Information Bulletin for Shoeprint/Toolmark Examiners

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Index

INDEX **3**

FOREWORD **4**

THE 3RD EUROPEAN ACADEMY OF FORENSIC SCIENCE (EAFS) MEETING **5**

ABSTRACTS *8*
Pattern Recognition Of Wear, Class and Identifying Characteristics In Footwear Impression Evidence *8*
Interpretation of footwear impression evidence: An image processing approach *10*
The Status of Barefoot Examinations in Europe *11*
Interactions of Spices with Plastics and the Restoration of Erased Numbers in Polymers *12*
Duplication process of sidewinder keys: Traces left on the pattern key and elements of interpretation *13*
The individualisation of tool marks made by a chainsaw in wood. *15*
Forensic Interpretation of the Course of the Event based on the Analysis of Traces Revealed on Clothing *18*
Polish Methods of Earprint Identification *20*
Laser profilometry: the missing link in the examination of polyethylene bags? *22*

MARKS ON THE GROUND : FOOTPRINTS OF MAN OR ANIMAL **26**

UPCOMING CONFERENCES **28**

FOREWORD

Dear readers,

Time flies and soon we can again celebrate the beginning of the New Year. This IBSTE issue is the last one of this year and it contains a short report of the 3rd EAFS meeting in Istanbul and a collection of the abstracts of the oral presentations given in the Marks Working Group's scientific sessions. The presentations, the posters and the workshop given in the Marks WG's scientific sessions were a good overview of the large area of different types of examinations, mark examiners are daily working with.

The start for the 3rd EAFS meeting was very promising for Marks WG, namely the amount of sent abstracts for the Marks WG sessions was much more than there has been in the previous EAFS meetings. But in fact there were finally quite a lot of cancellations of presentations concerning mark examinations due to many different reasons. Now after the EAFS meeting I hope many of you, dear collegues, have already started to make plans to attend the next SPTM meeting in 2005. You will be informed about the SPTM meeting as soon as we have the basic confirmed information available about the place and the dates.

I think during the Christmas time, we all are using more or less time looking also backwards into the past time. It makes good for us sometimes, in between the busy work, to notice that already a long ago many people have been working with the same type of examinations and problems as we are working with nowadays. You can find in this IBSTE a translated chapter from an old french text-book concerning footprint examinations. The publication is from the year 1877 and the chapter is translated by Gerrit Volckeryck.

Season greetings,
Anja Ytti

THE 3rd EUROPEAN ACADEMY OF FORENSIC SCIENCE (**EAFS**) MEETING

Istanbul, Turkey 22-27 of September 2003

Anja Ytti

The 3rd European Academy of Forensic Science meeting was organised in Istanbul, Turkey last September by the Institute of Forensic Sciences of Istanbul University. The Proceedings of the EAFS 2003 included 876 accepted abstracts of oral and poster presentations submitted by forensic scientists from 58 different countries. All the ENFSI Working Groups had their business and scientific sessions at the meeting.

The Marks Working Group had arranged specific program for mark examiners on four different days. The program included oral presentations, poster presentations and one workshop concerning a shoe print case and the conclusion drawn from it, given by Per Krat from Denmark.The collection of the abstracts of the oral presentations you can find in this IBSTE also. By reading the abstracts you can notice that the presentations given in the MWG scientific sessions were a good overview of all the different type of examinations mark examiners are doing nowadays. The presentations were concerning shoeprints, shoeprint coding and shoeprint databases, earprints, key examinations, erased numbers, special toolmarks, plastic bags, bare feet and different type of marks in clothings. Unfortunately there were also quite many cancellations of interesting presentations in the MWG program but on the other hand it is unavoidable because the abstracts had to be sent to the evaluation almost a year before the meeting.

In the business meeting the MWG chair, Dr. Horst Katterwe, presented the Annual report of 2002. The continuing memberships in the MWG steering committee were ratified in the business meeting and two new members were chosen to the steering

committee, to replace the representatives of FSS/John Birkett and SKL/Gösta Strand. The members of the MWG Steering Committee are: Horst Katterwe/BKA, Germany (chair, till January 2004), Isaac Keereweer/NFI, Netherlands, Silvia Ramsl/Austria, Anja Ytti/NBI, Finland, Dave Baldwin/FSS, England, Lennart Jonasson/SKL Sweden.

Our thanks to John Birkett and Gösta Strand for all the work they have done for the Marks Working Group during many years. Specially I want to mention John Birkett, who has been very actively working in MWG since its very beginning.

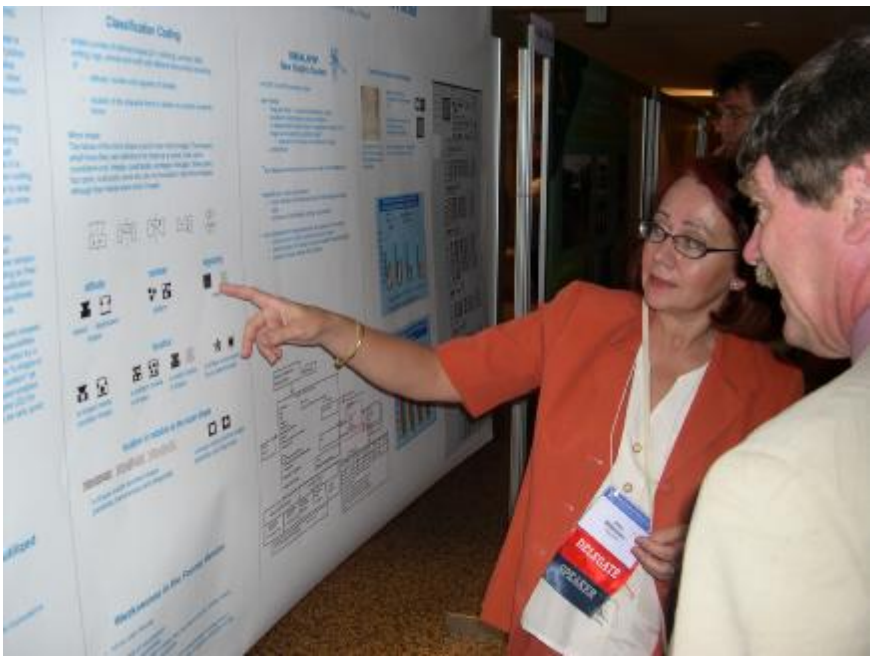
The next steering committee meeting was decided to be held in Zürich in January 2004. The next SPTM meeting has been decided to be arranged in 2005, but the steering committee don't yet have confirmed information about the place and dates.

Generally all the arrangements at the EAFS meeting worked very well. Many thanks to the organisers for the enourmous amount of work they had done planning everything so well. The meeting was arranged in the Istanbul Convention Exhibition Center.

Istanbul Congress & Exhibition Center (ICEC)

Workshop/chair

Workshop/presentor



Poster/ Presentor

Photographs: Bert Lesger

ABSTRACTS

PATTERN RECOGNITION OF WEAR, CLASS AND IDENTIFYING CHARACTERISTICS IN FOOTWEAR IMPRESSION EVIDENCE

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Learning Objectives: *Be able to understand how individuals may be positively identified by their footwear. *Be able to understand how individual's footwear is unique to themselves. *Be able to understand how class characteristics may be identified. *Be able to understand that standardized photographic techniques are essential for recording and accurate comparison purposes.

Purpose: The purpose of the paper is to demonstrate how footwear impressions can be used to positively identify an individual.

Introduction: In the scientific examination of footwear impression evidence, identifying characteristics result when something is randomly added or taken away from a shoe outsole that either causes or contributes to making that shoe outsole unique. Identifying characteristics occur on the shoe outsole with some degree of randomness. The methods used and examples of their value in criminal cases are given. Because of their random nature, they are also unlikely to recur precisely in the same position and orientation on a shoe of the same design, that they can contribute enough weight in the examination to establish positive identity. If both the questioned impression and a shoe contain sufficient identifying characteristics in common, it can be stated without any reservation, that that particular shoe positively made the impression and no other shoe could have made it. Although identifying characteristics usually occur through the use of the shoe, some identifying characteristics such as random air bubbles, damage or incomplete formation of the outsole material, occur in shoes during the manufacturing process and either contribute to or result in a shoe's individuality before it is even worn.

It is important in the comparison of footwear impressions that the degree of wear and the position of wear on a shoe are in agreement with those reflected in the questioned impression. In addition it is important to be able to accurately recognise the manufacturing method and correctly evaluate the significance of that method in a particular examination. Identification based on structural features is nothing more than the recognition of a physical pattern. Such identifications are accomplished by comparing the questioned pattern with a known one. The process of identifying an item by recognition of a physical pattern is widely used, often inadvertently.

Method A standardised photographic technique was used for this study to demonstrate a technique of matching plantar pressure points to the indentations found on the insole of a pair of worn shoes.

Conclusion A conclusive result is achieved by matching similarities between the toe patterns found within a worn shoe and the pressure points of the subject. Plantar pressure points and footprints are unique to a specific individual. Pressure points within shoes are also unique due to each individual's gait characteristics. Humans walk by transferring weight across one foot at a time and, as a result, indentations within the shoe are produced. As pressure is exerted by the foot within the shoe, the areas of the outsole directly beneath the weightbearing areas of the foot will wear more quickly than other areas. This is because there will be greater frictional forces beneath the weight-bearing areas. The entire shoe will adapt to the foot according to the foot's form and function. The reproducibility of a characteristic in both the questioned and known impressions often enters into the assessment of detail in a characteristic. Any characteristic will vary slightly in its reproduction, even under very similar circumstances. There must be some degree of association between the random characteristics on the shoe and the characteristics in the questioned impression before that characteristic can he used in the comparison. There is an increasing need for techniques of image quantification and analysis, plus the assistance of image

processing to improve and enhance images for better understanding and evaluation in forensic imaging.

Detection and recognition of a specific object in a scene relies on its independent properties such as shape, size, contrast, texture, colour and contours (i.e. edges). The understanding and recognition of the potential for the presence of combined class characteristics and their resulting value can, however, contribute significantly to the overall examination results. Pattern recognition identification plays a vital role in forensic imaging. In view of changes of sources to be used in future imaging, a thorough knowledge and application of pattern recognition is important.

Keywords: footwear, pattern recognition, impression evidence, identifying characteristics

INTERPRETATION OF FOOTWEAR IMPRESSION EVIDENCE: AN IMAGE PROCESSING APPROACH

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1276 footwear impressions were collected from male volunteers at an exhibition in Dublin in January 2002. Details of the make and size of the shoe and age group of the wearer were recorded for each impression. In conjunction with the Digital Signal Processing Research Group, University College, Dublin, a method was developed to scan these impressions into a database. Software was developed which can classify the images through feature extraction and pattern matching. This system is fully automatic and functions with minimum user intervention. When presented with an image of a new impression, the system compares the pattern of the impression with the patterns in the database and displays a ranked sequence of matches.

We envisage the system having two main uses. Firstly, when an impression is found at a crime scene, the system can provide information on the make of shoe that may have made the impression (if that pattern is already in the database) and possible links between scenes may be established. Secondly, where impressions made by a suspect's footwear match impressions at a crime scene in pattern, size etc. but there are insufficient features present to permit a unique identification, the system provides information on the frequency of occurrence of that pattern allowing the strength of the evidence to be assessed by the Bayesian method.

Key Words: footwear, image, interpretation

THE STATUS OF BAREFOOT EXAMINATIONS IN EUROPE

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This paper gives the results of a survey looking at how many barefoot examinations have been carried out at different forensic science institutes in Europe after representatives from 20 institutes attended a training course in Tampere, Finland during 1999. It also reviews further developments that have taken place since then in those institutes and others. The examinations are split into two types; 'barefoot impressions at scenes' and 'feet in shoes'. A brief overview of the methods used is given.

The majority of examinations in some institutes are 'feet in shoes' to link footwear to the regular wearer. DNA may offer the potential of linking a person to a pair of shoes. This paper looks at the two different options, which have possibly conflicting demands in respect of sampling and preservation of items.

Keywords: marks, feet, surveys

INTERACTIONS OF SPICES WITH PLASTICS AND THE RESTORATION OF ERASED NUMBERS IN POLYMERS

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Erased numbers in polymeric materials can he revisualized by swelling techniques, relief polishing and/or heat treatment (1,2,3,4). In this paper a new method of restoration - using clove powder - is described. The cloves are spices of the tree Caryophyllus Aromaticus. The idea making experiments with cloves was discovered, when baking Gingerbread Men and it was observed that clove powder reacts with the surface of a little tray of plastic (ABS = Acrylonitrile-Butadien-Styrene Copolymer). The polymer contains finely dispersed particles of butadiene rubber in a matrix of acrylonitrile-styrene copolymer. The component butadiene as a "real rubber component" is the most important factor for the revisualization in ABS, because the property "rubber elasticity" is essential for the revisualization. When a warm stamp penetrates the surface of the polymer, leaving a mark some tenth of a millimeter deep, the macromolecules around the mark get orientated. When erased, there might remain an area of orientated material at the bottom of the mark surrounded by disordered molecule chains. Storing the sample in dry or better in wet clove powder for several hours, molecular relaxations in the orientated regions are induced and the formerly erased marks appear as a small elevation. Responsible for this effect is a component of the etheral clove oil called Eugenol.

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Keywords: erased numbers, recovery methods, clove powder

DUPLICATION PROCESS OF SIDEWINDER KEYS: TRACES LEFT ON THE PATTERN KEY AND ELEMENTS OF INTERPRETATION

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The key duplication process sometimes leaves traces on the pattern key. For this reason, expertises are often applied to have the possibility to determine whether a key has been duplicated or not. Moreover, sometimes requests are made in order to determine how much time has passed since the duplication of the key or how many times it has been used since the duplication. This study focuses on the traces left on sidewinder keys. Sidewinder keys, also called laser keys, are typically automotive keys with (a) biting(s) milled into the widest side(s) of the key blade. Because of the process used to perform the duplication of this type of keys, the traces found on the pattern key are very different from those that can be found on cylinder keys.

This study has two aims, the first is to determine which machines are able to duplicate sidewinder keys, to study their principle of operation (this in particular regarding the reading process of the pattern key) and then to characterize the traces left by these machines. There are two main categories of sidewinder key duplicating machines: the mechanical key cutting machines with a manually guided reading of the key and the automatic electronic key cutting machines. For the first category, the reading of the pattern key by the guide or tracer point is done simultaneously to the cutting of the key blank. The second category of machines permits to duplicate a key either after having decoded the pattern key or by directly introducing the code of the key into the machine. So it is possible that no traces are present on the original key after the duplication. The used procedure was to duplicate several new sidewinder keys of different types with the different key duplicating machines and then to itemize the different kinds of traces, and their location, left on the keys by the guide of the machines.

The results show that depending on the type of the key and on the machine used, the quality of the traces varies a lot. Another important result is that, in case of lack of traces, it is not possible to conelude to the non duplication of a key. The second aim is to determine the persistence of the traces, if present, on the key. Duplicated and non duplicated keys have been used (inserted, turned and extracted) up to 3000 times in their corresponding lock and examined at regular intervals in order to follow the evolution of the traces. Observations have been focused at first on the differentiation of biting marks (manufacturing), duplication marks (left by the guide), wear marks and accidental marks. Then, the question of dating has been evaluated in order to know if it is possible to determine how many times a key has been used after its duplication.

Results show that marks due to wear and accidental marks (observed on non duplicated keys) can be differentiated from duplication marks (observed on duplicated keys). Concerning the persistence of the traces, it has been observed that their degradation depends on their position on the key cut and on their initial quality. It has also been observed that the traces due to wear are not correlated with the number of uses of a key. In conclusion, observations made indicate that it is not possible to determine how many times a key has been used after its duplication. This implies that no estimation of the time passed since the duplication process can be made.

Keywords: keys, duplication process, persistence

THE INDIVIDUALISATION OF TOOL MARKS MADE BY A CHAINSAW IN WOOD.

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A number of wooden power poles had been sabotaged by using a chainsaw to make nearly complete cuts through them. The cuts to the power poles were compared with test cuts made by the chainsaw from a suspect. Microscopic marks within one of the cuts were identified as having been made by one of the links of the chainsaw. To support this conclusion, consecutively manufactured saw chain links were obtained from the manufacturer. A study was conducted of the reproducibility of marks arising from their manufacture, together with a consideration of the manner in which the cutting links were made, to detemine whether or not marks made by the cutting links could be considered an individualisation. This paper presents a study into the identification of a tool mark made by a chainsaw in wood.

There were a number of difficult aspects to this investigation: the nature of the substrate, wood; the multi-cutting surfaces of the chainsaw; the high-speed nature of the cutting action of the chainsaw; and the lack of any previous reported study of this type of tool mark. Two approaches were considered to determine whether or not there was an association between the suspect's chainsaw and the cut poles. These were a comparison of the wood debris on the chainsaw with the wood of the cut poles and a comparison of the tool marks made by the chainsaw as it cuts through the wood. An analysis of this wood debris showed the presence of the same types of wood as the poles. However the evidential significance of this finding was considered to be weak. The second approach was to consider the possibility of a tool mark comparison. The cutting action of a chainsaw is generated by the high-speed circulation of a chain, which consists of altenating left- and right-sided cutting links joined together to form a continuous chain around the saw bar. As the saw chain moves at high speed whilst

being held against wood, each cutting link cuts away a portion of wood. For the model of Husqvarna chainsaw submitted in relation to this case, the saw chain has sixteen cutting links on each side, totalling thirty-two in all. For each revolution of the chain there are sixteen cuts on each side of the bar to form a groove or cut approximately 10 mm wide. For one of the hardwood poles, there were clearly striated marks on the cut surface.

Test cuts were made using the chainsaw in various woods. Detailed striae could be produced when cutting the hardwood eucalyptus pole. The detailed marks were made by a single cutting link making its final cut. Casts were made of the test cuts that had been obtained.

These were compared to a cast of the cut on the pole from the crime scene. One of the test cuts showed an excellent correspondence of fine detail when compared to the cut in the pole from the crime scene. Test marks of each of the cutting links were made by hand by scraping a wax candle along each of the cutting links against the direction of the saw chain. Mikrosil casts were made of all these test marks. Duplicate test marks showed excellent reproducibility. The casts of the test marks were compared with the cut in the pole. Only one of the sixteen right-side cutting links matched the cut in the pole and the test marks from the remaining cutting links could be readily excluded. Although the relevant test cut and test mark showed an excellent correspondence of fine detail when compared to the cut in the pole, it was necessary to investigate the significance of this comparison to determine whether or not it could be considered to be an individualisation. Although wood is a far from ideal substrate for the production of fine detail, in this instance there was excellent detail produced and the quality of correspondence between the test mark and the cut in the pole was very high. Consideration was given to whether or not there was any reproducibility in the manufacture of cutting links that could result in the production of cutting edges on different links that could generate the same or similar tool marks.

An examination of the cutting edge of the cutting link showed that it was formed by a grinding or filing process where the direction of grinding is across the surface of the cutting edge, which is nearly perpendicular to the direction of the cut. The saw chain was identified as an Oregonâ brand, chain type Super 20. The cutting links did not appear to have been re-sharpened. Enquiries were made of the manufacturers, Oregon Cutting Systems Division of Blount Inc., Ontario, Canada. They kindly assisted by providing relevant manufacturing details, a grinding disc, 20 consecutively manufactured left cutting links and 20 consecutively manufactured right cutting links. Test marks for each of the cutting links were made in wax and the ground cutting edge surface of the links themselves were examined. These surfaces did not display any similarity in the grinding marks on successively manufactured links. Mikrosil casts were prepared of the test marks. Many inter-comparisons were conducted, but in particular, the marks made by successive links were compared. No correspondence was found between any of the links and between successive links in particular.

It has been shown that it is possible to obtain an identification of a chainsaw to a cut made by that chainsaw. This can be achieved by comparing the marks made at the base of a cut with test marks made of each cutting link. The formation of the cutting surface by grinding creates a random surface topography. This was confirmed by a study of consecutively manufactured cutting links, which showed no correspondence between the marks made by those links.

Keywords: forensic science, toolmark, chainsaw, wood, cut identification, mark individualisation.

FORENSIC INTERPRETATION OF THE COURSE OF THE EVENT BASED ON THE ANALYSIS OF TRACES REVEALED ON CLOTHING

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Clothing belonging to people taking part in a criminal case provides a lot of useful information pertaining to its full or partial course. It frequently gets stained, dirtied, mechanically damaged, or there remain patterns of features (often individual ones) of objects which got in contact with it. Changes in clothing most frequently occur in cases of: road accidents, homicides, assaults, robberies and rapes, and the specific character of these changes makes it possible, even at the stage of initial analysis, to predict as to what kind of event has taken place. Clothing belonging to a person who has taken part in a road accident is characteristic because of; large damages in the form of tears and blood stains, fragments of paint and glass, oil spots, patterns of car elements (e. g. tyres) [1].

The authors present an example of an expert's opinion made at the Institute of Forensic Research in Cracow, in which there were traces of car tyres and the pattern of the side of one tyre and the logo of manufacturer on the T-shirt of a victim of a road accident. Strong mechanical forces and high temperature which occur in extreme conditions of a road accident bring about various damages to textile products (melting, tearing). Often, heated elements of a vehicle, e. g. seat-belts or their clasps leave permanent patterns on clothing of people taking part in the event. Examples of expert's opinions will be presented in which the revealed patterns of this kind enabled to determine the position of the person (a driver or a passenger) who was in the car at the time of the event.

A person taking part in a homicide, fight, assault or a rape often sustains injuries which result in bleeding. The analysis of the shape and the size of blood stains on the surface of clothing enables to verify the course of the event which is testified by a suspect

involved in the event. If the dried blood drops on clothing have a circular shape one may assume that their dropped perpendicular to the surface of the garment. If the blood stain has a shape of an ellipsis, the flight path of a blood drop can be assessed from the ratio of the longer axis to the shorter one of the ellipsis. On the basis of the analysis of the size of blood stains revealed at the scene of the crime one may conclude as to the length of the path of individual blood drops [2]. The authors present examples of a few of expert's opinions made at the Institute of Forensic Research which prove these assumptions.

Clothing of people taking part in events such as a flight, eg. contains characteristic damages to the continuity of textiles and knitwear. In the expert's opinion being made at the Institute of Forensic Research one can see typical tears along the stitches and other mechanical damages. In cases when the participants of the event used a tool, clothing reveals traces of its use. Traces in textile products after the use of a knife have a whetstone-like shape (stretched ellipsis), or an elongated wedge, leads to the conclusion whether the knife in question was single or double-edged.

This information, together with the additional one concerning the width of the damage, allows the prediction as to the type of the knife used, or the elimination of analysed knives in the course of the investigation. Estimation of the width of the knife-blade on the basis of the width of the damage to clothing is fraught, with a large margin of error resulting from the kind and elasticity of the punctured textile product and the sequence of separate layers of clothing on the body [3]. In the analyses of this kind of damages carried out at the Institute of Forensic Research in Cracow it was found that frequently the width of the damage on clothing differs from the width of the blade of the knife which had been used. However this fact is not exclusively caused by the properties of the clothing or the fabric of which it was made. It was established that the width of traces on clothing depends also on the angle of the insertion of the knife into the body. The more open the angle is, the larger is the cut to the clothing.

The shape of damage to the clothing inflicted by knife and its width do not allow to reconstruct the angle of the blow precisely. In order to carry out such analysis one should know, if possible, the direction of the channel of insertion of the knife into the body of the victim. The above-mentioned examples of the directions in research and particular expert's opinions show that the logical combination of information from the analyses of traces revealed on the clothing of people taking part in the event, allows to reconstruct the course of the event quite accurately.

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Keywords: trace analysis, garment, course of the event

POLISH METHODS OF EARPRINT IDENTIFICATION

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Forensic otoscopy is a investigation technique that deals with identification of humans based on ear traces. In the contemporary forensic science more and more attention has been paid to those traces, which until recently were considered untypical, such as lip, nose or forehead impressions or ear impressions. It should be clearly stated that the value of those traces is not directly related to the frequency of their occurrence but should be attributed to the increased potential of human identification thus contributing to an improved effectiveness of law enforcement. In the investigative practise ear impressions aroused more interest in the late 196Os. Today, it is difficult to detemine the date of issuing first Polish expertise of auricle impressions. In the second part of

1960s, forensic personnel started to be looking at the marks of plot skin structure, lip traces and also ear traces at scenes of crime. According to practice in Poland 88% of ear traces are detected during inspections of burglary scenes. In 96% of cases marks are found on objects which posed an obstacle for the perpetrator, such as doors and windows. Unfortunately, as a rule, auricle marks are revealed accidentally when scene of crime officer searches for lateness.

In Poland, identification of auricle traces is carried out in the following stages: 1 - assessment of evidential and comparative material 2 - group identification examinations 3 - contour method 4 - common characteristics method. The method of determining common features involves comparison of such auricle parts as helix, auricular tubercle, tragus, intertragic notch, antitragus, antihelix, concha, lobule. This method is most important for ear print identification. The research on this field carried out in the years 1998-2002. Ear prints were collected from 1500 persons (including 590 women), coming from various locations around the country. The age of the volunteers varied from 15 to 60 years. Experimental studies have shown that ear prints should be taken with pressure force of 1 kG, 2 kG and 3 kG from right and left ear to use special equipment "otometr".

Altogether 9.000 traces of the ear were examined. As a result of the examination the types of pattems - shapes, catalogue of individual features and system of ear skin structure were discovered. Ear prints can be categorised into five basic patterns - shapes: oval, round, triangular, rectangular, polygonal. The next step in the identification is establishing individual features. The discussed study resulted in the first catalogue of 24 areas on the ear prints . Every areas can be distinguished on each pattern - shape of ear print and consist of subcatalogue of features. (all 24 subcatalogues). This subcatalogues include from 2 to 9 individual features depends on area. We can distinguish also types of these features from subcatalogues. This all

system give us opportunity to use statistic methods to count probability. According to the theory of combinations, using the same principles as in fingerprint analysis, in order to established identity of an evidential trace with a comparative trace, one should determine seven individual features for Poland and nine features for the whole world. However in Polish forensic practice, usually 12-16 common features are distinguished. The system of ear skin structure, if the skin structures are visible and legible, supplement and support the method of establishing common properties. The practical use of ear prints in detection work shows that the trace of this kind carries a huge amount of precious information which can be used in the reconstruction of the event, establishing versions and checking them and identifying suspects. Full utilisation of ear prints depends to a high degree on the skill of members of the law enforcement agencies. The problems involved in otoscopy are relatively little known and thus, so far, ear prints have been used only occasionally, despite their fragment occurrence on the scene of the crime.

Keywords: Marks Identification, Earpints Identification, Forensic Otoscopy

LASER PROFILOMETRY: THE MISSING LINK IN THE EXAMINATION OF POLYETHYLENE BAGS?

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The area of tool marks is one of those domains in forensic sciences, in which several efforts are currently being made to introduce new measuring techniques as well as algorithms for the automatic comparison of traces. The production process of polyethylene (garbage) bags leaves several characteristics, present on the bags, which can be analysed in the tool marks division. Plastic trash bags are frequently present in crime scenes and may play a crucial role as evidence material when containing

narcotics or parts of bodies. Several murder cases are known in Belgium in which plastic bags were used. An examination of such bags is only relevant when other bags are present for comparison.

The main question is whether there is a connection between a plastic bag retrieved on the scene of crime and reference bags recovered e.g. at the suspect's home. Connecting polyethylene bags from different crimes is a second challenge. Plastic trash bags are made of low (LD, branched carbon chains) - or high-density (HD, linear carbon chaing) polyethylene. Due to the fact that a mixture of different types of pellets and even recycled pellets is used, the surface of the bags is heterogeneous. During a first examination macroscopic features have to be considered. These include its dimensions, the shades of colour, the kind of counterfoil, and the type of welded joint. These characteristics allow one to exclude already a large number of plastic bags from different production chains. The next step of the analysis is the investigation of the macroscopic features present as tiger stripes, pigment bands, fisheyes, arrowheads and extrusion Iines. The latter mostly show up as a pattern of parallel, sometimes inclined, Iines. As this typical pattern of extrusion lines continues over several subsequently produced plastic bags, the latter can be matched together. The extrusion lines can he visualised by means of conventional lighting techniques. Crossed Polaroid filters are frequently used to enhance the contrast.

The examination of the extrusion pattern can be approached in a different way by means of a laser profilometer. This focus-detection device is, thanks to its capacity to perform highly accurate measurements, appropriate for a detailed three-dimensional characterisation of surfaces. In the first phase of our research (cf. Berx V. & De Kinder J., 3D Measurements on Extrusion Marks in Plastic Bags, Joumal of Forensic Sciences Vol. 47, No. 5 pp. 976-985) several strips, cut either out of a single bag or out of several subsequent bags were measured by means of laser profilometry; LD as well

as HD polyethylene bags were considered. To reduce the quantity of data from one strip, we extracted the most important features to collect them into a feature vector. Only feature vectors from strips near to each other show a high correlation value, indicating that the height profile of subsequent extrusion lines only persists over a small length scale. This contrasts with the more persistent correlation length of the optical extrusion lines. Taking the hampering heterogeneous structure of the ground material into account as well as the rigidity of the applied filtering and comparison techniques, three additional analysis methods are added. First, as the rough signal is multifrequential, a wavelet filter is applied. Wavelet analysis can overcome the shortcomings of a Fourier transform. The signal of interest is cut into several parts so that information about when and where the different frequency components are present can be extracted. By means of a wavelet filter, the noise into the signal can he eliminated without losing the important information from the extrusion pattern. Further the concept of surface roughness characterisation is considered.

In obtaining a well-chosen characterisation of the surface texture, the various geometrical-microscopic parameters are often of significance. Roughness can be referred to as the short-wave spectrum of the signal. Defined by the standards ISO 4287, ISO 4288 and ASME B46.1, several roughness parameters can he calculated. Comparison of these parameters may provide complementary information to make a connection between several bags or, the other way round, to make a distinction between at first sight resembling sacks. The thickness of the plastic garbage bags varies in time due to pollution of the extruder head during the production process. A specific variation in profile can remain the same over a number of plastic bags. This may provide an alternative means to make links between bags produced by the same extruder head. The correlation length of the thickness variation will be studied. The profile of thickness as well as the transparency of the same samples as those measured by the laser profilometer will be analysed. The combination of the changes in

thickness, transparency and surface profiles can give a decisive answer about their mutual relationship and, based on each of their correlation length, about their relevance in the garbage bag-issue.

Keywords: garbage bags, profilometry, correlation

Gerrit Volckeryck

MARKS ON THE GROUND : FOOTPRINTS OF MAN OR ANIMAL

Dr. A. Lacassagne

(translated from “Précis de Médecine judiciaire”, éditeur G. Masson, 1877 – pages 214-215)

The foot or the shoe makes more or less good impressions in the soil, depending on its nature, its hardness and its humidity. Due to this, one can ascertain the shape of the foot, the placement of the toes, the wear of the outsole and even the placement of the nails. To preserve these marks on loose ground, Mr. Hugolin has suggested to solidify them. One has to heat the marks first by passing a red-hot iron above them, then pour stearic powder into them. If the marks are being made in snow, one can pour liquefied gelatine of a suitable temperature into them.

It may happen that bloody footprints have been found on a carpet or a wooden floor. The marks shown in figure 28

These two examples show how much the shape of the foot and especially of its arc can yield different impressions. The lines we have drawn, according to Dr. Caussé (of Albi), will serve to establish the mark’s identity and can be used to make a comparison

with marks made by a suspect person, walking in the same conditions. If the imprints would be clearly visible, on a carpet for instance, we think it would be easy to trace its contours with the aid of the instrument called the pantograph.

We have to add, according to Briand and Chaudé, that, examining footmarks in the snow or in humid soil, one can determine if the marks were accompanied by those of a wheel of a wheelbarrow or a vehicle or if the individual was leaning on a stick on his left-hand or right-hand side. Likewise, one can examine the marks of horseshoes, of a donkey, a bovine. Taken into account the works of Marey and Carlet which, as a matter of fact, we have studied for a long time (1), we can even get an idea of the way the man or the animal was walking.

(1) see our “Précis d’hygiène” (summary of hygiene), page 194

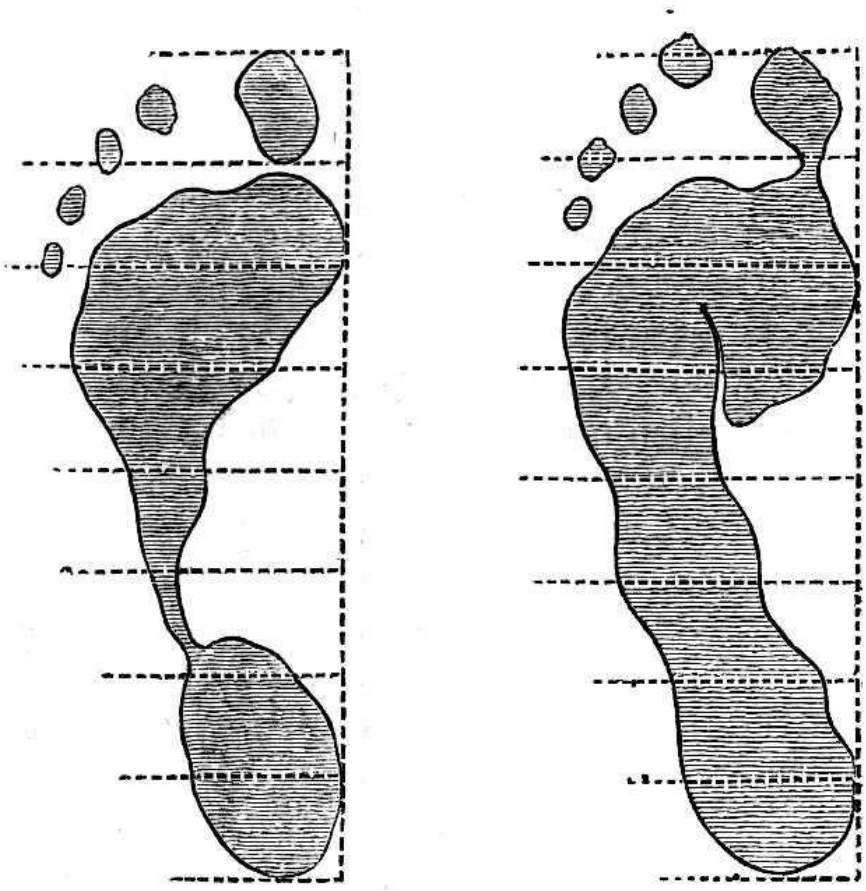

Fig. 28. — Empreintes de pas.

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