

## THE BEGINNINGS OF USING FINGERPRINTS AS BIOMETRIC CHARACTERISTICS FOR PERSONAL IDENTIFICATION PURPOSES

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**Abstract:** *Fingerprints were used at the beginning for forensic purposes. The study and use of fingerprints started from the mid-19<sup>th</sup> century. After several researches, they were used for control access and for other purposes. This paper will present a brief history of the fingerprints usage from the beginning of their development, with the most important authors and their researches.*

**Key words:** *biometrics; internet banking; fingerprints; tokens.*

### 1. INTRODUCTION

Biometrics is a term derived from the Greek words “bios” (life) and “metrikos” (measure) and stands for a personal identification that uses measurable characteristics of a person.

During the development of biometrics, multiple characteristics that are suitable to uniquely identify a person were taken into the account.

The most used biometric characteristics are fingerprint, face, iris, palmprint, gait, signature, keystroke, etc. and are presented at large in the book [1].

Bellow will be presented the beginnings of personal identification by using, in the first, the anthropometry, and then the fingerprints.

### 2. THE PRECURSOR TO THE FINGERPRINT IDENTIFICATION – ANTHROPOMETRY

At the beginning of the researches in this field existed different ways to identify a person. In 1879 Alphonse Bertillon, a police officer in Paris, introduced the anthropometric registering system ([2]).

He demonstrated that by registering more dimensions of the human body (i.e. waist, width, height, head circumference, height of right ear, length of several phalanges and other bones from the left hand), it would be almost impossible to find two individuals with absolutely the same dimensions.

Romania was one of the first countries in the world that adopted the identification system proposed by Bertillon.

But the anthropometry didn't last too long, really quickly revealing its deficiencies and error possibilities. The main imperfections of this method, we can mention: (i) the instability of the human body's parameters (it wasn't applicable to children and teenagers); (ii) subjectivism in measuring the important parts of the human body (police officers didn't place the measurement instrument in the same point all over the time); (iii) decalcifications, caused by the aging, diseases or trauma, producing the modification of the dimensions of human skeleton ([3]).

While the anthropometry was revealing these problems, some researchers started to study the fingerprints.

### **3. THE BEGINNINGS OF STUDIES IN USING FINGERPRINTS FOR IDENTIFICATION**

Simultaneously with anthropometric and photographic recording methods, which were more understandable and easily to introduce them in police practice, the dactyloscopy was born. This method is one of the safest that can be used for positive or negative identification. However, in the beginning, its development was much slower and the method was more difficult to understand for police officers and lawyers.

The term of “dactyloscopy” comes from the Greek words “daktilos” (meaning “finger”) and “skopein” (to examine, to discover). Thus, the term signification is: a personal identification method by examining the fingerprints. This term is still used, but mainly for forensic purposes. According to “Enciclopædia Britannica” – [4], the dactyloscopy stands for “the science of fingerprint identification”. Also, “dactyloscopy relies on the analysis and classification of patterns observed in individual prints.”

Many authors are considered the discoverers in the field of using fingerprints for identification because all of them, without knowledge of each other, in the same time and in different places, were preoccupied by researches and experiments which concerned the personal identification by drawings formed by the lines that relies on the inner face of the fingers and palms.

In 1884 Sir Francis Galton started to study the

Starting with 1858, William Herschel, a British officer in India, has used for 20 year the fingerprints to distinguish the indigenous in order to pay their salary, because they hadn't an ID and for a European they look alike. In the meantime, Herschel discovered that fingerprints taken from an individual weren't identical with others' and learnt how to distinguish a fingerprint from another and further more to identify the people by using the “finger picture”, as he called this method. From an anatomy handbook he took the term of “papillary lines”. Following this experience, in 1877 he wrote a letter to the General Inspectorate of Prisons in Bengal, outlining his findings and proposing the usage of fingerprints to identify people. But it wasn't yet the time for such a revolutionary method, so his project wasn't approved. His book [5] was published in 1916, one year before his death.

Almost contemporary with him, in 1879, dr. Henry Faulds, a Scottish physician in a Japan hospital and professor at Tokyo University, who never heard anything about Hershel and his experiences in India, found in Japan some prehistoric shards on which he observed some fingerprints. In 1879 and 1880 he started to study them and he was interested in the variety of the papillary drawings, if exists differences between nations and if they are hereditary transmitted. Henry Faulds was the first that used the fingerprints in order to discover the author of a delinquency.

After he solved two cases with the help of the fingerprints, he was convinced that he invented a probation method. He wrote a letter to the “Nature” magazine in London presenting his findings. The letter was published on the October 28, 1880, 3 years after the letter addressed by Hershel to the General Inspectorate of Prisons in Bengal. Herschel, who in the meantime had come to London, reading Faulds' communication, addressed himself a letter to the magazine, claiming the fact that he was the first that used fingerprints for identification. Being extremely angry, he didn't observed that Faulds came with original ideas. Faulds responded to the accusations, and so a fight for priority began between them.

fingerprints. Four years later he found by mistake the researches presented above and he addressed to the “Nature” magazine for clarifications, who responded by sending him the Herschel’s address. Galton, who was doing anthropometric researches, as a request from the “Royal Institution” in London, got acquainted with the Herschel’s works and he realized their importance in comparison with the Bertillon’s methods. He moved to a higher stage than his predecessors by trying to figure a classification of the fingerprints. He discovered four basic types of drawings: with a triangle in right (called “deltas”), a triangle in the left, others with 2 triangles and, finally, some without any triangle. If a combination between these 4 basic types and 10 fingers is made, then results a number of 1,048,570 different combinations and, in this way, the classification problem would be solved. All this findings were published in 1892’s book called “Finger prints” – [6]. The year this book was published can be considered the birth year for the using of fingerprints for identification.

The introduction of dactyloscopy at the beginning of the 20<sup>th</sup> century in police’s practice was due to the discovery of some criminals by using fingerprints, but also because of some personalities, like Francis Galton and Edward Henry in Europe and Juan Vucetich in South America. In 1891, Juan Vucetich was charged by the Police’s chief in La Plata, Argentina, to study a new identification system discovered in Paris: the anthropometry, and to introduce it in the practice. On this occasion, his chief provided him a French magazine, “Revue Scientifique” from May the 2<sup>nd</sup>, 1891, where he found some articles about the Galton’s experiences referring to dactyloscopy. Few days later he put into operation an anthropometric measurement system, but he wasn’t quite enthusiastic with this recording method. But he was attracted by the Galton’s method and in only 6 weeks he established the great variety of (unrepeatable) papillary drawings, as well as the fact that they are unchanging for the same individual and clarified the basic principles in their classification. Vucetich discovered independently the four basic forms established by Galton, although the magazine didn’t presented them.

He contributed in solving different cases using fingerprints and tried to present this new method to his chiefs, but they were much too narrow-minded. In 1893 he published, on his own expense, two books on this new method. His books have demonstrated the efficiency of this new method. The next year, the advantage of the dactyloscopy was acknowledged, and from 1896 the Argentinean Police of the South America’s states introduced, one after another, his identification system: Brazil and Chile in 1903, Bolivia in 1906, and after 1908 Peru, then Paraguay and Uruguay.

In Europe it had to pass several years before this method to be introduced, especially because of the more powerful conservatism. A vigorous push has received the dactyloscopy in 1896, when Edward Henry, a scientist preoccupied for three years to find a fingerprint classification method, discovered the way to catalog millions of fingerprint cards in a classifier, in such a way that each could be found in the shortest time. Besides classifying fingerprints into five basic drawings, he proceeded to a subdivision of them, which presented a great importance on the recording and keeping out the fingerprints. Henry, like Herschel, who was a British official in Bengal, India, addressed in January 1897 to India’s general governor, with the proposal to form a committee that should decide the introduction of the dactyloscopy instead of the anthropometry. On July the 12<sup>th</sup>, 1897, the India’s general governor ordered the cessation of anthropometric measurements and the introduction of dactyloscopy in the entire British India. Meanwhile, Henry continued his researches and militated for the application of dactyloscopy in the discovery of the criminals by the fingerprints left at the crime scene.

We can observe that four Europeans: William Herschel, Dr. Henry Faulds, Sir Francis Galton and Edward Henry, had developed the dactyloscopic method for the identification and registering of criminals, but this was introduced for the first time in India, while in Europe was still used an imperfect anthropometric model.

A famous case, that happened in London, known with the name “the Beck case” – [7], who shocked the UK because it was a seriously mistake of justice, was the decisive reason that

country that introduced the dactyloscopy for criminal identification, paving the way for its implementation across the entire Europe.

#### 4. THE BEGINNINGS OF USING FINGERPRINTS IN ROMANIA

Due to the rapid circulation of scientific and cultural values, global progresses in science and technology have entered the second half of the 19th century in Romania, at first timid and unsteady, then, after the Union of the Romanian Principalities and connect to Europe , increasingly faster. A noteworthy fact is that judicial photo is practiced in our country since 1879, the year of birth of anthropometry in Paris, which places Romania among the first countries in the world that used photography for judicial purposes. 1892 is the year recognized for the introduction of anthropometry as a scientific method for registration of offenders and recidivists discovery, because now it is established the first anthropometric service in the Bucharest's Palace of Justice. Judicial Identification Service was organized in 1895 under the leadership of Dr. Andrei Ionescu, who was not a police officer, but a medical-examiner. This service used anthropometric records that also had face and profile photos, as well as four fingerprints from the right hand. Dr. Mina Minovici was the one that choose and trained Dr. Andrei Ionescu as a identification service chief. The first anthropology school was established in 1892, for the training of officers and policemen, where, in addition to anthropometry, was taught spoken portrait. Because anthropometric system proved to be quite cumbersome and imprecise, there were sought other technical and scientific means for identifying criminals, reaching shortly to dactyloscopy. Prof. Dr. Nicolae Minovici, medical-examiner with an important European reputation, although at the beginning was one of the promoters in using anthropometry in our country he was among the first convinced followers in using dactyloscopy in our country. He obtained several positive results in discovering criminals by using their fingerprints. As a result of his researches, this system was introduced in our country since 1914.

only after 1905 the UK was the first European Romania and France were the last countries in Europe that adopted this system. The development of the system continued and the methods are still developing further.

#### 5. CONCLUSIONS

In this paper we presented the beginnings of using fingerprints for identification. As it could be seen, the fingerprints are used for more than 100 years and the development of methods to uniquely identify them is still in an exponential growth. Parts of this article had been presented in our article [8], but this scientific research is more elaborated and complete. There exist serious reasons to believe that the fingerprints will be used for a long period of time from now on.

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