

Photos and article by Thomas Hanratty

# Walking in another's shoes

***Footprint evidence provides  
clues to solve crimes***

**A**s dawn broke on a large Midwestern city in August, the partially clothed body of a young woman was found on a concrete slab near the state fairgrounds parking lot. The woman, in her early 20s, had sustained multiple stab wounds and some genital mutilation. Investigators found no traces of semen on site.

Though the fair had ended its 10-day run the night before and the parking lot had cleared of cars by 2 a.m., liquid blood and the body's condition led investigators to conclude a more recent time of death.

Police investigators were unable to discern any footprints on the concrete slab. But the parking lot, just 10 feet away from the body, was not paved; its surface was hard-packed dirt and took impressions well. At first, investigators thought someone driving a motor vehicle dumped the body in this location, but the amount of blood at the scene indicated the victim had bled out on the spot. Officials began a hunt for footprints in the parking lot and quickly found a pattern matching the sole of the victim's sneaker.

"We followed the footprint trail back to where the woman had entered the parking area," the police detective lieutenant reports. "From there, the paved road began and all traces were lost. But we knew that where the victim's tracks were found, the suspect's footprints also would be located, and the hard-packed dirt provided a good surface."

After locating and properly photographing all of the victim's footprints, investigators carefully measured the distance between the prints. The stride between the victim's left-foot and right-foot track measured an average of 26 inches when she entered the parking lot. But it was apparent from the track

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impressions that at one point she had looked over her left shoulder.

"The pattern in the bottom of the track was broken down, as if she had twisted her foot a slight amount," the lieutenant recalls. "We used a cleared area of the parking lot and attempted to reproduce the amount of twist. A female police officer, wearing a similar type of shoe, tried a variety of movements to duplicate the pattern of disturbance in the track. The same type of breakdown occurred when the officer looked over her left shoulder."

After the victim glanced over her shoulder, the distance between the footprints increased, first to 28, then 34 inches, indicating a boost in the speed of her walk. As the victim approached the far side of the lot, her stride grew to 40 inches.

A close inspection of the victim's individual tracks indicated that as her stride lengthened from 26 to 28 inches, the footprints showed more pressure being applied to the ball of the foot, but only enough to cause cracks in the soil. At 34 inches, the individual prints revealed the victim was now up on the balls of her feet, her heel marks gone. In short, she was running. Then her tracks suddenly exploded, kicking dirt 2 feet behind the prints as she went into an all-out sprint.

As investigators trailed the victim's tracks, they found another set of footprints. Because some of these prints overlaid a number of the victim's tracks, investigators determined these footprints most likely belonged to the perpetrator. Investigators then employed a procedure similar to that used to reconstruct the victim's actions to deduce the suspect's actions.

First, investigators photographed the trail and each suspect footprint using a tripod, footprint scale and offset lighting. Then they carefully measured the length of each clear footprint and plugged the average length into a formula designed to approximate the suspect's height. By measuring the perpetrator's stride, investigators presumed he also started out walking then broke into a fast run as he chased the young woman.

Officials retraced the suspect's steps to determine where he entered the parking lot. The trail ended at a set of tire tracks. Several cigarette butts, all the same brand, were found in the area. Investigators believed

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the suspect sat in his vehicle, smoking, and lying in wait for his victim. They photographed and cast the tire marks and collected the cigarette butts for DNA analysis. Officials speculated the victim did not see the vehicle when she entered the lot, and later became aware of the suspect and began to walk fast, then run, and finally sprint.

Because of this diligent search for footprints, even though the body had been found on concrete, investigators developed a great deal of information and were able to reconstruct the chain of events leading up to the killing. They had photos and casts of the suspect's shoes, his approximate height, possibly his DNA, and, by using a computer program, an idea of the make and model of his vehicle.

Subsequent questioning of state fairgrounds workers led to a temporary worker, who smoked the same brand of cigarettes as those found and was approximately the determined height. His motor

***"Because we were thinking of  
footprints right from the start, we  
were careful to avoid stepping on the  
best evidence we had."***

*— Midwest police detective lieutenant*

vehicle was parked in plain view outside his trailer, and the tires visually matched those found near the body. When questioned, the man supplied vague and evasive answers. Officers also observed the suspect's shoes and noted they had the same class characteristics of the footprints at the crime scene. They subsequently arrested the man, seized his shoes, and obtained a search warrant for his residence and vehicle. They found bloodstained clothing and a hunting knife stuffed in the air conditioner of the suspect's house trailer. He is now serving a life sentence.

"Because we were thinking of footprints right from the start, we were careful to avoid stepping on the best evidence we had," the lieutenant recalls. "We were fortunate to have a tracking surface we could use. If the crime had been committed on grass or in a

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Walking print with little disturbance and clear heel mark.

wooded lot, we would have needed a more advanced set of skills.”

### Surface tracking

While it's long been said that a picture tells a thousand words, to the crime investigator a footprint clearly does the same. Identifying and interpreting both victim and suspect tracks tells a story about the crime itself. Everything from the order of the events, the relative position of the people involved, the height of the individual and more can be learned by tracking

footprints at the scene.

A crime is a dynamic, chaotic event that occurs in a three-dimensional space. But the crime scene investigator must reproduce the event by interpreting evidence found on two-dimensional surfaces, such as floors, ceilings and walls. When the crime occurs outdoors, the only surface available is often the ground. As the example above clearly denotes, experience and training in locating, documenting and interpreting footprints maximizes an officer's

ability to reconstruct the crime and bring responsible parties to justice.

But not all surfaces where tracks may be found are created equal. Tracking on grass or forest debris is often more difficult than locating and interpreting footprints on dirt or snow.

When tracking footprints on grass or forest vegetation, first a careful search must be made at the crime scene and nearby for any disturbances that have changed the natural pattern of the plant life. Crushed leaves, bent stalks

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and plant material kicked up or pressed down are sought. Next, distinguishing between animal and human activity is achieved by determining the shape of the foot that made the disturbance. In North America, only humans and bears leave large flat tracks, and only humans wear hard-soled hunting boots. The final and the most difficult task is aging the track. This means determining to a reasonable degree of certainty when the footprint was laid. Many trails and woodlands in America are multiple-use and aging the footprints becomes critical in order to distinguish the

## How to determine the height of an individual from the shoeprint length

There are three methods currently in use to help investigators determine the height of an individual from a shoeprint. All three methods will give a value within 2 inches of the height of the trackmaker.

- (1) Measure the shoeprint length in inches and divide by two to get the height in feet. For example, a shoeprint that measures 12 inches in length will indicate a person 6 feet tall. This is a rough estimate for use at the scene to rule in or rule out possible suspects.
- (2) Measure the shoeprint length in inches, multiply by 3.447, and then add 32.364.

Height (inches) = 3.447 x (shoeprint length) + 32.364

This applies to roughly 70 percent of males between the ages of 17 and 50, the prime ages for criminal activity. For example, a footprint measuring 12 inches long will indicate a trackmaker between 6-feet 1-inches and 6-feet 2-inches tall.

- (3) Measure the footprint length in millimeters and divide by 0.167. This method requires conversion to inches and feet to get a meaningful height, but has been shown to be fairly accurate in practice. A footprint measuring 12 inches long (305 mm) gives the height of the suspect as 6 feet.

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Photo of left footprint looking over left shoulder. Arrows indicate areas of twisting disturbance.

suspect's footprint from all others. This type of tracking requires extensive training and experience, but the results are worth it.

"Broken or crushed vegetation can be aged," says Tony Kemnitz, former chief of police for the Mukwonago (Wisconsin) Police Department. "Moisture is squeezed out of a plant stepped on by a human shoe. The plant will appear a deeper green if recently crushed, then undergo a series of color changes related to the length

of time since it was damaged."

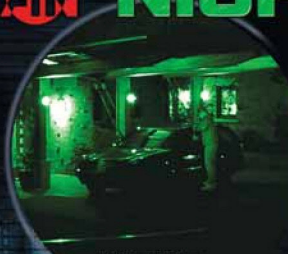
Kemnitz, a cop for more than 30 years and the only certified police tracker in Wisconsin, says it's up to

## Web sites with tracking schools and footprint information

- Joel Hardin teaches mantracking for police and search-and-rescue personnel. He's a former Border Patrol tracker with more than 30 years of law enforcement experience. [www.jhardin-inc.com](http://www.jhardin-inc.com)
- Tom Brown's Tracker School teaches animal and human tracking. [www.trackerschool.com](http://www.trackerschool.com)
- William Bodziak is a former FBI footwear impression evidence analyst and has written a textbook on the subject. He teaches identification of footwear impressions. [www.bodziak.com](http://www.bodziak.com)
- Chesapeake Area Shoeprint and Tire Track Web site. This is one of the most complete Web sites on human tracking information. [members.aol.com/varfee/mastssite/](http://members.aol.com/varfee/mastssite/)
- Universal Tracking Services teaches law enforcement and search-and-rescue tracking. [www.uttracking.com](http://www.uttracking.com)

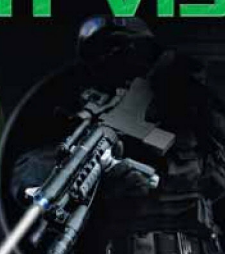
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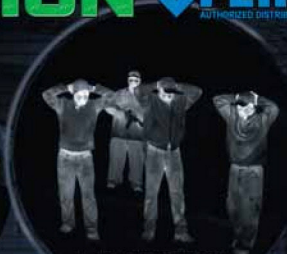


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each tracker to train himself to recognize such color changes in the area they are tracking.

He recommends the following training trick to novice trackers: "Break a branch of a low-hanging bush. Attach a tag and record the date, time of day the branch was snapped, and the amount of shade or sunlight at the time. Return to the bush at various times of the day for a week, making notes as to the amount of plant juice expressed, the time it takes to dry in the shade and/or sun, and the color change in the damaged area. Repeat this process for a variety of plants." The observer will notice the plant juice of most plants in direct sunlight dries in a



**Jogging print with light heel mark and "dish."**

matter of 2 or 3 hours during the summer months. In the shade, the same break will appear fresh for 24 to 36 hours, but the ends of the broken branch will discolor.

Master tracker, Joel Hardin, has tracked lawbreakers for the U.S. Border Patrol for three decades. He now runs a school designed to teach police officers and search-and-rescue personnel the science of tracking and aging footprints.

"Gravity, wind, rain and the sun will age footprints," Hardin pointed out at a workshop in Michigan. "Knowing recent weather conditions is critical



**An all-out sprint with no heel mark visible. All the force is on the ball of the foot.**

for interpreting tracks at a crime scene. It's incumbent that investigators know when and how much rain fell in the 24 to 36 hours before a crime is discovered."

Training and experience in a variety of environments are essential for becoming a competent mantracker. If a clear footprint is discovered in dirt or mud, investigators may use several methods to estimate the time the track was laid. Gravity, Hardin mentions, will age a track in a

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predictable manner. The edges become less sharp, rounding off with age as gravity pulls the soil into the track. By pushing his thumb into the soil next to the track and observing how long it remains crisp, an investigator

can estimate the time interval since the track was laid. Another factor to consider is wind. A print protected from the wind remains much fresher than one subjected to a breeze. Trucks and other traffic on a highway create a wind

that will obliterate tracks in a matter of hours. And certain soils hold prints better than others. For example, a footprint in sand will appear to age rapidly, within minutes, while a track in loam or light mud will hold its freshness for hours or even days.

Determining the age of footprints left in snow at a crime scene can be a helpful skill for officers working in the northern areas of the country. "Ice will form in the track because foot pressure squeezes out some moisture,"

*"What we don't look for, we don't find" is a cliché that seems to apply to tracks. Footprints are truly "the missed evidence" in many jurisdictions.*

Kemnitz says. "Knock on the floor of the track with your knuckles. If you hear a hollow sound, the track is probably more than 24 hours old. But, if the track is in a shady area, it may be more recent. The officer can check his time estimate by placing his own footprint nearby and seeing how long it takes to freeze." Kemnitz, who spent much of his life tracking in the frozen north, adds this tip. "Frost in the track means the track was made before nightfall, and animal prints found inside your suspect's footprint were probably

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made during the night. Many animals are nocturnal, and it's up to the tracker to know the animal patterns in his area."

### The missed evidence

The art and science of tracking has a long history in America, but it has fallen out of favor over the last century. Other parts of the world are more cognizant of the usefulness of footprints in law enforcement. In Europe, usable footprints are found at approximately 40 percent of crime scenes, and Australian police officers discover and process even more. However, American crime labs report only 1 to 2 percent of submitted evidence involves footprints. Crime scene investigators in the United States are seldom trained to proactively search for footprint evidence. "What we don't look for, we don't find" is a cliché that seems to apply to tracks. Footprints are truly "the missed evidence" in many jurisdictions.

Along with other evidence found at an outdoor crime scene, footprints can bring order to the chaos a criminal act normally creates. Identifying and interpreting the tracks of the actors will lead to an understanding of the order of events, relative position of the people involved and information leading to the identification of the suspect. The two-dimensional surface of the ground can be made to yield its secrets to the investigator experienced in footprint analysis. With these secrets in hand, crimes can be solved and perpetrators brought to justice. ■

Thomas Hanratty worked 18

years as a forensic investigator for Milwaukee County, Wisconsin. He has taught forensic tracking since 1988 to law enforcement officers for Medicine Hawk Wilderness Skills Inc. He is currently employed as an instructor in the Protective Services

Department, Division of Law Enforcement, at Milwaukee Area Technical College. Hanratty is the author of "The Art and Science of Tracking Man and Beast," which is available at Amazon.com.



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