

How the Innovation by an Indian Sage Transformed into a Global System of Fingerprint Identification: An Overview

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Abstract

Fingerprints are the criss-cross lines on the fingertips. These are called *ridges*. The pattern formed by ridges is so unique that it is not repeated on any other finger. For this reason, fingerprints serve as the most infallible means of identification, especially in criminal cases. The science of fingerprint identification originated in India more than five thousand years ago. A sage named *Samudra Rishi* studied the patterns of ridges on fingertips and categorized these into three broad types. The same threefold categories are relevant even today – albeit with a different nomenclature. About 125 years ago, the world's first fingerprint bureau was established in India. It was christened *Bengal Fingerprint Bureau* and was housed in Writer's Building in Calcutta (now Kolkata). Since then, Indians have consistently studied and researched this branch of knowledge, traversing from initial speculation stage in ancient era, to its development into a perfect system of identification in modern era.

The present paper traces the evolution of fingerprinting in Indian history, emphasizing that we Indians were passionate about this discipline and were aware of its importance at a time when no other country had an inkling of it

Keywords: Fingerprints; History; Minutiae; Patterns; Ridges

Introduction

Whether one believes in theological genesis or anthropological provenance of man, it is beyond doubt that each person is individualized by his or her fingerprint impressions [1]. Today, fingerprint individuality is ubiquitous all over the world, but when we dive into the history of this subject do we realize that Indians knew about the significance of fingerprinting before any other civilization had a glimmering of it. From ancient era to present times, Indians have brought about metamorphosis of fingerprint science to a stage where it has replaced all other trivial systems of identification [2].

The history of identification by virtue of ridge characteristics on fingertips, as it originated in India, and then became worldwide, is described in this communication.

Fingerprinting in Ancient India

Since ancient times, fingerprinting has remained intertwined with Indian culture and civilization. An Indian scripture, *Samudra Shastra*, compiled by a sage named Samudra Rishi in 3102 BC, tells us a great deal about fingerprinting. The modern forensic scientists advocate that fingerprint patterns may be classified into three broad types: Arches, loops and whorls (Figure 1A). It has also been observed that statistically, 5% of fingerprints have arch pattern, 60% are loops and 35% are whorls. Samudra Shastra too identifies three types of fingerprint pattern (Figure 1B). Two of these, *shankh* (corresponding to loops), and *chakra* (corresponding to whorls) are quite common and prevalent, but the third type, *seep* (corresponding to arches) is rare. It is not surprising that the fingerprint examiners of modern era and Samudra Rishi of ancient era reached the same conclusion. The astonishing fact is that what the experts inferred merely one hundred years ago, the holy man could ratiocinate more than 5000 years ago! There is no written record on description of fingerprints prior to Samudra Shastra [3].

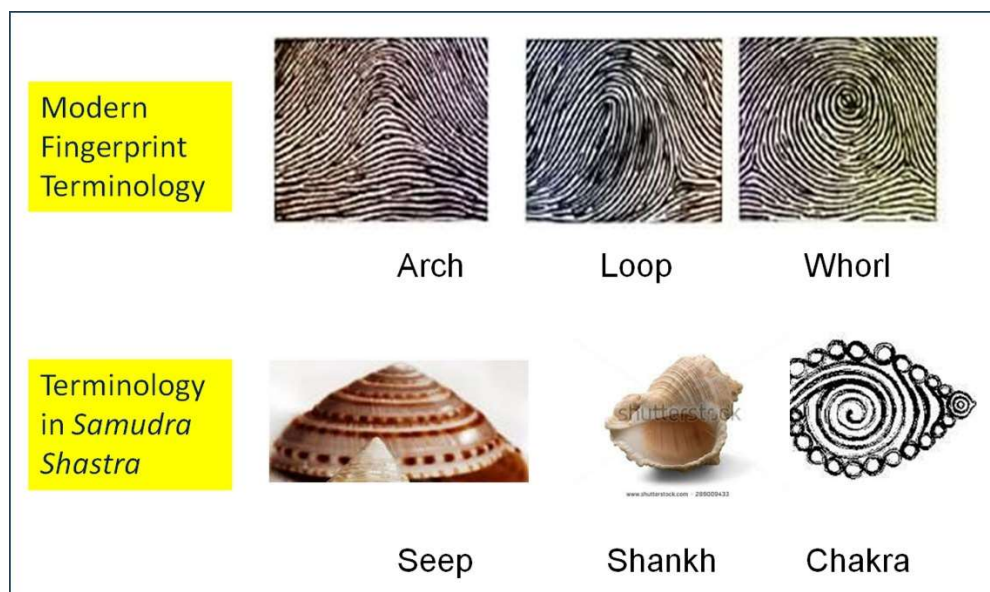


Figure 1. Fingerprint patterns in modern era and ancient era (Figure by authors)

Embedded within the arch, loop and whorl ridges are minute irregularities, called fingerprint characters or *minutiae*, which interrupt the parallel flow of these patterns. Modern fingerprint examiners recognize seven main types of fingerprint characters (Figure 2A); *Samudra Rishi* too identified a number of minutiae as depicted in Figure 2B. A comparison of Figures 2A and 2B reveals that *apuran java*, *puran java*, *padam* and *aax* are concurrent to *bifurcation*, *lake*, *hook* and *island* respectively, of modern fingerprint discipline. *Nirpaax* and *kundla* are close to island, while *kamal* is close to lake. *Toran* appears similar to crossover (Sodhi and Kaur 2003). The fact that the portrayal of fingerprint characters in *Samudra Shastra* is far less tangible than what it is now reflects the limitations of technology when the scripture was written.

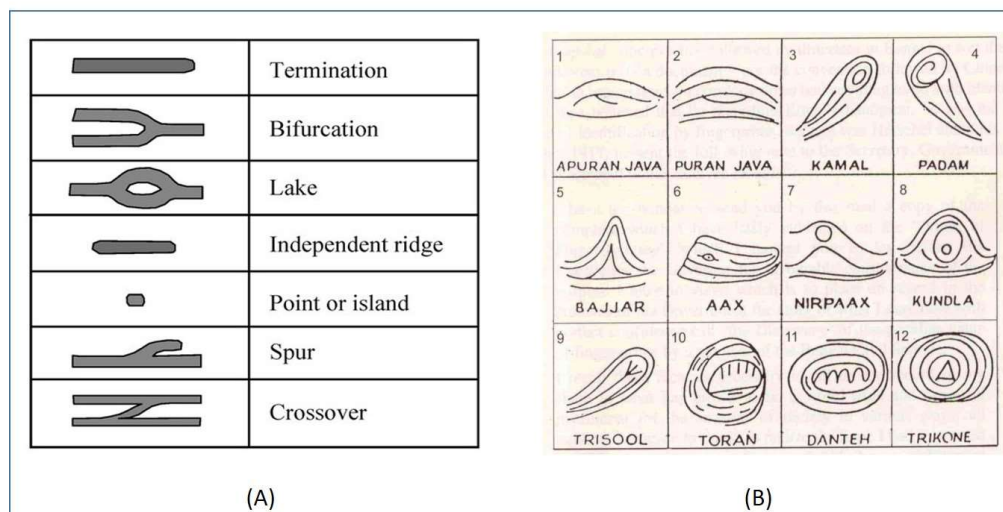


Figure 2. Fingerprint characters in (A) modern era and (B) ancient era (Figure by authors)

It must be acknowledged that *Samudra Shastra* does not correlate the ridge patterns or ridge characters with identification. It deals with astrology – the science of predicting the future. It advocates that the destiny of a person is controlled by the number of *seep* (arches), *shankh* (loops) and *chakra* (whorls) on his or her fingers. However, this subject is beyond the scope of the present paper. Suffice it to say that since in the ancient era the Indians studied the

ridge patterns of the fingers so minutely and so meticulously, that by the beginning of the Middle Ages they could perceive the utility of fingerprints for identification purposes.

Fingerprinting in Modern India

Sir William Herschel (1833-1917), an English officer, started studying fingerprints when he was posted in India during the latter half of nineteenth century. He propounded the concept of ridge persistency, according to which the patterns of criss-cross lines on the fingertips or palms of an individual remain unchanged from birth till death. It goes to the credit of Herschel that he propounded the theory of ridge persistency, implying that fingerprints remain unchanged throughout one's life time. Later, he realized that it was more advantageous and less cumbersome to use the impressions of right index and middle fingers as against using the entire palm. He also made it mandatory to append fingerprints on all legal deeds [5]. In 1895, the two-finger impression system suggested by Herschel was further simplified by Inspector General of Registration, who, in turn, notified that a thumb print alone would suffice for identification purpose [6].

The modern period saw the establishment of the world's first fingerprint bureau in India [7]. It was named *Bengal Fingerprint Bureau* and was set up at Calcutta (now Kolkata) in 1897. Thereafter, the study of fingerprints became more organized, systematic and scientific. From that time onwards, this science came to be known as *dactyloscopy*. It is based on the following three principles.

1. *No two persons and no two fingers of the same person have identical ridge design on the fingertips.*
2. *The fingerprints remain unchanged throughout life.*
3. *Fingerprints can be classified for maintaining criminal record.*

The Bengal Bureau became a centre for innovation in the field of fingerprinting – and here too the Indians made a mark for themselves. The classification system of fingerprints was worked out by two native officers of Bengal Police, Sub Inspectors Azizul Haque and Hem Chandra Bose. This formula was adopted worldwide by all the civilized nations [8]. The need for this exercise arose because criminals make use of fresh aliases whenever they shift the scene of their operation in order to obscure their past history. In addition to working out the classification formula, Hem Chandra Bose also invented a technique of telegraphically transmitting the fingerprint record from one fingerprint bureau to another [9].

Fingerprints in Criminal Investigations

The earliest reference to fingerprinting in a legal report appeared in the Section 45 of the India Evidence Act 1872, as amended in 1899 [10]. In fact, the world's first conviction on the basis of fingerprint evidence also took place in India, the case being monitored by the Bengal Bureau [11]. According to Indian law, when a person is arrested, his fingerprints are recorded on a special type of proforma, called the *index card*. This card was designed by the Bengal Fingerprint Bureau and later modified by the *Central Fingerprint Bureau*, under the aegis of *National Crime Records Bureau, Ministry of Home Affairs*. Each finger of the suspect is rolled on a fingerprint ink pad from nail edge to nail edge, so that an even, thin layer of ink gets applied in the area between the and tip and the first joint. The inked fingers are then rolled, one-by-one on the index card. This record of ten rolled impressions is called *inked fingerprints*. If the same suspect commits another criminal activity, he/she will leave a set of invisible finger impressions at the crime scene. The invisible impressions are called *latent fingerprints*. The latter may be rendered visible with the aid of one or more chemical reagents [12]. The visible impressions are called *developed fingerprints*.

Next, the fingerprints lifted from the crime scene are matched with the inked impressions on the index card. The matching is carried out in two steps. First, the outer pattern (arch, loop and whorl, as shown in Figure 1) is compared. If the outer patterns in the two impressions are different, the possibility of these being made by the same finger is ruled out, and there is no need to go to the second step. On the other hand, if the outer pattern is same, then the second step mandates that the type and position of fingerprint characters (as shown in Figure 2) be compared. According to the Indian law, if at least eight fingerprint characters in the inked impressions tally with eight fingerprint characters of the same type in the developed impressions, then the two finger marks have been impinged by the same finger.

There is one in 6.4×10^{10} chance that eight characters of one finger will bear qualitative and quantitative likeness to eight characters in another finger. And the world's human population is 6.8×10^9 – almost one-tenth of this figure!

Conclusion

More than five thousand years ago, an Indian sage by name of *Samudra Rishi* made a detailed study of ridge patterns on the fingertips of individuals, as well as of the minute fingerprint characters embedded therein. Since then the science

of identification, by way of fingerprinting, has remained inalienable part of Indian culture and civilization. In the modern era, the first fingerprint bureau of the world was established in India. Working at this bureau in Kolkata – the Bengal Bureau as it was called – two Indian police officers, Sub Inspectors Azizul Haque and Hem Chandra Bose invented a formula for classification of fingerprint record. More than one hundred and twenty-five years later, this classification is as relevant today as it was when Haque and Bose invented it. In fact, the criminal record bureaus all around the world classify the fingerprint record on the basis of this formula. The method of recording ink fingerprints and initial technologies of developing latent fingerprints were both worked out at Bengal bureau. The comparison standards too were worked out in India.

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