

# Footwear and Tire Evidence

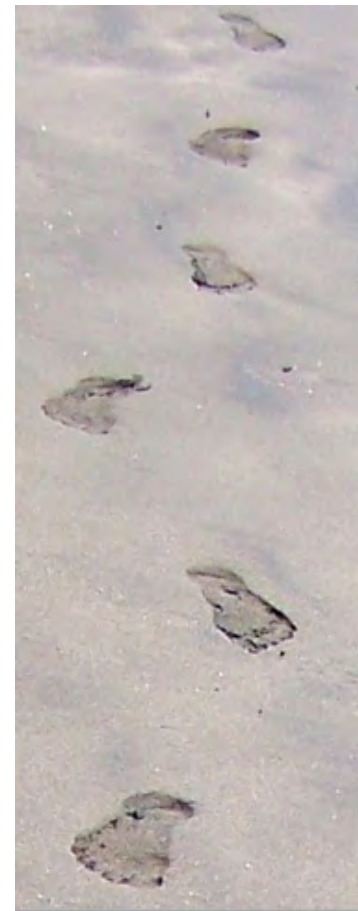
An Introduction for Non-Practitioners



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# Footwear and Tire Evidence IN THE PAST

- Foot and footwear impressions were man's first recognized "evidence" of a person or animal's passage
- Later, cart and wagon wheel tracks also left considerable evidence of their passage



# Footwear and Tire Evidence: extent of use

- Used in all countries
- Symposium on Footwear and Tire Evidence in 1994 had representatives from over 30 countries
- Fingerprints, DNA and Footwear Evidence are now ranked as top three volume categories in UK
- In US, laboratories and CSIs continue to enhance training and efforts to detect, recover and utilize this evidence

# Footwear and Tire Evidence: Occurrence

- When there is a transfer of class and possibly individual characteristics from a shoe or tire to a firm or soft substrate
  - Two dimensional: transfer of accumulated dust, residue, blood, etc., to firm substrate
  - Three-dimensional: impressions in soft substrate such as soil, mud, sand and snow



# Factors Affecting Detail

- Shoe sole or tire tread condition
- Contaminants - quantity and quality
- Receiving surface type and condition
- Moisture
- Movement & distortion
- Degradation of impression before recovery



# Examples



# Partial to complete impressions

- Most shoe and tire impressions are partial
- Detail retained ranges from very poor to excellent



# Critical Nature of Detection & Recovery of Evidence

- Only evidence that is found can be recovered
- Recover all impressions “whenever possible”
- Need to recover properly
- Need to properly evaluate and document evidence at scene
- Is often the only physical evidence remaining at a crime scene!





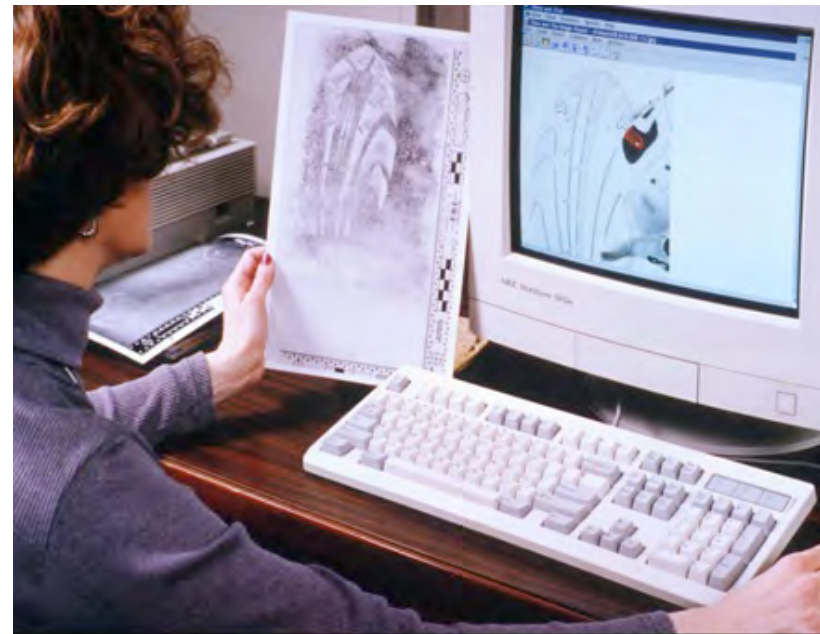
# VaLUE of Footwear and Tire Evidence

- May identify shoe or tire with impression
- May eliminate a specific shoe or tire
- May reveal important similar or dissimilar features in cases which are not identifications or eliminations



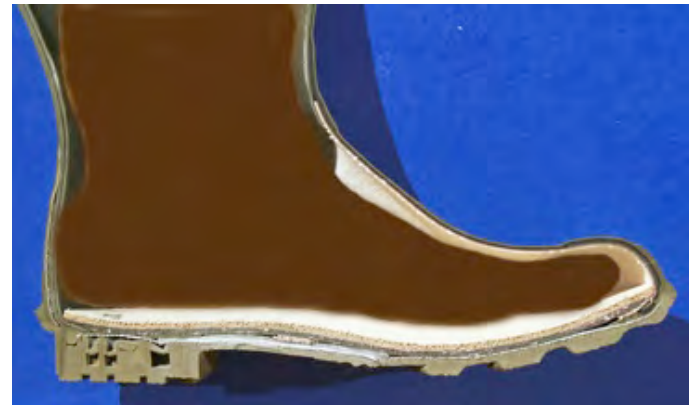
# VALUE of Footwear and Tire Evidence

- May identify brand and style of footwear or tire based on crime scene impressions



# VALUE of Footwear and Tire Evidence

- Can potentially size footwear or tires based on dimensions and/or outsole and tread design features of crime scene impressions



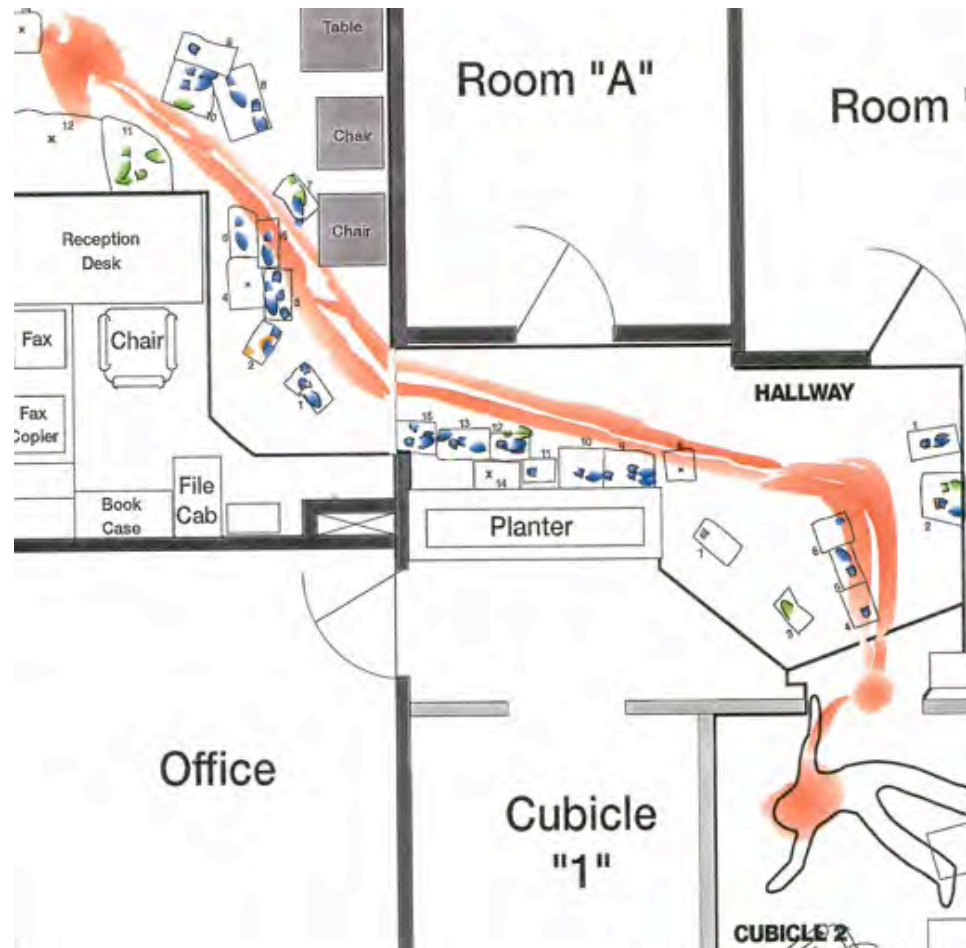
# VALUE of Footwear and Tire Evidence

- Tire impressions can be compared to tires from a suspected vehicle
- Track features can provide substantial information about size of perpetrator's vehicle - track widths, wheel base, and turning diameter measurements
- Combined impressions



# Value of Footwear and Tire Evidence

- Can corroborate or dispute alibis
- May provide information about number of suspects
- Impressions on bank counters, in blood of victim, etc. show direct relation to crime



# Typical Case example

- Bank Robbery by two individuals, both wearing gloves and full face halloween masks
- One jumps up onto counter with shotgun (recorded with bank camera)
- Flee in Cadillac witnessed and described by elderly couple
- Two hours later, car apprehended with suspects but no money nor halloween masks in car.
- Converse shoes from one suspect identified with multiple shoe impressions on bank counter.

# Detection of Impressions

- Visible impressions
- Impressions found with special lighting - oblique light and ALS
- Latent footwear impressions located through electrostatic lifting, powdering, chemical enhancement
- Significantly enhanced with aggressive approach at scene



# Recovering the Evidence

- Original Evidence
- Photography
- Lifting
- Casting





# Original Evidence

- Small and portable items that have been stepped on such as broken glass, paper, etc.
- Larger items where recovery may be difficult at scene

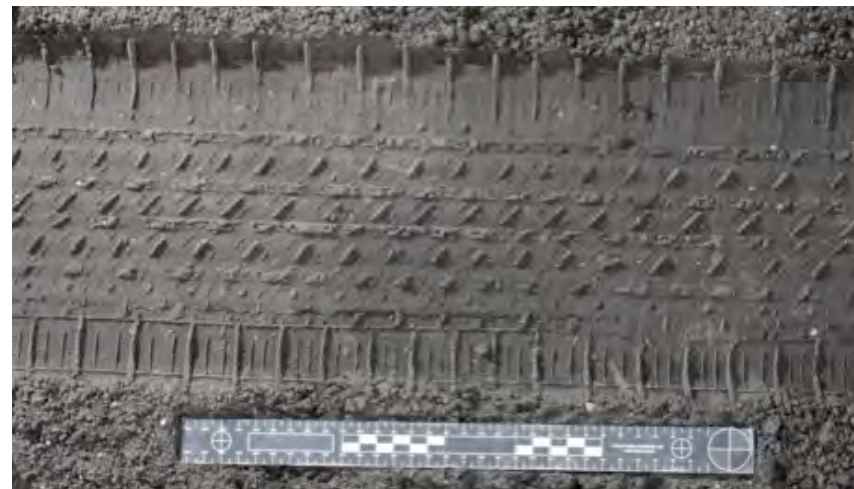


# Photography

- General Scene - to document impressions and scene - not for examination

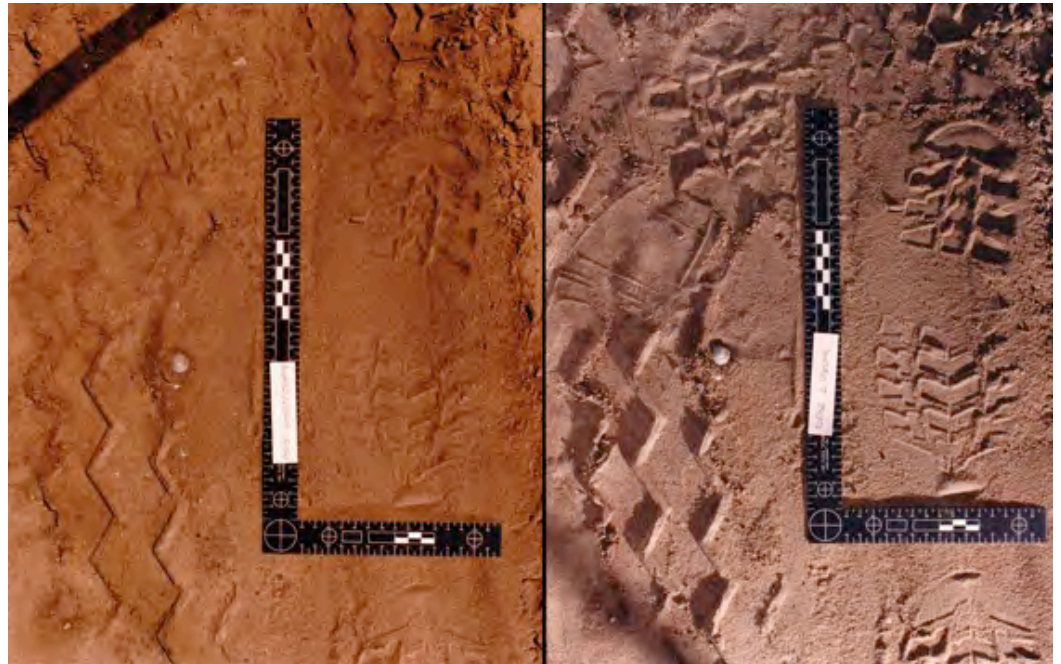


- Examination Quality Photograph - for examination



# Proper Lighting

- Lighting is crucial
  - Existing lighting or flash on camera
  - Existing light blocked out and oblique light provided with off camera flash



Bright ambient light

Ambient light blocked  
with flash

# Casting

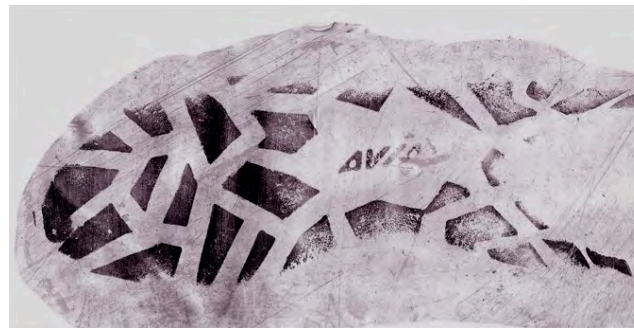
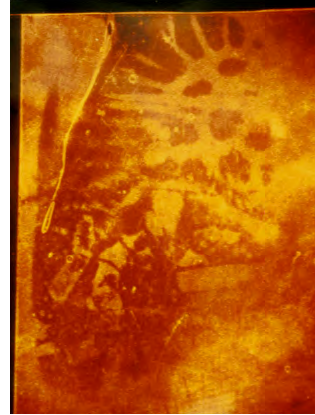
- Use of Dental Stone to fill three dimensional impressions in soil, sand, snow



(Movie)

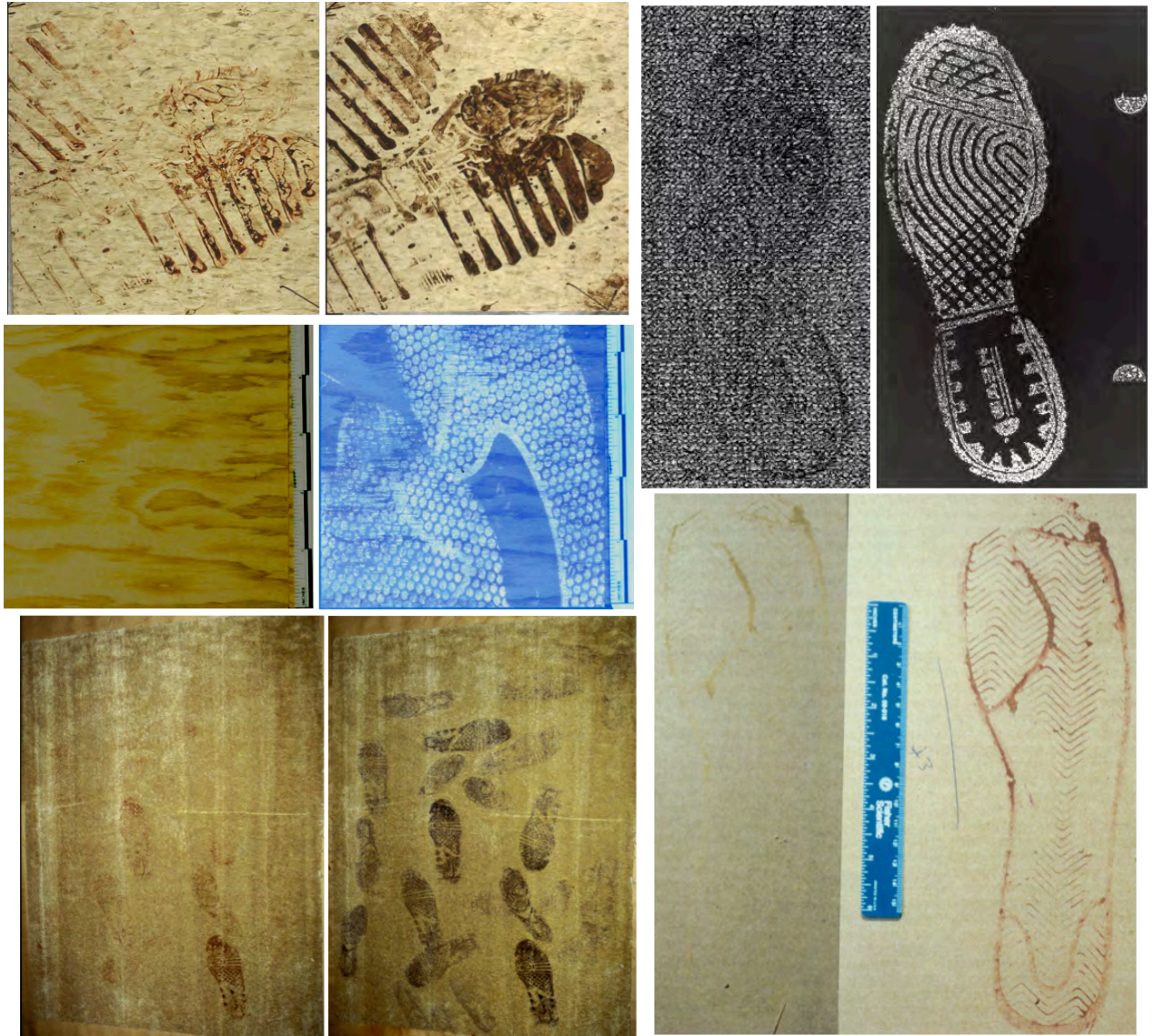
# Lifting

- Many ways to lift impressions from two dimensional surfaces
- Includes gelatin and adhesive lifts, electrostatic lifts, Mikrosil, dental stone



# Chemical Enhancement

- Performed both at crime scene and in laboratory
- Many reagents for both bloody and non-bloody impressions



# Known Shoes and Tires

- Must have actual shoes & tires for proper examination, not just a photograph or test impression
- Need to know date shoe or tires are obtained versus date of crime to account for any changes in wear
- Elimination prints or photos of shoes and tires of first responders, victim, etc. assist in focus on perpetrator's impressions



# Known Shoe and Tire Impressions

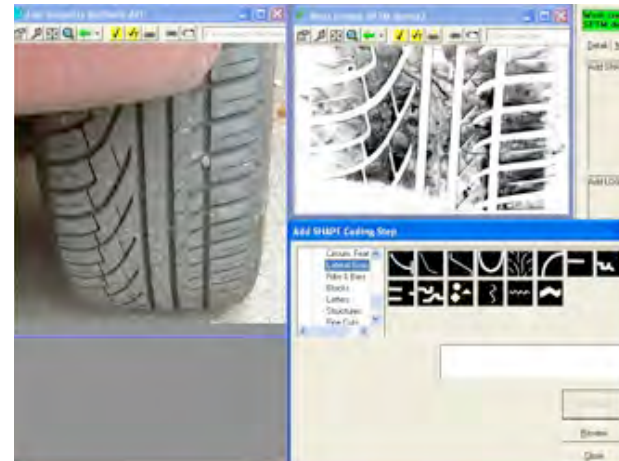
- Known impressions are used to demonstrate repeatability of design, size, wear and individual characteristics and to provide a comparative aid in the examination





# When no shoes or tire are recovered

- Data base searches
- Shoe boxes, photographs, surveillance cameras, witness statements, etc.
- Sizing of shoe or tire impressions



# Examiner Qualifications

- Minimum recommended requirements of training and experience (per SWGTREAD)
  - Bachelor's degree in physical or natural science recommended
  - Extended formal training program with qualified principal trainer. Should include all relevant topics in field and be documented in training log.
  - Regular & sufficient casework experience under training examiner
  - Proficiency testing
  - Experience, experience, experience!!!

# Examiner Certification

- Certification through the International Association for Identification (IAI)- accredited by the FSAB
  - Must be primarily employed in the field of Forensic Science whose duties include the examination of footwear impression evidence
  - Bachelor's degree recommended plus three years experience as a footwear examiner (or equivalents)
  - Must have satisfactorily completed a training program in this field

# Examiner Certification (continued)

- Certification through the International Association for Identification (IAI)
  - Two letters of endorsement
  - Must pass written test
  - Must pass practical examinations
  - Must take new practical test and accumulate continuing education points every five years to be “Re-Certified”

# Professional Affiliation and Continued Education

- Examiners should actively participate in national and/or regional forensic science organizations for the purpose of continuing education
  - International Association for Identification (IAI)
  - American Academy of Forensic Sciences (AAFS)
  - Regional Forensic Science organizations (MWAFS, SWAFS, IAI state chapters, etc.)
  - European Meetings
  - Special classes and workshops

# Examination

- Hypotheses
  - Shoe or tire made impression
  - Shoe or tire did not make impression
- Shoes or tires and their known impressions, measuring devices, magnification, enhancement
- Comparison includes overlay and/or side by side; replication of characteristics; documentation



# Characteristics Examined

- Design and Physical Size of Design
- Specific vs General Design



Size 9

Size 9

# Characteristics Examined

- Some complex issues with regard to size and design require knowledge of mold making and possible information from manufacturer





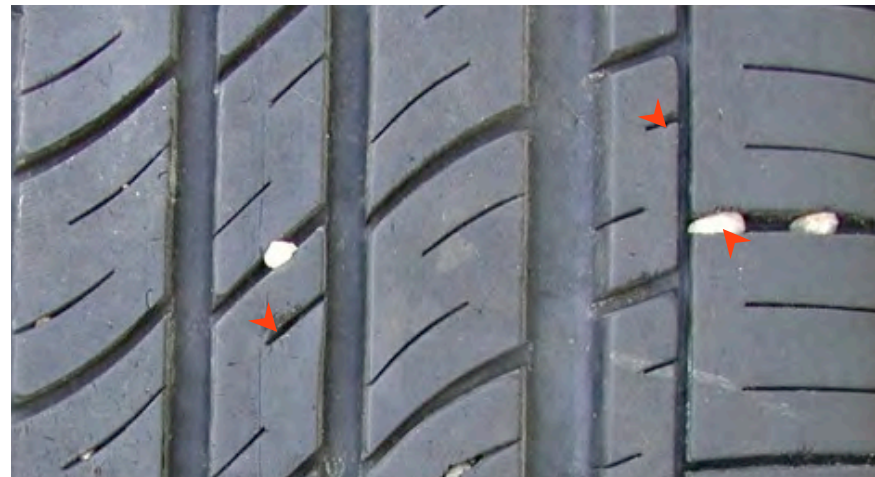
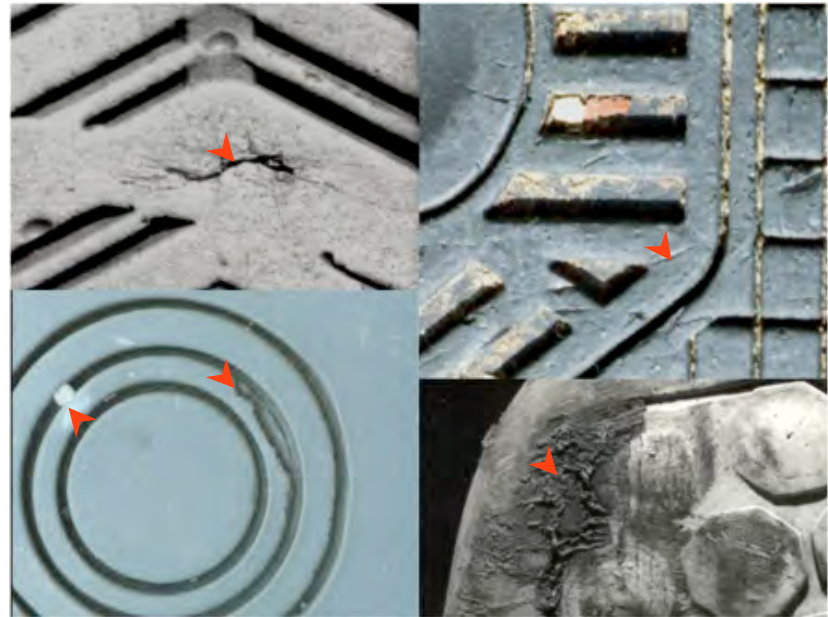
# Characteristics Examined

- General wear - the gradual erosion of rubber due to frictional forces
  - Wear creates visible changes in appearance of shoe or tire and the impressions they leave
  - Agreement in general wear further reduces number of tires or shoes that could have made impression



# Characteristics Examined

- Individual Characteristics
  - Anything randomly added to or taken away from the shoe or tire
  - Cuts, scratches, stones held in tread, tears, tar, gum, nails, patches, etc.
- Required for Identification

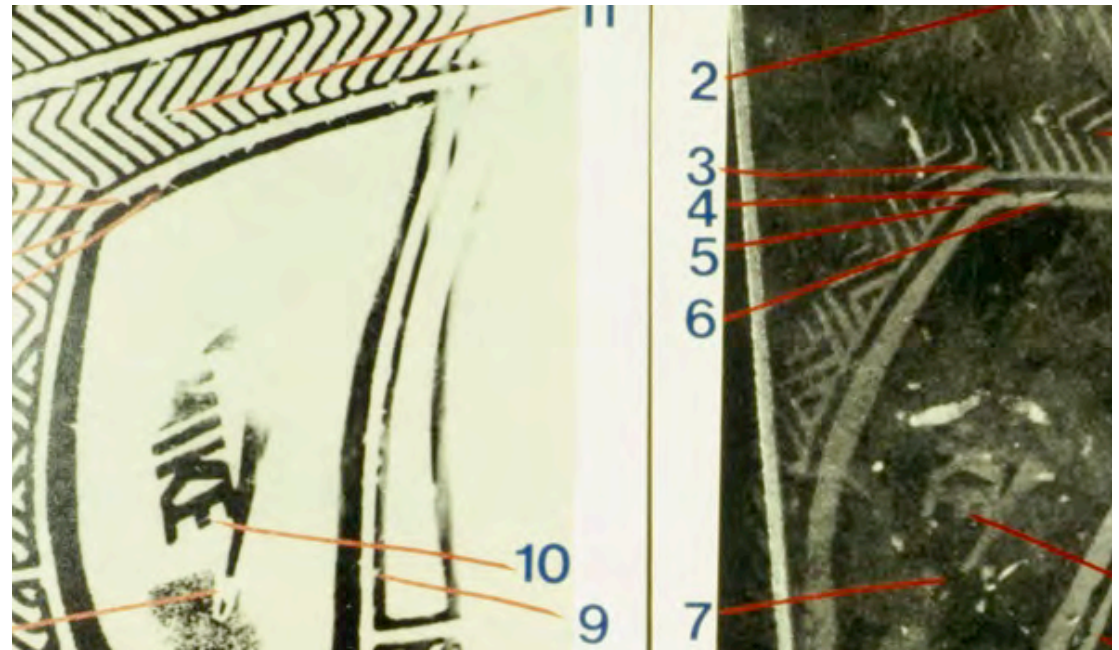


# Conclusions in Footwear and Tire Evidence Examinations

- Conclusions range from “Elimination” to “Identification”
- Should be stated and supported on a case by case basis with demonstrable features
- Discourage use of pre-determined terminology and vague and non-specific conclusions such as “the shoe and impression are consistent with each other” or “the shoe cannot be eliminated”

# Example of Identification

- Identification is made when, in the opinion of the examiner, a set of clear, confirmable and demonstrable class and individual characteristics exists, that would not be repeated in another shoe.



# EXAMPLE OF IDENTIFICATION

CRIME AND PUNISHMENT

## THESE ARE THE TIMES THAT TRY MEN'S

**I**N THE HIERARCHY OF forensic evidence, shoe prints have never carried the weight of fingerprints, hair, or blood. But a recent trial may change that.

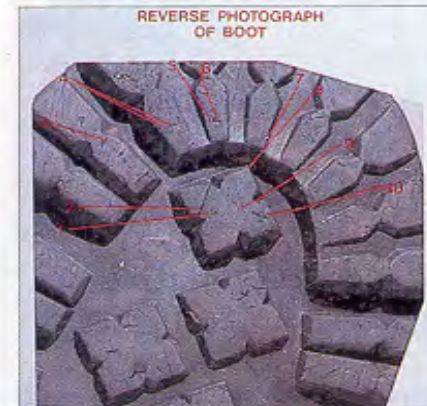
On May 10, 19-year-old Anwar Abdul was convicted in State Supreme Court of the January 1992 murder of Lisa Steinberg, an assistant

manager at the Gap store on West 57th Street. One of the few pieces of physical evidence was a bloody shoe print, which was hacked out

Abdul. "Without that piece of evidence," says prosecutor Armand Durastanti, "I don't suppose there would have been a case."

The prosecution's star

predominant on shoes in the early seventies with the jogging craze," Bodziak explains. "Murderers, burglars, and the like tend—for obvious reasons—to wear

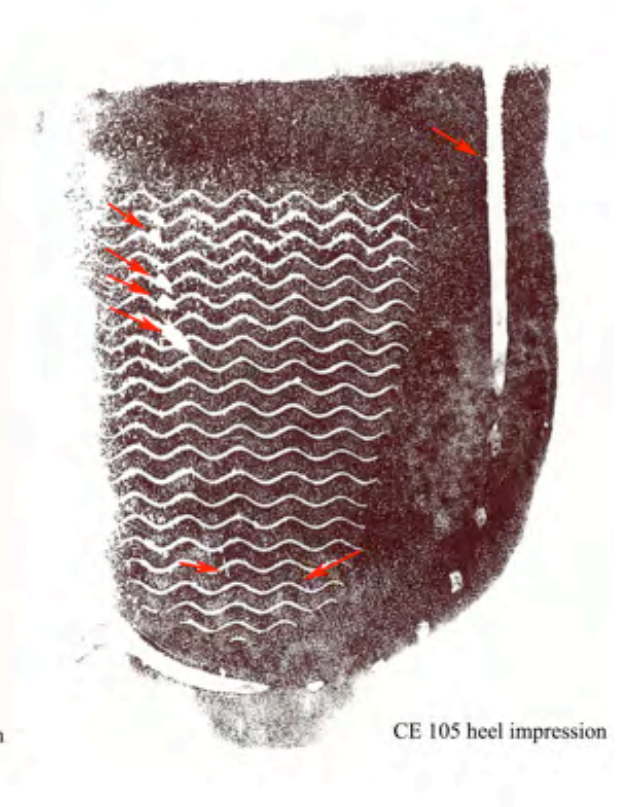
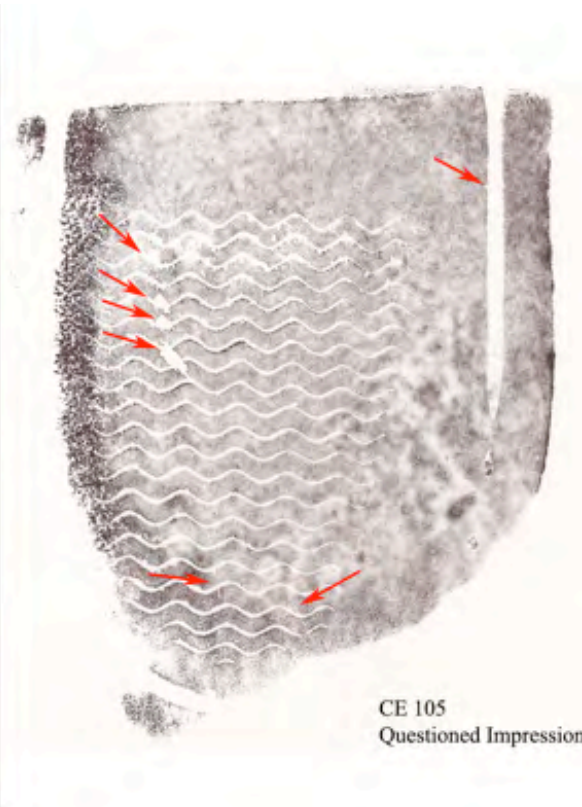
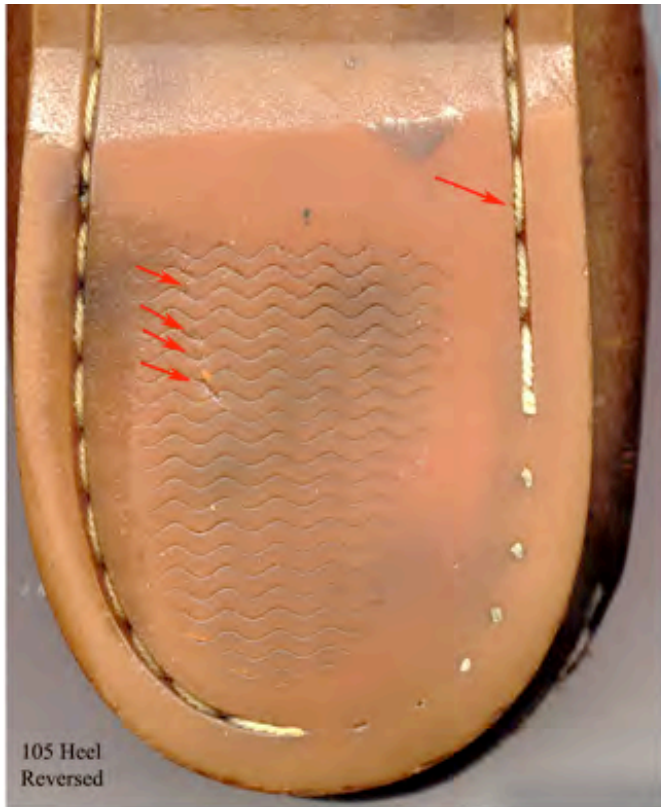


*The murder-scene shoe print, the defendant's print, and the sole of his shoe.*

witness was William Bodziak, an agent in the FBI's Footwear and Tire Tread Impression Unit. Bodziak is

athletic shoes. And these shoes tend to leave cleaner prints than the flat leather soles of old."

# EXAMPLE OF IDENTIFICATION



Bloody Footwear Impression  
on Bundy Walkway



Impression with Overlay  
of Size 46 Bruno Magli



# Success of Examination Depends on:

- Amount of detail retained in impression
  - Original impression always had the most detail
- Amount of detail recovered from crime scene
  - Varies depending on equipment, experience, resources
- Equipment / standards used in comparison
  - Test impressions, standards, lighting, enhancement, etc.
- Expertise / methodology of examiner



# Tire Examinations

- Tires are significantly more complex than rubber shoe soles
- Tires are dynamic - actually change slightly in dimension when traveling over different surfaces
- Require additional knowledge, experience and skills beyond footwear examination expertise
- Additional knowledge also required for proper documentation and recovery of this evidence



# SWGTTREAD TERMINOLOGY

- **Identification** – this is the highest degree of association expressed in footwear and tire impression examinations. This opinion means that the particular shoe or tire made the impression to the exclusion of all other shoes or tires.
- **Probably made (very high degree of association)** – this opinion means that the evidence is very persuasive that the shoe or tire made the impression, yet some critical feature or quality is lacking and/or missing so that an identification is not in order.

# SWGTTREAD TERMINOLOGY

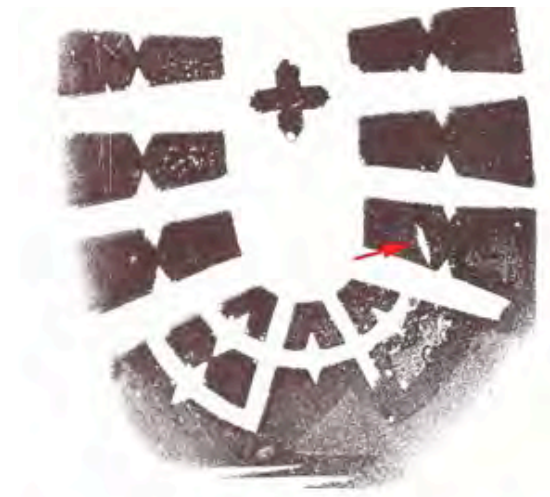
- **Could have made (significant association of multiple class characteristics)** – this opinion means that the design and physical size correspond, and there may also be some correspondence of the general condition of wear
- **Inconclusive (limited association of some characteristics)** – this opinion means some similarities are noted; however, there are significant limiting factors in the questioned impression that do not permit a specific association between the questioned impression and the known shoe or tire.

# SWGTTREAD TERMINOLOGY

- **Probably did not make (very high degree of non-association)** – this opinion means that the evidence is very persuasive that the shoe or tire did not make the impression, but the impression lacks sufficient quality or clarity for an elimination.
- **Elimination (definite exclusion)** – this is the highest degree of non association expressed in footwear and tire impression examinations. This opinion means that the particular shoe or tire did not make the impression.

# Footwear and Tire Evidence: In Court

- Records of use in court exist from 1700s
- Universally used in investigations and accepted in courts in U.S. and around world
- FBI lab used this evidence and maintained reference files since its inception in 1932



Known Impression of  
Right Heel

# Requires properly Trained Expert to Evaluate

- The argument that anyone can perform these exams and evaluate this evidence properly is wrong
- Research and experience has confirmed that layman or insufficiently trained persons are not equipped to reach proper conclusion
- Experts in court should be tested extensively on their specific qualifications of training and experience
- Judges tend to allow unqualified “experts” to testify with weight going to jury

# Daubert Factors

- Daubert court gave guidelines that trial courts should consider / Kumho said guidelines were meant to be helpful to trial judges
- Not all are required
  - Proof of testing of basic underlying hypotheses upon which the technique rests
  - Peer review and publications
  - Known or potential error rate
  - Existence of an accepted methodology
  - General acceptance of the technique in the forensic community

# The NAS Report & Research

- No practitioners were on committee of the NAS study
- SWGTREAD response published ([www.swgtread.org](http://www.swgtread.org))



# Research

- Research has been conducted and continues to be needed to test new materials, techniques and procedures.
- Funding requested from Congress should go towards research that is identified by examiners as “needed” versus research that is proposed by those in academia that have no understanding of these examinations and what would enhance the performance of that discipline
- Research in any forensic discipline is always welcome and needed but must include practitioners playing major roles
- A certified examiner should be a major player in that research



Scientific Working Group for  
Shoeprint and Tire Tread Evidence

- Established in 2004
- To standardize and advance the forensic analysis of footwear and tire evidence
- Provides a professional forum where examiners can share knowledge, evaluate practices, develop standards, and identify research needs
- Meets twice yearly
- Is open to your comments, suggestions and other input

## INTERESTING ARTICLE OR WEBSITE?

Please submit **articles** (from journals or online) and **URLs** with information pertinent to footwear and tire tread impression evidence including **best practices, research, products** and **legal decisions**. We will post this information so it can be shared with the community. Direct these submissions to **Gary Hauptmann** ([gauptmann@baltimorecountymd.gov](mailto:gauptmann@baltimorecountymd.gov)).

## RESOURCES

[Daubert Resource Kit](#)

[ENFSI Wanted Page](#)

## LINKS

[Footwear Certification](#)

[Organizations](#)

[Publications](#)

[Search Tools](#)

[Journals](#)

[Other Publications](#)

[IAI Publications](#)

[Training/Education](#)

[Working Groups](#)

### Counterfeit Nike Sneakers

31 Tuesday, June 29, 2010



Wisbey D. **Counterfeit Nike Sneakers**. J. Forensic Ident. 2010; 60 (3): 337-351.

#### Abstract

The popularity of Nike Air Force One sneakers has resulted in the sneaker being a common brand submitted for footwear examination. In the course of the examination process, footwear examiners have contacted the Nike Corporation for manufacturing details. In some cases, Nike was unable to provide information because of the sneaker being counterfeit. This paper will highlight some methods to assist the footwear examiner in assessing the likelihood that the submitted sneaker may be counterfeit.

### If the Shoe Fits: An Illustration of the Relevance of Footwear Impression Evidence and Comparisons

31 Tuesday, June 29, 2010



LeMay, J. **If the Shoe Fits: An Illustration of the Relevance of Footwear Impression Evidence and Comparisons**. J. Forensic Ident. 2010; 60 (3): 352-356.

#### Abstract

It is the author's experience that footwear impression evidence is misunderstood and undervalued when an identification cannot be made. The author uses a case example to illustrate just how significant a

## IMPORTANT DATES

### IAI Annual Conference

July 11-17, 2010  
Spokane, WA

### Impression and Pattern Evidence Symposium

August 2-6, 2010  
Clearwater, FL

### The 33rd Canadian Identification Society Annual Education Conference

September 20-23, 2010  
Orillia, Ontario

# Other Resources

- Books

- Footwear Impression Evidence: Detection, Recovery and Examination (Bodziak, W.J., CRC Press, 2000)
- Tire Tread and Tire Track Evidence (Bodziak, W. J., CRC Press 2008)
- Traces De Souliers (Girod, A., Champod, C. Ribaux, O., France, 2008) (In French)
- Footwear Identification (Cassidy, M.J., RCMP 1980)
- Recommended Course of Study



# Other Resources

- Journals
  - Journal of Forensic Identification (IAI)
  - Forensic Sciences International
  - Journal of Forensic Sciences (AAFS)
  - Others



Reverse photograph of  
suspects shoe identified with  
lift



Clear gelatin lift of fluorescent  
powder impression on bank  
counter

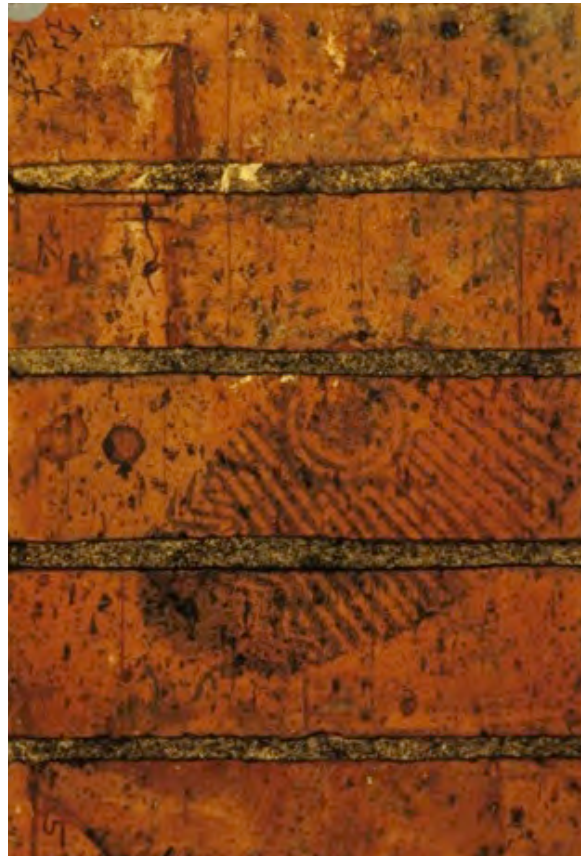


# Case Example

Before  
Enhancement



Amido Enhanced



B/W photo w/red  
filter



# Tire CASE EXAMPLE



This piece was reassembled with other smaller pieces of the original cast.



# Obtaining Inked Known Standards from Truck Tires

- An inked board is prepared that is longer than the tire's circumference.
- A similar sized board is prepared over which clear film will be taped to received the inked impression.
- The result is a full circumference clear inked impression.



# Examination of Tires and Inked Impressions with Cast Impression

- Tire designs are made up of a series of tread blocks.
- These tread blocks vary in size and arrangement around the circumference of a tire to help reduce noise.
- Their combined size and arrangement usually never repeats and is different on each side of the tire.



# Examination of Tires and Inked Impressions with Cast Impression

- Each inked impression is passed over the cast to locate areas where the tread block sizes and arrangement correspond.
- When found, the segment of the tire represented by the inked impression is compared directly with that segment of the tire.



# Examination of Tires and Inked Impressions with Cast Impression

- Only one segment of each tire was found to have a corresponding arrangement of tread block sizes.



# Examination of Tires and Inked Impressions with Cast Impression

- The area defined by blue tape is the segment of the right rear tire which corresponds with the crime scene cast.



# Examination of Tires and Inked Impressions with Cast Impression

- The segment of the right rear tire was found to contain a “stone hold” i.e., a stone wedged in between two tread blocks.
- It is present in both the cast and the exact position in the tire.
- The left rear tire and the front tires did not have this characteristic.



# Conclusion

- The right rear tire corresponds in tread design, tread dimension and general condition of wear
- It also shares a stone hold of similar dimensions and shape in the same precise location as the cast.



Photograph of segment of right rear tire overlaid on top of the cast to show correlation of stone hold.

# Conclusion

- It is probable this tire made the cast crime scene impression.
- Only another tire of the same tread design, dimension and general condition of wear, and possessing a stone hold with similar features and held in the same precise position in the tire's tread, could have made this impression



Photograph of segment of right rear tire overlaid on top of the cast to show correlation of stone hold.