

The Question of Identification and Individualization in the Science of Criminalistics

BALLÁNÉ FÜSZTER Erzsébet¹

The reconstruction of a criminal event depends on the testimony of the people involved (victim, suspect and witnesses) and the thorough examination of the available physical evidence. In answering the questions that occur during an investigation, it is mostly the specialists of criminalistics and forensic scientists that may come to our help. Identification is an essential element of criminal investigation. In criminalistics, the term refers to a complex procedure that both identifies an unknown material and also aims to unveil its origins.

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The happenings of the material world are a series of actions and events in which the participating parties are always altered and undergo change. The same principle applies to crimes, where the scene of the crime, the people and objects involved are no longer in the same state as they were before the crime took place.

The reconstruction of the events depends on the testimony of the people involved (victim, suspect and witnesses) and the thorough examination of the available physical evidence.

To be able to identify how, where, when and by whom the crime in question was committed, it is essential to study the clues and physical evidence for we may obtain much useful and matter of fact information.

In answering the questions that occur during an investigation, it is mostly the specialists of criminalistics and forensic scientists that may come to our help. Criminalistics and the “mother sciences” of forensic sciences (biology, chemistry, physics and medicine) – with the use of their scientific methods and equipment – are able to identify unknown things and their origins.

¹ Prof. BALLÁNÉ FÜSZTER Erzsébet, PhD, Police Colonel, Head of Department, National University of Public Service, Faculty of Law Enforcement, Institute of Criminalistics, Department of Criminaltechnics.
ORCID: 0000-0001-7299-4954. fuszter@gmail.com

What Do We Mean by Identification in Criminalistics?

The definition of identification used in criminalistics and forensic sciences slightly differs from its definition in the common language. In criminalistics, the term refers to a complex procedure that both identifies an unknown material and also aims to unveil its origins.

The procedure can be divided into two phases. During identification, the object in question is defined and classed into a smaller or larger group of things/objects etc., while individualization points to a unique source.

Practically, identification means examining prints and marks, physical evidence and other relevant items related to a certain case. To be able to reconstruct events while uncovering a crime, it is usually necessary to point out the exact source of the evidence.

The Theory of Identification in Criminalistics

The aim of the identification procedure is individual identification, meaning that one object can be told apart from another without any doubt. The main criterion of criminalistic identification is the indisputable scientific validity of each theory and method applied during the process.

Theoretically, identifying the origin of a certain item (print, physical evidence, handwritten text etc.) is only possible when there is one singular object that bears the traits of the item in question.

The methods of criminalistic identification are based on the philosophic principle of uniqueness, meaning that no two distinct entities can be exactly alike. This idea should be solely regarded from a philosophical aspect for it can be neither confirmed or infirmed by scientific methods. Empirically it cannot be proven for we are unable to examine and compare all entities that exist, or have existed in the past or are to exist in the future. Therefore, we accept the uniqueness of every entity as a philosophical axiom that serves as a cornerstone in both philosophical and mathematical reasoning.

Concerning the uniqueness of objects, Nickell and Fischer said the following:

“No two things that happen by chance ever happen in exactly the same way.

No two things are ever constructed or manufactured in exactly the same way.

No two things ever wear in exactly the same way.

No two things ever break in exactly the same way.”²

The question of the uniqueness of things – that nothing has two exactly identical copies – appears often in the history of philosophy as well. Heraclitus³ was the first to cite similar principals in his fragments:

“No man ever steps in the same river twice (B91a), for it’s not the same river and he’s not the same man (B12).”

² Nickell–Fischer (1999) 3.

³ Heraclitus a Greek philosopher of the late 6th century BCE.

Leibniz⁴ also dealt with the question of identity. He put down his thoughts in the following statement: “If two things are alike in every aspect, then they are the same object, and not two things at all.”

Quetelet⁵ claimed: “nature never repeats itself”. He came to this conclusion with the use of the product rule,⁶ a fundamental tool of probability theory. He recognized that the probability of the coexistence of two things that were completely alike was so small that it was basically zero, due to the infinite number of existing things and their multiple characteristics.⁷

In general, every object and living being can be described by a group of characteristics. During the identification process, the examination of these elements permits the identification of the entity, its source or establishing the identity of the person. The underlying principle of the process is the uniqueness of things.

Living beings, like humans, and all objects can be sorted into two groups according to their characteristics. Class characteristics apply to similar entities that can be sorted in the same group of objects. On the other hand, individual characteristics can only apply to a singular entity, making it different from all other objects in the same group.

During the identification process, specialists – especially forensic scientists – analyse these classes and group characteristics in order to answer the specific questions that occur during a case.

The Process of Identification

The first phase of the identification process – and the forensic investigation – focuses on uncovering characteristics, while the second phase is always a comparative exam, which is preceded by drawing conclusions and issuing the forensic expert report.

One of the participating elements of the comparative phase is always the object in the focus of the investigation (e.g. fingerprint found on the crime scene, blood mark on the suspects clothing, a paint fragment of the vehicle implicated in a hit and run incident) and its unveiled characteristics, which needs to be compared to the reference sample.

The Levels of Identification

The main principle of criminalistic identification is the ability of identifying and telling apart one single person or object who or what was involved in the crime in question from all the other people and objects on Earth.

⁴ Von Gottfried Wilhelm Freiherr Leibniz (1646–1716) was a German objective idealist philosopher and mathematician. Leibniz’s Law means the Indiscernibility of Identicals which claims that self-identical objects must be indiscernible from themselves and the Identity of Indiscernibles which claims that indiscernible objects must be identical.

⁵ Lambert Adolphe Jacques Quetelet (1796–1874) was a Belgian astronomer, mathematician, statistician and sociologist.

⁶ Product rule: a fundamental tool of probability theory that yields the joint probability of independent events by multiplying their separate probabilities $P(A \text{ and } B) = P(A) \times P(B)$.

⁷ Saks-Koehler (2008) 199–219.

The awareness of geographical and time restrictions, the possession of other information and data acquired during the investigation may help us decrease the number of potential people and objects. This is why we never have to deal with contemplating infinite possibilities in the first place.

In other words, identification is a reductive process during which the number of potential entities in question can be diminished with the help of targeted investigations to a level where individual identification is possible, thus a certain object and its source can be identified without doubt. Practically, we are able to tell who left his/her fingerprints at the crime scene, which rifle fired the shot, whose DNA can be found on the murder weapon etc.⁸

In most investigations, the possible source of forensic evidence can be limited to a certain group of entities. These group-identifying investigations bear an important value in criminalistics, for they can reduce the infinite number of possible sources to a finite and easily definable number of entities, from which the object in question can be identified with the use of further criminalistic investigations.

In most fields of investigations (paint, metal remnants, soil, textile fibres, drugs, poisons, explosives, physical evidence of burn catalysts and shot etc.) we are only able to identify class characteristics.

The possibility of individualization mostly applies to the fields of finger, palm and other prints associated to body parts, tool marks, footprints, rifle identification and handwriting examination.⁹

We must accentuate the importance of biological evidence that is eligible for DNA-typing, for the newest DNA techniques offer such a high level of accuracy with probabilities of 1×10^{-15} and 1×10^{-20} that they can be interpreted as individual identification.

The level of identification refers to the most predominant statement that can be made about the object in question, meaning that whether identification can be done on a class or on an individual level. Expert opinions dealing with the source of evidence can be thus based on probability or category.

Describing probability can be either numeric or textual. There have been several attempts at an international level to establish a widely used and acknowledged nomenclature, but a significant breakthrough is still yet to come.

In case of individual identification (individualization), when a certain object and its origins can be defined, the conclusion of the specialist will be categorical. When giving a categorical opinion, the expert clearly pronounces the origins of the entity.

The “Proving” Force of Specialist Opinions

Identification is an essential element of criminal investigation, but identity pronounced by experts is not equivalent with identity proven in court. The latter is the task of the

⁸ Champod (2000) 303–309.

⁹ Broeders (2014) 3513–3526.

judge who relies on both the reports of the forensic experts and on other evidence available in the case. The level of identity can be interpreted by mathematics. Probability theory and formal logic are tools that provide us with help in this task.

The proving force of evidence can be calculated objectively with putting the physical evidence in a mathematical formula. With the use of Bayes' theorem,¹⁰ one can calculate the probability of the repetition of each event and therefore facilitate the delivery of a verdict.¹² The use of Bayes' theorem is mostly necessary when the report of a forensic expert contains statements including probability. To sum up the essence of the law without getting into the details of its complicated mathematical elements, the formula can be solved like this: *a priori odds x Likelihood Ratio = posteriori odds*.

The most critical part of the analysis is establishing the *a priori odds*, which – depending on the case in question – are for example the data collected during the investigation, testimonies, other physical evidence and expert opinions etc., all which are essential in establishing the probability of the null hypothesis.

Defining the Likelihood Ratio is always the task of the forensic expert, for it can be only done based on the results of the previous forensic analyses. Finally, the posteriori odds calculated by Bayes' theorem would give the probability of our null hypothesis.

To give an example, if the origin of a bloodstain is the object of Bayes' theorem, the *a priori odds* depend on the judge's judgment whether he/she believes the blood originated from the suspect and not the victim. The Likelihood Ratio is derived from the incidence rate of the genetic profile obtained by forensic examination. In other words, according to the expert, what is the probability that the bloodstain found on the suspects clothing is the blood of the victim.

After examining the evidence, the judge decides how likely it is that the blood originated from the victim – these are posteriori odds.

Science, technology and the continuous development of scientific methods help forensic experts to identify more and more evidence, thus they facilitate the establishment of the verdict.

¹⁰ Thomas Bayes (1701–1761) was an English Nonconformist theologian, mathematician, statistician, philosopher and Presbyterian minister. He set out his theory of probability in 1764.

¹¹ Bayes' theorem (or Bayes' Law and sometimes Bayes' Rule) is a direct application of conditional probabilities. It is a simple mathematical formula used for calculating conditional probabilities. The theorem of probability describes the probability of an event, based on prior knowledge of conditions that might be related to the event.

¹² Downey 2012.

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