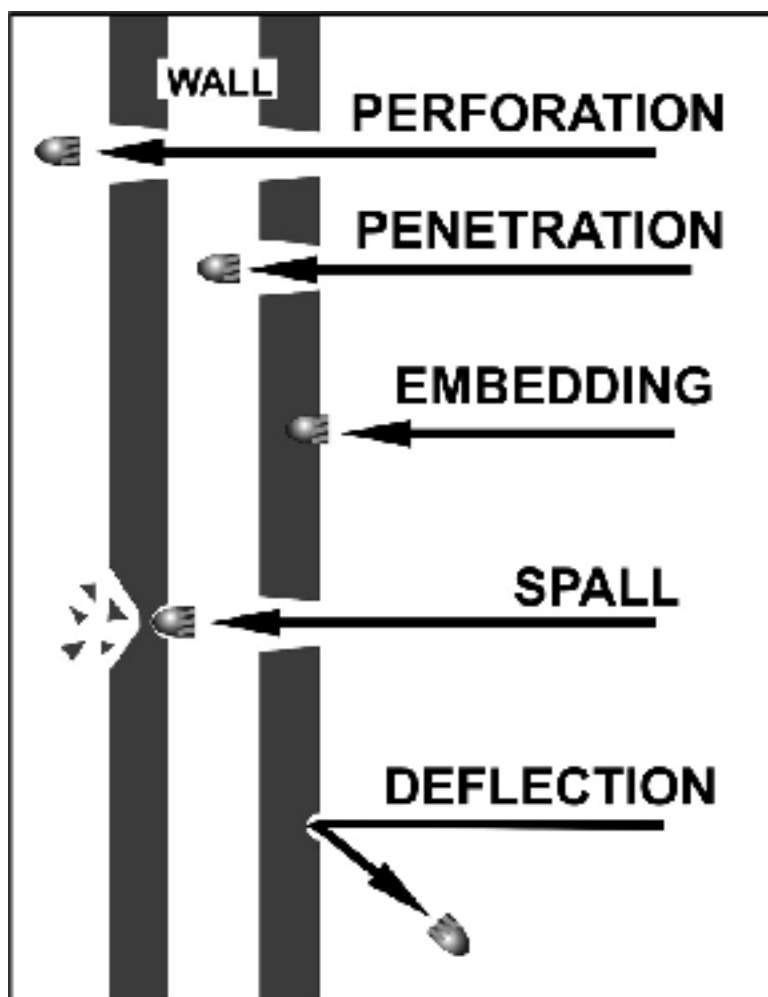
The size of a mark that a projectile leaves on an object is related to the material the object is made of, the shape and size of the projectile and the material it is made of, and the velocity of the projectile (which itself is a function of a cartridge’s loading, the length of the weapon’s barrel, the distance between the weapon and the object struck), and a slew of other weird things like paint surfaces, wood density, soft body tissue, intermediate targets, glass tempering,

ammunition manufacture variations, and so on. Everybody, of course, is an expert when it comes to saying that such and such a hole was probably made by such and such a caliber bullet. With no other reliable crime scene information, bullet defect size simply doesn't matter much. Little tiny round holes are hardly ever made by shotgun slugs. Giant round holes are hardly ever made by BBs. And neither tiny nor giant round holes are made by throwing a boot. Alone, the information is, at best, material for estimation. This does not mean that scale photos and measurements should be neglected; such photos, accompanied by the location of casings, other projectiles, and a shooting victim, all make useful evidence. But one must be wary of the person who states a caliber of projectile that made a given bullet defect (based on size alone).

Ejection Patterns

Automatic and semiautomatic and pump-action weapons eject fired cartridge cases in different ways (left, right, front, rear, near, or far), depending on the weapon, the ammunition, the surface that the casing falls upon, the number of cops who have walked on the casings with their shoes, and apparently where the firearm decides to kick out a casing at that particular moment. Many weapons will eject thirty casings to the right but spill out the thirty-first one to the front. Some casings land nearby, while some roll away. Things get moved at crime scenes. Again, like bullet hole size information, ejection patterns are only for rough estimates. One should beware of a person who will state a shooter's position based on one or two ejected cartridge cases. Shootings inside cramped quarters, like crowded rooms, stairwells, and vehicle interiors, make ejection pattern data unreliable.

* * *



Chapter Two

Photographing the Shooting Scene

The proper recording of the condition, position, and location of bullet defects at crime scenes is essential to shooting reconstruction and subsequent courtroom proceedings. There is perhaps nothing quite as frustrating (and yet so common) as crime scene photographs that do not adequately document bullet defects. Either by lack of detail, lack of scale, or lack of reference, many shooting scene photographs are rendered useless to investigators and triers of fact.

Detail Photographs of the Bullet Hole's Condition

As we know from our study of research by Rathman¹ and Jordan et al², the bullet hole, whether it be a penetration or deflection defect, can tell us a lot about how it was made. More importantly, the bullet defect can often show us how it was ***not*** made, and criminal cases sometimes turn on such information.

A bullet hole demands as much photographic attention as a single hair or partial shoeprint at a crime scene. The same principles of multiple photos, angled lighting, and exposure bracketing apply. Bullet defects on items that you are *not* collecting as evidence should be photographed with the same care as a footwear impression. As with other three-dimensional impressions, a bullet defect has depth and, especially with ricochet sites, can reveal much about direction and incident angle. If the crime scene investigators follow the impression photography directions in footwear examination texts³ or tire impression evidence texts⁴, they should emerge from the scene with bullet hole photos that actually show meaningful detail. Color film recording of impression evidence is often not considered important; bullet hole photography, however, should have a color rendering, so that lead wipe, transfer evidence, and distinctions between paint layers on objects are not lost. An appropriate scale is, of course, critical to the photography of any bullet defect.

1.) Take close-up photos with film plane parallel to the struck surface.

2.) Take multiple exposures with oblique lighting at several angles.

3.) Use color film and a scale.

Photographs of the Bullet Hole's Position

Position is different from location. A dead man lying on the living room floor and the woman standing over him are in the same location but in different positions. The bullet holes in a closed door fired from the outside and the holes in the door made by bullets fired from the inside are in the same location but in different positions. While the close-up photograph of a bullet hole in a wall gives us detail, it appears on the final print as a blob free-floating in space. Hand someone a bullet hole close-up photo and watch them turn it round and round, trying to orient the picture to the scene, or hand it to them upside-down and notice how they

can't tell the difference. These are the sorts of problems generated when a bullet hole's position is not properly photographed.

After those first general scene views are recorded and whatever necessary trace evidence collection is completed⁵, the bullet defect should be marked and labeled, and then photographed again. You already have a scale in the photo; now you need to add a North arrow (on horizontal surfaces) or an Up arrow (on vertical surfaces). In scenes where projectiles strike two perpendicular surfaces, such as both the south and east walls of a room, it also helps to include in your labels the north-south or east-west directions. Some people spray paint huge numbers or great circles around their bullet holes and then stand back far enough to get the whole mess in their pictures. This technique seems to work best on bullet defects in trees, but can irritate homeowners who don't like graffiti. Some people take brightly colored evidence tape (yellow works well) and make a little box around the defect. They then write their initials, case number, bullet defect number, and Up arrow right on the tape. This works well on many surfaces and under most weather conditions (tape doesn't work well on trees in the winter). Better still is to make a triangle, instead of a square, with the tape, which turns the tape label into its own Up arrow.

For deflection defects (ricochet marks, skids, skips, "dings," or whatever you want to call them), it helps to affix a six- to 12-inch length of marking tape next to the defect but running in the same direction. This can not only help orient the person viewing the resulting photographs, but can help you at the scene when you're trying to find the bullet or terminal defect. Make sure you duplicate the long axis of the mark as carefully as you can.

The problem with numbering your bullet defects is that this is often interpreted as a sequencing of shots in a multiple-shot incident (i.e., Hole #7 was fired after Hole #4). Numbering also creates problems when a bullet strikes two items that you can definitely associate; you end up in court