Footwear Impression Evidence

Susan Gross MSFS, F-ABC
Forensic Science Supervisor
Minnesota BCA

Daubert Factors

- Testability
- Peer review
- Error rate
- Standards
- General acceptance

Definitions

- *Footwear*: any apparel worn on the foot, such as shoes, boots, etc.

- *Impression*: is an object or material that have retained the characteristics of other objects or materials which have been impressed against them

Testability

The theory that a footwear impression can be identified to an article of footwear given sufficient quality and quantity has been tested:

- **Cassidy MJ (1969/1980)**

Footwear Identification Canadian Government Publishing Centre 1980

- duplication of a single characteristic in a general area can occur, but infrequently
- duplication of multiple accidental characteristics in identical areas does not occur
- identification of an impression with an article of footwear is possible

- **Stone RS (2006)**

Footwear Examinations: Mathematical Probabilities of Theoretical Individual characteristics, *Journal of Forensic Identification* (2006) 56:577-599

- theoretical model for probability model for likelihood of occurrence of accidental characteristics

The theory that a footwear impression can be identified to an article of footwear given sufficient quality and quantity has been tested:

- **Adair TW et al (2007)**

The Mount Bierstadt Study: An Experiment in Unique Damage Formation in Footwear, *Journal of Forensic Identification* (2007) 57:199-205

- accidental damage found on footwear outsoles is randomly produced

- **Parent S (2009)**

"The Significance of Class Association of Footwear Evidence" presented at the NIJ Trace Symposium, August 2009, Clearwater FL

- determine the likelihood that 2 people have shoe similar in tread design, size and wear

Class Characteristics:

- Characteristics that repeat during the manufacturing process and are shared by one or more shoes. These include: size, design/pattern and mold characteristics.

- Class characteristics reduce the number of shoes from every shoe in the world to a group of similar shoes.

Individual Characteristics:

- Unique, accidental, random damage on the outsole that is the result of its use and wear.

- These nicks and scratches are in the outsole accidentally and in a completely random shape, orientation and position.

Theory of Footwear Impression Evidence Examination and Identification

- The unknown impression can be compared to the sole of a shoe, called the “known”
- The unknown impression can be compared to a test impression of the sole of a shoe called the “known test impression”
- Given sufficient quantity and quality of the unknown impression, differences and similarities can be observed between the unknown impression and the known shoe and known shoe impression

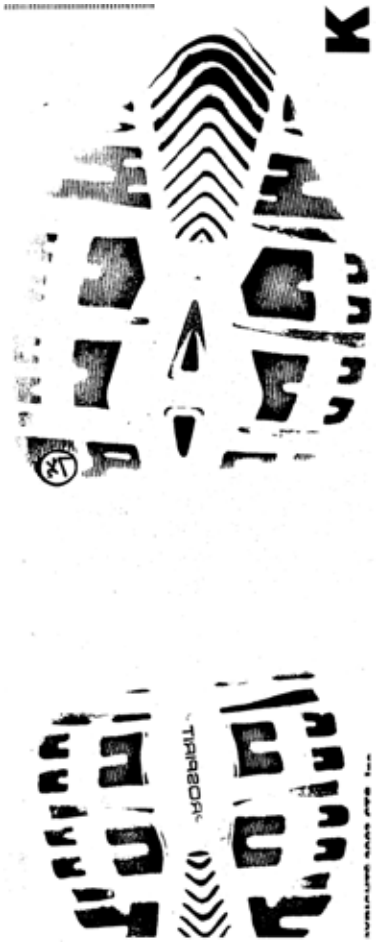
Analysis

- Of the Known Footwear
  - Is the pattern/design similar or different from the crime scene impression?
  - Is there contamination in the outsole?
  - Is there any wear or accidental/random damage on the outsole?

- Of the Test Impression made from the Known shoe
  - How are the characteristics in the outsole of the footwear represented in the test impression?
  - How do the characteristics in the outsole of the footwear repeat from one test impression to another?

Comparison: Side-by-side

- Characteristics observed in the crime scene (unknown) impression are compared to the characteristics observed in the test impression of the known shoe
  - Side-by-Side comparison
  - Superimposed comparison (overlay)



Evaluation

- What is the significance of the information that is gathered?
- Knowledge of the significance of what is observed comes from training and experience.
  - Footwear manufacturing and how that affects the outsole appearance
  - Classes in footwear examination
  - Many footwear comparisons
- Conclusion
  - Elimination
  - Identification
  - Inclusion
  - Inconclusive

Peer Review

Peer Review and Publication

- At least five text books have been written dealing exclusively with Footwear Impression Evidence:
  - Abbott, J. “Footwear Evidence” Charles C. Thomas Pub., 1964
  - Cassidy, M. “Footwear Identification”, Canadian Gov. Pub., 1980
  - Bodziak, W. “Footwear Impression Evidence: Detection, Recovery and Examination” 1st ed., Elsevier Science Pub. Co., 1990
  - Hilderbrand, D. “Footwear, The Missed Evidence” Staggs Pub. Co. 1999
  - Bodziak, W. “Footwear Impression Evidence: Detection, Recovery and Examination” 2nd ed., CRC Press, 2000

Peer Review and Publication

- Some books that include Footwear Impression Evidence
  - Fisher, B. “Techniques in Crime Scene Investigation” 6th ed. CRC Press, 2002
  - DeForest, P., Gaensslen, R., Lee, H., “Forensic Science-An Introduction to Criminalistics” McGraw-Hill, 1983
  - Kiely, Terrence “Forensic Evidence: Science and the Criminal Law” CRC Press. 2001

Peer Review and Publication

- Articles on Footwear Impression Evidence have been published in numerous peer-reviewed journals all over the world
  - Journal of Forensic Identification (US)
  - Identification Canada
  - Journal of Forensic Science (US)
  - Science and Justice (UK)
  - Kriminalistik (Germany)
  - Report of the National Institute of Police Science (Japan)
  - Journal of the Indian Academy of Forensic Sciences
  - La Police Scientifique (France)
  - Information Bulletin for Shoeprint/Toolmark Examiners (European)

Peer Review and Publication

- Presentations on Footwear Impression Evidence have been given in numerous forensic science conferences
  - International Association for Identification
  - Regional Divisions of the IAI
  - American Academy of Forensic Science
  - Canadian Identification Society
  - FBI International Symposium on Footwear and Tiretread Evidence
  - International Association of Forensic Science
  - European Shoeprint/Toolmark Association
  - European Meeting of Forensic Science

Error Rate

- Complex issue
  - Inherent in technique?
    - Sample dependent
    - Reflected in conclusion
  - Examiner- proficiency test

- Retesting/reexamination always an option

Standards

Quality Control/Quality Assurance

- Accreditation through ASCLD-LAB/International
  - American Society of Crime Laboratory Directors-Laboratory Accreditation Board
    - Lab must prescribe to quality standards set by an outside governing agency
    - Lab practices are subjected to outside scrutiny
    - Requires yearly proficiency testing
  - The Minnesota Bureau of Criminal Apprehension Forensic Science Service Laboratory accredited through ASCLD-LAB/International
    - All shoeprint examiners in trace evidence section take yearly proficiency tests in shoeprint impression evidence

Standards/Certification

- A footwear certification program is available through the IAI
- Laboratory accreditation is available through the American Society of Crime Laboratory Directors-Laboratory Accreditation Board (ASCLD-LAB).
  - Minnesota BCA is an ASCLD-LAB International accredited laboratory
  - All conclusions of the footwear examiners in the Minnesota BCA are verified by another qualified examiner.

Methods/SOPS followed

- Method followed:
  - Shoeprint Method (MTC-011)
- Standard Operating Procedures followed:
  - Clothing/Tool Search (TC-011)
  - Test Shoe Print Production (TC-030)
  - Digital Images (TC-049)
  - Interpretations and Report Writing (TC-045)
- Quality Assurance Manual
- Evidence Handling Manual

Verification

- Confirmation of an examiner's conclusion by another qualified examiner
- 100% of all cases are peer reviewed and verified by another qualified examiner
- Quality control system in place

General Acceptance

Generally Accepted Standards Governing the Application of the Techniques and Theories

- International Association for Identification (IAI)
  - The goal of IAI is to share knowledge and information in forensic identification
  - Publishes a peer reviewed journal “The Journal of Forensic Identification”
  - World’s oldest and largest forensic organization
  - IAI membership today is comprised of over 6000 individuals from 70 nations and 13 forensic disciplines
  - Multiple Regional Divisions of the IAI
  - Created a guideline for the training of footwear/tire tread examiner

Generally Accepted Standards Governing the Application of the Techniques and Theories

- Scientific Working Group on Shoeprint and Tire Tread Evidence (SWGTREAD)
  - Created by the FBI to serve as a professional forum
  - Experts in footwear and tire tread evidence share, discuss and evaluate methods, techniques and protocols, quality assurance, education and research
  - Committee comprised of examiners from Federal, State and Local laboratories as well as private practice

Generally Accepted Standards Governing the Application of the Techniques and Theories

- Standard Methodology: “ACE-V”
- “ACE” is a scientific and systematic means of gathering information
- ACE takes into account size, shape, orientation and position in relation to other characteristics

Generally Accepted Standards Governing the Application of the Techniques and Theories

- Standard Used During the Examination: The Known Test Impressions
  - Known test impressions are the standards by which all the other impressions are compared
  - A proper set of test impressions records all the outsole features of the known shoe
    - Size
    - Design/pattern
    - Wear
    - Random/Accidental characteristics

Widespread Acceptance of the Techniques and Theories

- Published, Taught, Lectured
  - Techniques (development and recovery)
  - Ability to individualize a shoeprint impression to a specific shoe
  - ACE-V examination methodology

Widespread Acceptance of Footwear Impression Evidence

- Richardson case – Scotland – 1786
- Routinely accepted in courts throughout US, Canada and Europe
- Accepted in US courts as early as the 1930's
- Accepted in Daubert hearings in other states
- Accepted in MN courts
  - 2001 State vs. Carpenter
  - 2003 State vs. MacLennan
  - 2004 State vs. Haynes
  - 2006 State vs. Wilson
  - 2009 State vs. Ortega, Jr
  - 2010 State vs. Ortega, Sr