WORD AHEAD

The achievement of the tasks of the criminal process, which relate to the identification and punishment of persons who have committed criminal acts, is inextricably linked to the restoration of the truth in criminal cases. Only on the basis of comprehensive and thorough investigations of all aspects of socially dangerous acts can we determine the role of each person involved in the crime and establish with sufficient certainty the circumstances in which the crime was committed.

The basic function of forensic science, as the science of the reasons for the appearance of information about crimes and the procedures and means of discovering, collecting, investigating, assessing and using this information for the effective investigation of criminal offences, is to scientifically provide law enforcement officials and experts with specially developed technical means, tactical procedures and methods of investigating and examining certain categories of crime.

In the system of means of evidence, a special place is given to the corpus delicti. Traces play a very important, and in some cases even decisive, role, as they reflect, in real time and spatial dimensions, certain individual objects in the material environment of the event under investigation.

The perpetrators' actions lead to certain changes in the surrounding material environment. They correspond to the character of certain facts, reflecting the particularities of the impact (influence) of a person or object. In forensic science, these changes are known as “material traces”, and are one of the main sources of evidence used in the investigation and detection of crime.

By refining existing and developing new methods, methods and means of discovering, collecting and investigating traces, forensic scientists have made a substantial contribution not only to the development of forensic science, but also to the many practical issues related to the use of traces in crime investigation.

The scientific development of techniques and methods for detecting, fixing and investigating material traces, the analysis of the laws and mechanisms of their formation on the basis of the achievements of technical and natural sciences led to the emergence of a specific field of forensic science – tracing (the science of traces).

Traceology is a branch of forensic science that studies the mechanism and theoretical basis of the formation of traces, the laws of the appearance of traces, which reflect the mechanism of criminal acts. It also develops and provides us with

many recommendations on the application of methods and means of discovering, collecting and investigating traces in order to establish the relevant circumstances for the investigation of criminal cases. Forensic tracing provides us with knowledge of the following: the theoretical bases of tracing; the reasons for and specifics of the appearance of traces reflecting the mechanism of crimes; the methods and means of discovering, collecting and investigating them in order to establish the circumstances relevant to the investigation of criminal acts; the basic provisions of the methodology of tracing examinations; the system of tracing expertise, etc.

Trace investigations, according to the frequency of the forensic examinations ordered and carried out, are the most widespread area of forensic expertise, since the range of objects targeted during their disposal is quite large: human footprints, traces of clothing, traces of means of transport, traces left by tools, mechanisms, etc. Their use to solve certain identification and forensic diagnostic tasks allows us to obtain information of significant evidential and indicative value.

In recent years, trace specialists have developed new procedures and methods for discovering and fixing traces, much more efficient methods of tracing them have been implemented, and remarkable practical experience has been gained in using traces in the process of investigating and discovering crimes. All of these factors have made it necessary to produce a work that corresponds to the current level of development of tracing.

In this paper we focus on the general considerations concerning crime scene traces, we talk about their classification, we explain the specifics of forensic investigation of certain categories of traces (hand traces, foot traces, biological traces of a human nature, etc.) and, last but not least, we focus on several relevant aspects related to the specifics of the arrangement and performance of certain categories of trace analysis. Forensic transcription and trace analysis are two components which, in their unity, are determined by a single task: to support the prosecution and the courts in identifying evidence that would ensure a complete, objective and objective investigation of crimes and the proper examination of criminal cases.

Studying these aspects shapes the scientific vision of forensic experts (future and present), activates their creativity, initiates them in the issues examined and solved by tracing. The work provides the reader with general scientific provisions and specific techniques for tracing different categories of traces, and reflects the importance and timeliness of arranging and carrying out certain categories of tracing expertise necessary for the investigation and detection of criminal acts.

Authors

Chapter I

Theoretical Considerations on Crime Scene Evidence

Wherever he steps, whatever he touches, whatever he forgets by mistake will serve as a silent witness against him. Not only fingerprints, but hair, textile fibres, glass he has broken, tool marks, blood or collected semen can all be silent witnesses against him. This is evidence that should not be overlooked.

They are not influenced by the circumstances of the moment. They exist even in the absence of human witnesses. They cannot be totally absent.

Only their interpretation can be wrong. Only human failure to find, study and understand them can diminish their value (Kirk, 1974, p. 2).

1.1 General concepts

As the famous Locard Edmond said ,,No one can act with the intensity that criminal action implies without leaving multiple traces of his passage, sometimes the offender has left traces of his activity at the scene, sometimes, by a contrary action, he has imprinted on his body or on his clothes clues of being at the scene of the crime or of his action" (Locard, 1948, p. 68).

The study of traces is the most important research topic in forensic science. Some researchers in this field admit that there is even an autonomous science, traceology, whose object of study is the entire activity of discovering, fixing, lifting and recovering traces (Ciopraga et. al., 1996, p. 12).

Traces are the most relevant and irreplaceable element in the investigation and discovery of criminal acts of any kind.

In the process of investigating criminal offences, the discovery and investigation of traces occupies a special place. Several people are involved in the crime, bringing changes to the material environment of the crime scene, leaving various traces on different objects. Forensic trace investigation allows us to determine the specific object that left the trace, either by assigning it to a particular class, genre or type. With the help of traces, the anatomical, physiological, functional and dynamic characteristics of the person can be established. At the same time, identification and diagnostic tasks are solved (Rusu et. al., 2023, p. 260; Derevyanko, 2007, p. 35).

Since prehistoric times, the need to find food has forced hunters to recognise the marks left by the feet of animals on the ground to be discovered, tracked and caught. Rock paintings found in many places around the world show animal silhouettes, hunting scenes and hand and footprints (Drîmbă, 1984, p. 31). The need for them to study the tracks in order to learn about some of the events that had taken place enabled them to acquire everything they needed to survive (food, water, shelter). Later on, as experience and knowledge of the mechanism of trace formation were gained, the skills of these subjects began to be used in the legal sphere to search for people who had committed antisocial acts, and sometimes also to establish how they had been committed (Golubenco, 2015, p. 22).

Most offences involve the presence of the offender at the place where the crime is committed and the offender taking actions that cause changes to the environment. These changes are known generically as traces, which may remain on the perpetrator's body, the victim's body, their clothes, the ground, various objects, etc., and are of significant importance in investigating the case and establishing the truth (Ruiu et. al., 2016, p. 9).

The investigation of these traces, known in the field of forensic science as crime traces, helps to ensure:

- the reconstruction of the picture of the environment in which the crime was committed;
- the direct identification of the perpetrator and other persons participating or involved;
- the identification of the objects, in one way or another, exploited during the criminal acts;
- the establishment of concrete data on the circumstances of the place, time, mode of action and other circumstances of the crime committed (Doraș, 2011, p. 124).

In the framework of the trace forensic examination, particular attention is paid to the study of traces as impressions of the external structure of the creative object in order to identify it and reconstruct the whole according to its component parts. There are, however, two notable exceptions in this field: forensic dactyloscopy expertise, which deals with the identification of persons on the basis of papillary traces, and forensic ballistics expertise, which focuses on the identification of firearms through the analysis of traces left on tubes and projectiles (Ruiu et. al., 2016, p. 10).

The experience of trace work, combined with a sufficiently developed sense of observation and the ability to generalise systematically, can lead to the art of

„reading" traces. This art of trace tracing is possessed not only by experienced criminal investigation officers and investigators, but also by hunters, natural scientists and military scouts (Golunski, 1961, p. 82).

In the literature (Golunski, 1961, p. 82; Suciu, 1972, p. 200; Mircea, 1999, p. 56; Stancu, 2001, p. 111; Cîrjan, 2004, p. 52), the notion of trace has been defined in two senses: broadly and narrowly.

In the broad sense, traces are the result of changes in the environment caused by human action (intervention), and in the narrow sense, traces are only those changes produced in the environment during the commission of criminal offences (Ciopraga et. al., 1996, p. 37).

Most authors consider trace as any material change produced at the scene and in the process of committing a crime (Păşescu, 2000, p. 34). Some authors define traces as the most varied changes that may occur in the environment as a result of the action of the offender (Golunski, 1961, p. 82), or the totality of the material elements whose formation is determined by the commission of the crime (Suciu, 1972, p. 200), or any material change occurring in the conditions of the commission of a criminal act, between the act and the change produced there is a causal relationship (Stancu, 1992, p. 118).

Other authors, wishing to make more comprehensive and precise distinctions, define by the trace any material change produced as a result of the interaction between the offender, the means used by him and the elements of the environment in which he carries out his criminal activity, changes which, examined individually or in their entirety, may lead to: the establishment of the crime, the identification of the perpetrator, the means used and the clarification of the circumstances of the case (Anghelescu et. al., 1976, pp. 117-118), the trace representing a change created at the place and in the process of committing the crime, by the physical movements carried out at the time by the persons involved in the activity in question; the change produced, by its general appearance, by its specific or positive characteristics, is useful for forensic investigation (Mircea, 1996, p. 15).

In turn, traces, viewed in the forensic sense, have the following general characteristics:

- they necessarily appear in the process of committing a criminal act;
- their creation is the result of the interaction of factors that occur during the commission of the act;
- over time, traces undergo a series of transformations that may lead to their value being diminished in the identification process. For this reason

it is necessary to discover, fix, preserve and exploit them as quickly as possible (Ruiu et. al., 2016, p. 11; Anghelescu et. al., pp. 117-118).

As different as the traces themselves are, so too is the nature of their appearance. The formation of traces may be due to the action of an infinite number of physical, chemical and biological phenomena (Golunski, 1961, p. 82) such as:

- mechanical influences of some objects on other objects (handprints, break-ins, transport, animal tracks, etc.);
- the breaking or fragmentation of objects in the course of committing crimes (destruction of an obstacle, detachment of parts from the means of transport following a traffic accident, etc.);
- the disappearance of objects or substances from their usual place, the appearance of new objects at the scene (shell casing, bullet, instrument, other objects lost or left by the perpetrator at the scene, including micro-objects of a mechanical nature);
- physico-chemical processes, which take place in the course of the crime and which, for the most part, remain invisible (thermal, electrical, magnetic, radioactive traces);
- biological processes (body stains, rigor mortis, hangman's noose, etc.).

The importance of their study is determined by the possibility of solving identification tasks aimed at establishing the identity of the object on the basis of the traces created, including the determination of generic belonging, and diagnostic tasks aimed at establishing the mechanism of trace formation, the condition of the objects, the determination of causal links between certain actions and their consequences (Golubenco, 2015, pp. 25-27).

The great variety of traces left after the commission of a crime has conditioned the emergence, within forensic science, of traceology – a field intended to ensure the implementation of the achievements of the various sciences in the investigation of traces left at the scene or in other similar circumstances (Doraș, 2011, p. 124).

The name ,,traceology" comes from the combination of the words ,,trace" (of French origin, which translates as trail, trace) and ,,logos" (of Greek origin, which translates as order, idea) (Ruiu et. al., 2016, p. 9).

In its early stages, traceology focused exclusively on the traces left by the contact between an object and the surface or interior of another object. In the literature, it is emphasised that the main objective of tracing is to identify material objects by analysing their external features reflected in the environment.

Subsequent research has already led to the forensic exploitation of new categories of traces, which has broadened and modified the scope of tracing. Today, tracing is a well-defined field of forensic science, the aim of which is to understand the laws governing the formation of material traces of crime and to develop the methods and technical-scientific means needed to discover, fix and examine these traces in order to establish the crime, identify the perpetrator and determine all the circumstances of the case (Doraș, 2011, pp. 124-125; Granovsky, 1974, pp. 25-26; Shevchenko, 1975, p. 11; Artamonov et. al., 1977, p. 48).

In this context, the following tasks can be identified as tasks of traceology:

- the identification of the object that created the trace is the main task of tracing. In situations where the object in question is not available for direct comparison, detailed analysis of the trace can provide information on the type and characteristics of the object that created it;
- another important responsibility of tracing is to elucidate the circumstances in which the trace was formed and to explain the mechanism of its formation (Ruiu et. al., 2016, p. 11);
- the development of the technical-scientific methods and techniques necessary for the discovery, documentation and collection of criminal traces is another vital direction in tracing. The ability of the prosecution authorities to carry out their work effectively depends to a large extent on adequate technical and technological equipment. The development and refinement of the means necessary to carry out these activities is a fundamental task in forensic tracing;
- the development and application of forensic tracing methods is the final stage in the forensic trace investigation process. The aim is to evaluate and properly interpret the information obtained from the traces analysed (Doraș, 2011, p. 125; Gheorghiță, 2006, p. 288).

1.2 Classification of Traces at the Crime Scene

The diversity of changes that take place in the material world as a result of human intervention means that traces also take on many different forms and appearances, and their classification becomes very difficult. Therefore, for didactic reasons, the classification of traces is based on multiple criteria (Ciiopraga et. al., 2001, p. 37; Suciu, 1972, p. 200; Stancu, 1994, p. 137).

Obtaining a unified view of the track system and highlighting the interdependencies between the different categories, groups and subgroups of