CHAPTER 5

SYSTEMS OF FRICTION RIDGE CLASSIFICATION

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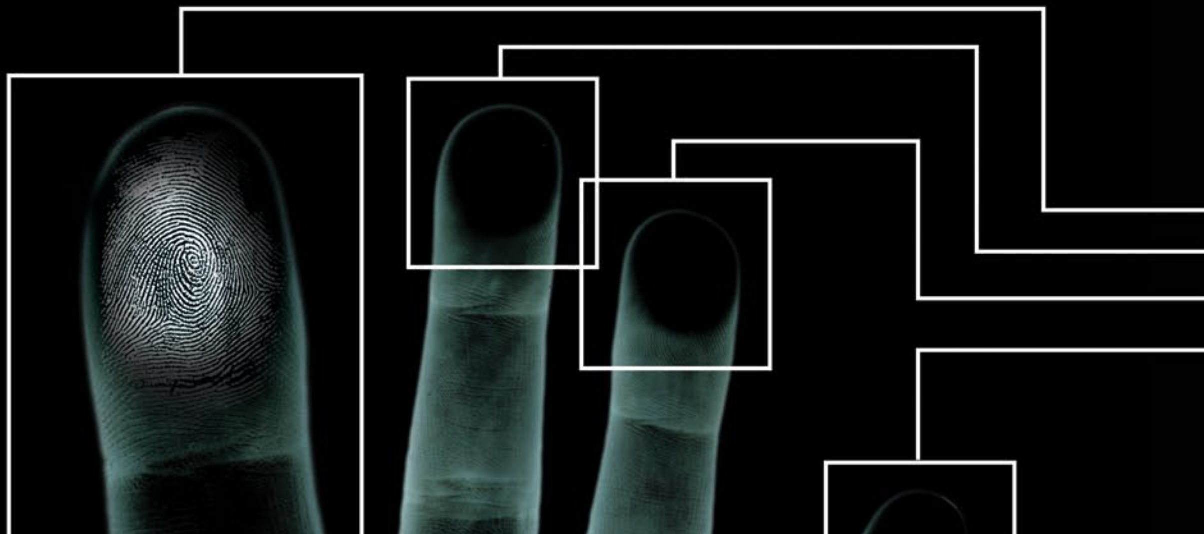

CHAPTER 5

SYSTEMS OF FRICTION RIDGE CLASSIFICATION

LAURA A. HUTCHINS

5.1 Introduction to Classification Systems

The concept of friction ridge individualization as an infallible means of individualization is rooted in the history of man and our inherent need to individualize ourselves, and be individualized, in an ever-expanding world. As populations grew and cities filled with differing classes of people, the populations of jails and prisons grew also. The ability to accurately identify repeat offenders was critical to the effectiveness of criminal justice institutions. It became paramount that an accurate method of individualization be developed.

5.2 Criminal Identification of the Past

Prior to any type of scientific criminal identification, the criminal justice community used purely visible methods to determine identity. These methods involved tattoos or scarification to denote criminals. However, this type of identification was seen as barbaric and inefficient. It was not until the advent of photography that a more humane method of criminal identification was devised.

This method involved taking photographs of all those who were arrested and incorporating the photographs into a compendium of identification, known as a rogues' gallery. (For more on rogues' galleries, see Chapter 8.) The use of the rogues' gallery as means of criminal identification soon proved nonscientific and ineffective because, when offenders were released, they could change their appearance. A simple haircut and change of clothes could render the offender unrecognizable. Additionally, many police departments lacked the insight to standardize the photographs that were taken of those who were arrested (Dilworth, 1977, p 1).

For example, women kept their hats on and veils down, with their heads tilted, when being photographed for the gallery. Yet, for the criminal justice community, photography was the only means of documenting the identity of criminals.

5.2.1 Alphonse Bertillon and Anthropometry*

Alphonse Bertillon began his public service career in 1879 when, having fulfilled his military service in the French army, he joined the Paris Prefecture of Police as a clerk in the Identification Division. He was tasked with the monotonous job of recording on index cards the physical descriptions of individuals who had been arrested. At the time, this was the only method that was available to identify recidivists.

Bertillon's first contribution to the reorganization of the department's criminal files was to incorporate the use of standard photography. Previous photography had been haphazard and inconsistent. Within a month of his appointment as a records clerk, he started an organized and standard system of photography. This system entailed the taking of full-face and profile portraits of the criminals entering the criminal justice system.

In 1882, having contributed greatly to the existing substandard method of criminal identification, Bertillon took on the task of establishing the identity of recidivists through a more scientific means (Rhodes, 1956, pp 71–101). Reflecting upon his family's professions as statisticians, demographers, and physicians, he embarked on the creation of a standard method of identification that was based on the measurement of specific body parts: anthropometry. He believed that by recording the body measurements of a criminal, he was establishing that criminal's body formula which would apply to that one person and would not change.

By 1883, Bertillon believed that he had devised a complete system of criminal identification. The information that was recorded was divided into three sections: (1) descriptive data such as height, weight, and eye color; (2) body marks such as scars, tattoos, and deformities; and (3) body measurements. He chose 11 specific body measurements that he thought could be easily and accurately measured. To create a system of classification that would be manageable and productive, each of the 11 measurements was further subdivided into three variation range groups.

This classification system became the first scientific system that was used to identify criminals. In fact, in 1884, *Bertillonage,* as his system came to be known, identified 241 repeat offenders (Beavan, 2001, p 91). Because of this impressive track record, other European and American criminal justice institutions quickly adopted Bertillonage.

As more police institutions began to maintain Bertillon records, it became apparent that the system was flawed and was merely a band-aid on the still-evident problem of reliable criminal identification. The foremost problem was that measurements taken by different officers were either different enough to preclude future identifications or similar enough to identify two individuals as the same person.

Another problem was that the 243 basic categories in the system were sufficient for an agency handling 5,000 to 10,000 records, but collections that exceeded 10,000 records presented problems; officers found themselves searching through categories that contained an unwieldy amount of cards. The time that was required to check for duplicate records increased from a few minutes to several hours. Additionally, the aging process could affect the accuracy of the measurements, especially if the measurements on record had been taken when the individual was not fully grown.

The realization of these challenges, along with the introduction of fingerprints as a method of identification, would eventually bring an end to use of the Bertillon system. Yet it was not until the early 20th century that anthropometry was completely dismissed as a method of criminal identification in Europe and in the United States.

5.3 Beginnings of Classification

5.3.1 Johannes Evangelist Purkinje

Johannes Evangelist Purkinje was a Czech professor of pathology and physiology at the University of Breslau in Prussia. He was a prolific scientist who made numerous contributions to the field of medicine. He researched sweat pores and skin, introduced the word *plasma*, devised new methods of preparing microscope samples, and researched visual phenomena (Jay, 2000, p 663).

* For more information on Bertillon and the other scientists discussed in this chapter, see chapter 1.

In 1823, Purkinje published his most famous medical thesis, *Commentatio de Examine Physiologico Organi Visus et Systematis Cutanei (A Commentary on the Physiological Examination of the Organs of Vision and the Cutaneous System)*. In this thesis, he described nine classifiable fingerprint patterns (Ashbaugh, 1999, p 40): (1) transverse curve, (2) central longitudinal stria, (3) oblique stripe, (4) oblique loop, (5) almond whorl, (6) spiral whorl, (7) ellipse, (8) circle, and (9) double whorl. At this time, this was the only detailed description of fingerprint patterns to appear in the scientific record. Although it is obvious that he recognized the classification element of friction ridge formations, he did not associate them with any type of classification system for use in personal identification (Faulds, 1905, p 33).

5.3.2 Dr. Henry Faulds' Syllabic System of Classification

Dr. Henry Faulds was a Scottish physician and superintendent of Tsukji Hospital in Tokyo, Japan. In the late 1870s, Faulds developed a friendship with the American archaeologist Edward S. Morse. While assisting Morse during an excavation, Faulds noticed the patent impression of a fingerprint in a piece of broken clay. It was at this moment that the connection between fingerprints and individualization was formulated in his mind (Beavan, 2001, p 69).

Faulds devised a method of using ink to record the fingerprint impressions of all 10 fingers on cards and soon had collected thousands of fingerprint cards. His collection became invaluable when the police accused a member of his medical staff of attempted burglary, committed by scaling the hospital wall and entering through a window. He compared a latent print that had been found on the wall with the accused staff member's fingerprints in his collection and determined that the latent print had not been left by his staff member.

Realizing that fingerprints could be the solution to the burgeoning problem of criminal identification, Faulds was determined to prove that fingerprints were the key to accurate and reliable personal individualization. To prove his theory, Faulds researched the permanence and individuality of fingerprints. To prove individuality, he compared the thousands of fingerprint cards he had collected and determined that the fingerprints on each card were unique. To prove permanence, Faulds and his medical students used various means—razors, pumice stones, sandpaper, acids, and caustics—to remove their friction ridges. As he had hoped, the friction ridges grew back exactly as they had been before.

Faulds also needed to prove that fingerprints did not change during the growth process. To this end, he observed the fingerprints of growing children over a period of two years and determined that friction ridges changed only in size and not in uniqueness.

Having determined the individuality and permanence of fingerprints, Faulds published his findings in the journal *Nature* (Faulds, 1880, p 605). In the article, he suggested the use of fingerprints in criminal investigations and the use of printer's ink in obtaining fingerprints. In addition, he mentioned two categories of fingerprint patterns: loops and whorls.

During the next few years, Faulds developed a syllabic system for classifying fingerprints (Faulds, 1912, pp 83–100). He felt that learning this type of classification system would be natural and quite easy for an identification official. His idea was based on his perception that the human brain can quickly associate an object with a sound.

In his system, each hand was represented by five syllables, one syllable for each finger, with each syllable separated by a hyphen. Syllables were constructed from an established list of 21 consonants and 6 vowels representing set fingerprint pattern characteristics (Table 5–1). For example, one hand may be represented and spoken as "RA-RA-RA-RA-RA". (In more complex examples, fingers may be represented by two or more syllables).

Based solely on the primary breakdown of the consonants alone, Faulds produced a classification system that had the potential to create nearly 17 trillion classifications (Beaven, 2001, p 131).

In addition to creating a strand of syllables to represent each hand, Faulds believed that there should be a single-finger index. This index would prove useful in comparing latent prints from a crime scene, provided that the syllable of the latent print could be derived from the known single prints on file.

In 1886, Faulds offered to establish a fingerprinting bureau in Scotland Yard, at his expense, and to institute his fingerprint classification system (Russell, 2004). However, Scotland Yard declined the offer and maintained Bertillonage as the agency's method of criminal identification.

Table 5–1

Faulds' description of syllables.

Consonant	Pattern Description
CH	Hook with short leg facing right
J	Hook with short leg facing left
B	Convex bow with left lineation
P	Convex bow with right lineation
T	Pear-shaped, free-floating
D	Pear-shaped, fixed by stem
K	Spindle with one stem
G	Spindled with stems on both ends
W	Clockwise whorl
V	Counter-clockwise whorl
Q	Large circle/oval w/elements
M	Volcanic mountain peak
N	Flag-staff on mountain top
L	Loop with straight axis
R	Loop with curved axis
S	Sinuous with no angles
Z	Zigzag with angularity
X	Nondescript
F	Aspirate used strictly for pronunciation
H	Aspirate used strictly for pronunciation
Vowel	**Pattern Description**
A	Interior empty, simple
E	Three short ridges/dots
I	Simple detached line/no more than two lines in heart of encircling pattern
O	Small circle/oval/dot in core
U	Fork with 2+ prongs in core
Y	Fork with prongs turning away from concavity

5.3.3 Sir Francis Galton and the Tripartite Classification

Sir Francis Galton, cousin of Charles Darwin, was a noted English scientist. Galton developed an interest in fingerprints in 1888 when he was asked to present a lecture on personal identification. To prepare for the lecture, he researched Bertillonage, the then-current method of personal identification. After investigating the use of anthropometry for criminal identification, he became a critic of the technique. His criticism stemmed from the observation that Bertillon measurements did not take into account the correlation between stature and limb length (Galton, 1889, pp 403–405). He believed that the continued use of Bertillonage as a method of criminal identification would lead to an unacceptably high rate of false identifications. He noted also that the taking of Bertillon measurements was time-consuming and the measurements could vary, depending on who was taking them.

As a result of his distaste for anthropometry, Galton researched the use of fingerprints for personal individualization. His research led him to Faulds' article in *Nature* and a rebuttal letter that same year by Sir William Herschel that stated that he had discovered fingerprint individualization first and had been using it in India since 1860 (Herschel, 1880, p 76). Soon after, Galton began corresponding with Herschel and obtained his collection of fingerprint data.

After four years of intensive study and research, Galton published his famous book *Finger Prints* (1892) in which he established that fingerprints are both permanent and unique. He also realized that for fingerprints to become a viable method of personal individualization, a systematic, understandable, and applicable system of fingerprint classification had to be developed.

In his book, Galton formulated a classification system that was based on the alphabetical enumerations of the three fingerprint patterns: L represented a loop, W represented a whorl, and A represented an arch. To classify a set of fingerprints, the pattern for each finger was labeled with one of these three letters. The letters for the right hand's index, middle, and ring fingers were grouped together, followed by the letters for the left hand's index, middle, and ring fingers. After this string of letters, the letters for the right thumb and right little finger were recorded, followed by the letters for the left thumb and left little finger. For example, a person with the right hand possessing all whorls except for the little finger having a loop, and the left hand having all loops except for the little finger having a whorl, would have the following classification: WWWLLLLWLLW. This classification code would then be recorded on a card and the card filed alphabetically by this classification.

Two years after the publication of his book, Galton's elementary fingerprint classification system was incorporated into the Bertillonage files at Scotland Yard. Although this was a success for him, his classification system proved too rudimentary for a large number of files and would not stand on its own as a method of cataloging and classifying criminals.

5.4 Birth of Modern Classification Systems

5.4.1 Juan Vucetich and the Argentine System

Juan Vucetich was born in Croatia and immigrated to Argentina in 1882. Within four years, he was working at the Buenos Aires Police Department, collecting arrest and crime statistics. Within a few more years, Vucetich became head of the Office of Identification.

During his tenure, Vucetich came to the realization that Bertillonage was an ineffective method of criminal identification. Concern regarding the mobility of criminals in and out of Argentina prompted him to search for a more effective method of identification. His search ended when he read the French journal *Revue Scientifique* (1891) detailing Galton's research into the scientific use of fingerprints as a means of individualization. After reading this article, he began his campaign to incorporate the use of fingerprinting into the criminal justice system of Argentina. His campaign paid off, and that same year (1891), fingerprints replaced Bertillonage at the Office of Identification. This was the first occurrence of fingerprint individualization officially usurping anthropometry.

Having achieved a major milestone, Vucetich realized that for the science of fingerprints to be accepted worldwide, a useful and manageable classification system had to be created. Working from Galton's overly general three-pattern classification system, he quickly created a classification system that used subcategories to classify, file, and locate fingerprint cards. He initially called his system *icnofalangométrica,* meaning "finger track measurement". In 1896, he renamed the system *dactiloscopía,* meaning "finger description" (Rodriguez, 2004).

Vucetich's system was an expansion of the three patterns established by Galton: the arch, the loop, and the whorl. However, Vucetich further divided the loop into internal loop (left slope) and external loop (right slope) categories, creating four types of patterns: arch, internal loop, external loop, and whorl.

The classification consisted of four single letters, representing the pattern on the thumb, and four single numbers, representing the patterns on the remaining fingers (Table 5–2). Like Galton's classification system, Vucetich's system started with the right-hand thumb and ended with the left little finger.

Table 5–2

Vucetich's pattern-type symbols.

Pattern	Thumbs	Other Fingers
Arch	A	1
Internal loop	I	2
External loop	E	3
Whorl	V	4

The Vucetich classification system consisted of a basic classification (called the *primary*) and a more descriptive secondary classification using extensions. The primary classification was divided into two groups: the numerator and the denominator. The numerator was termed the *series* and represented the right hand. The denominator was termed the *section* and represented the left hand. The right thumb (called the *fundamental*) and the remaining right-hand fingers (called the *division*) represented the *series.* The left thumb (called the *subclassification*) and the remaining left-hand fingers (called the *subdivision*) represented the *section.* For example, if both the numerator and denominator were A1141, then both the right hand and the left hand had arches in all the fingers except for the ring fingers, which had whorls.

The secondary classification further subdivided the fingerprints into five subtypes: 5, 6, 7, 8, and 9. Each number represented a further description of the pattern, applied to either hand, and was placed as a superscript in parentheses (Table 5–3). When the pattern type was a normal loop variety, the superscript defaulted to ridge count values (Table 5–4).

Table 5–3

Vucetich's secondary classification.

Pattern	Superscript	Description
Arch	5	Vaulted/Normal
	6	Left-inclined
	7	Right-inclined
	8	Tent-shaped
	9	All others
Internal loop	5	Normal flow
	6	Invaded
	7	Interrogatory
	8	Hooked
	9	All others
External loop	Designation same as Internal loop	
Whorl	5	Normal
	6	Sinuous
	7	Ovoid
	8	Hooked
	9	All others

Table 5–4

Vucetich's ridge count values.

Ridge Count Spread	Superscript Value
1–5	5
6–10	10
11–15	15
16–20	20
Over 20	25

For example, a person whose right-hand fingers all have external (right slope) loops and whose left-hand fingers all have internal (left slope) loops would have a Vucetich classification of:

$$\frac{E^{(20)}\ 3^{(10)}\ 3^{(5)}\ 3^{(15)}\ 3^{(10)}}{I^{(10)}\ 2^{(5)}\ 2^{(10)}\ 2^{(10)}\ 2^{(5)}}$$

In 1896, Vucetich published his new classification system in a pamphlet entitled *General Instructions for the Province of Buenos Aires System of Identification*. In 1904, he published the book that would take his classification system across the world: *Dactiloscopía Comparada (Comparative Fingerprinting): The New Argentine System.*

5.4.2 Sir Edward Henry and the Henry Classification System

In the early 1890s, Sir Edward Henry was the new Inspector General of the Bengal District Police in India and was experiencing a common problem of the day: the inability to accurately identify the native people. After reading Galton's *Finger Prints,* he was convinced that he could create a logical and applicable system of fingerprint classification that would enable fingerprints to become the sole system of personal and criminal identification.

Henry returned to England in 1894 and developed a personal and professional relationship with Galton. Galton provided him with his personal research material, along with that of Herschel and Faulds. With this information in hand, Henry returned to India to solve the fingerprint classification problem. Even without a classification system, in 1896 he ordered his police officers to begin taking fingerprints along with anthropometric measurements of Bengali prisoners.

Meanwhile, Henry assigned two of his police officers from the Calcutta Anthropometric Bureau to work on the fingerprint classification project. By 1897, the two officers, Azizul Haque and Hem Chandra Bose, formulated a mathematical method of dividing fingerprint records into a large number of primary groupings that were based on Galton's fingerprint pattern types.

The Henry system began with the formulation of the primary. The primary was determined by assigning a value to each of the 10 fingers, starting with the right thumb and ending with the left little finger. This value was based on the presence of a whorl on a particular finger (Table 5–5). If the finger did not contain a whorl, it was assigned a value of zero.

Table 5–5

Henry's primary values (Henry, 1900, pp 72–73).

Finger	Number	Value if Whorl
Right thumb	1	16
Right index	2	16
Right middle	3	8
Right ring	4	8
Right little	5	4
Left thumb	6	4
Left index	7	2
Left middle	8	2
Left ring	9	1
Left little	10	1

The primary was expressed in ratio form, with the numerator representing the whorl values of the even fingers plus 1 and the denominator representing the whorl values of the odd fingers plus 1. For example, if an individual had a fingerprint record with a pattern series of all whorls, the corresponding primary classification would be 32 over 32. If a person had loops in the right and left index fingers, the primary classification chart would be as follows:

Right thumb	Right index	Right middle	Right ring	Right little
16	0	8	8	4

Left thumb	Left index	Left middle	Left ring	Left little
4	0	2	1	1

The chart is then calculated as follows:

$$\frac{1 + (\text{Sum of Even Finger Values})}{1 + (\text{Sum of Odd Finger Values})} = \frac{1 + (15)}{1 + (29)} = \frac{16}{30}$$

This classification system allowed for 1,024 primary groupings.

To the right of the primary was the secondary. The secondary was determined by the pattern types in the #2 and #7 fingers and was shown in the formula by capital letters representing the pattern (A for arch, T for tented arch, R for radial loop, U for ulnar loop, and W for whorl). To account for the rarity of arches, tented arches, and radial loops in nonindex fingers, these patterns were indicated by lower case letters (a, t, r) and placed after the secondary. If one of these patterns was present in the thumb(s), the small letter was placed to the left of the primary. The subsecondary was to the right of the secondary and represented the ridge counts for loops or ridge tracing for whorls in the remaining fingers.

This new classification system was so successful that in March of 1897, the British Indian government instituted the Henry classification system as the official method of criminal identification. By 1900, the success of the Henry system in India made Scotland Yard review its own identification system. This review resulted in the abandonment of Bertillonage and the adoption of the Henry system. In 1901, Henry was transferred to Scotland Yard, where he set up its first central fingerprint bureau and began training officers in fingerprint classification.

5.4.3 Offshoots of the Henry and Vucetich Classification Systems

Both Vucetich and Henry gained international recognition in the arena of scientific criminal identification. Vucetich traveled the world promoting his book, and Henry gained the backing of the modern European world. Both systems were considered superior to Bertillonage, and both systems had equal recognition in international police and scientific circles.

Table 5–6

Classifications based on Henry and Vucetich systems.

Henry	Australian (Australia)
	Budapest (Budapest)
	Valladares (Portugal)
	Pateer (Amsterdam)
	Windt Kodicek (Germany)
	Spirlet (The Hague)
	Steegers (Cuba)
	Conlay (Federated Malay States Police)
	American (New York City)
	Flak Conley (Newark, NJ)
	RCMP (Canada)
	FBI Extensions (Washington, DC)
Henry-Vucetich	Daae (Norway)
	Protivenski (Prague)
	Olóriz (Madrid)
	Martinez (Mexico)
	Borgerhoff (Belgium)
	Harvey Pacha (Egypt)
	Cabezas (Valparaiso)
	Klatt (Berlin)
	Brussels (Belgium)
	Roscher (Hamburg)
	Japanese National
	Lebedoff (Russia)
	When (Berlin)
	Smallegange (Holland)
	Gasti (Italy)
	Portillo (Barcelona)
	Lyonnese (Lyon)
	Jouenne (Colonial Service in French West Africa)

Table 5–7

Single-fingerprint systems.

Based on Existing Classification Systems	Original Single-Fingerprint Systems
Collins	Born
Larson	Moran
Oloritz	Code
Borgerhoff	Sagredo
Stockis	Dresden
Gasti Register	Barlow
Lyonnese	Jaycox
Neben Register of Roscher	Crosskey
	Battley
	Giraud and Henquel
	Jorgensen
	Monodacylus

As other agencies began to adopt these classification systems, the systems were often modified (Table 5–6). Modifications involved the creation of extensions to produce classification systems that could handle larger populations (McGinnis, 1963, p 115). For example, the United States Federal Bureau of Investigation (FBI) incorporated extensions relating to the ridge counts and whorl tracings of specific fingers to split up the rapidly populating primary and secondary groupings.

5.5 Single-Fingerprint Systems

Although the known-print classification systems were useful for the identification of repeat offenders, they did not aid in the apprehension of criminals by identifying latent prints left at crime scenes. To address this limitation, numerous single-fingerprint classification systems were developed. Some of these systems were based on existing known-print classification systems and some were fully original (Table 5–7). Of all these single-fingerprint classification systems, Chief Inspector Henry Battley and Detective Superintendent Fredrick Cherrill of New Scotland Yard developed the most popular system.

Table 5–8

Battley's subgroup designations (Cherrill, 1954, pp 82–90).

Pattern	Subdivisions	Designation
Arches	Plain arch	1
	Left-sloping	2
	Right-sloping	3
Tented arches	Circle reading (summit of first platform ridge)	A–H
Radial loops	Ridge count between delta and core	#
	Predetermined core definition	A–L
	Circle reading of delta	A–H
Ulnar loops	Ridge count between delta and core	#
	Predetermined core definitions	A–L
	Circle reading of delta	A–H
Whorls / Central pocket loops	Circle reading of first recurving ridge	A–H
	Predetermined core definitions limited to small spirals in "A" circle reading	A.1 A.2 A.3 A.4
	Circle reading of left delta	A–H
	Ridge tracing	I, M, O
	Circle reading of right delta	A–H
	Ridge count between left delta and core	#
	Ridge count between right delta and core	#
Twinned loops	Radial or ulnar slope of descending loop	R,U
	Circle reading of core of descending loop	A–H
	Ridge count between loops	#
	Ridge count between core and delta of descending loop	#
	Circle reading of left delta	A–H
	Ridge tracing	I, M, O
	Circle reading of right delta	A–H
Lateral pocket loop	Radial or ulnar slope of majority of ridges	R, U
	Ridge count between delta and core of innermost loop	#
Composite	No subdivision	
Accidental	No subdivision	
Severely scarred	Cannot classify	

5.5.1 Battley Single-Fingerprint System

In 1929, Battley and Cherrill developed the idea of a single-fingerprint system that did not require all 10 known fingerprints of an individual. They postulated that latent fingerprints found at a crime scene could be individualized using a known print of the same finger of the offender.

The Battley system used 10 main patterns followed by additional subdivisions, depending on the pattern designation (Table 5–8). These additional subdivisions included radial or ulnar inclination, ridge counts, ridge tracings, formation of the core(s), position of the delta(s), and circle readings. A specific subdivision, known as a circle reading, was derived using a special magnifying glass with a plain glass window at the base. This base window consisted of a center circle with a dot in the middle, designated as area A, and seven concentric circles, each 2 mm in width, designated B through H. The center dot was placed over a designated point of the impression, and circle readings were taken that were based on the position of specific formations.

In the system, the known fingerprints from an arrest card would be individually classified according to pattern and established in 10 collections, one for each finger, from the right thumb to the left little finger (i.e., No. 1 collection through No. 10 collection).

Single-fingerprint cards were constructed by mounting the specific fingerprint on a card and filling in particular information in designated areas. This information included the number and name of the digit, the criminal's reference number, the Henry classification, and the Battley classification (Table 5–9).

Table 5–9

Battley index card.

<table>
<tr><td>TYPE</td><td>CORE</td><td>Subgroup Designation</td></tr>
<tr><td colspan="2" rowspan="9">Criminal ID No.
Finger No. & Description
Henry Classification

Adhered Fingerprint
From Known Exemplar</td><td>Subgroup Designation</td></tr>
<tr><td>Subgroup Designation</td></tr>
<tr><td>Subgroup Designation</td></tr>
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<tr><td>Subgroup Designation</td></tr>
</table>

The Battley system required a great deal of labor to classify and maintain the collections. Eventually, the collections became too large, and it became impossible to accurately and quickly individualize a latent print from a crime scene with a known single print on file.

5.5.2 Additional Single-Print Systems

As previously mentioned, there were single-print systems other than the Battley system. Like Battley, these other systems were based on the classification of individual fingerprints, independent of the other fingers. These systems were frequently based on existing systems or a combination of existing systems and definitions used by those systems.

Similar to Battley, most of the other systems were based on predetermined pattern types (i.e., whorl, arch, and loops) with further subclassifications, such as core formations, delta position, ridge counts, and ridge tracings. Although some systems were similar to the Battley system, they differed in some respects because of added subdivisions (Table 5–10). Some systems went into great detail describing the patterns, some divided each print into sections or zones and recorded the location of ridge characteristics within that area, and some further defined the shapes of deltas (Bridges, 1963, pp 181–213).

5.6 Footprint and Palmprint Classification Systems

The next logical step in the evolution of friction ridge classification systems was the establishment of palmprint and footprint classification systems. Footprints and palmprints were being detected on evidence with enough frequency to warrant the development of classification systems.

5.6.1 Classification of Footprints

Along with the need for a footprint classification system based on latent impression evidence, there was also a need for such a classification system for filing the footprints of newborn babies, military airmen, and people lacking arms. Two main footprint classification systems were developed and used over the years: the Federal Bureau of Investigation system and the Chatterjee system.

5.6.1.1 The FBI's Footprint Classification System. The FBI's classification system was a highly modified version of the system developed by Wentworth and Wilder in their landmark book *Personal Identification* (1918). The basis of the FBI's classification system was the observance of the ball area of the foot, directly below the large toe. This area typically exhibits one of three types of pattern groups: arch, loop, or whorl. Each group was designated by a letter and was further divided by type and ridge count (for loop and whorl patterns only) (FBI, 1985, p 24).

Arch patterns were designated by the letter "O". The O group was further subdivided according to the flow of the ridges. Type 1 subdivision (O1) indicated a vertical ridge flow (i.e., ridges flowing from the big toe to the heel). Type 2 subdivision (O2) indicated a horizontal ridge flow (i.e., ridges flowing from the big toe to the little toe). Looping

Table 5–10

Single-print systems other than Battley (Bridges, 1963, pp 181–213).

Name of Single-Print System	Subdivisions
Collins	Pattern types Ridge counts Ridge tracing Ridge characteristics
Larson	Pattern types Inclination of pattern Core type Ridge characteristics Delta type Ridge tracing Combinations
Oloriz	Primary from Oloriz tenprint system Core type Limiting lines (type lines) Delta type Apex angle
Borgerhoff	Pattern types Ridge counts Ridge tracing
Stockis	Pattern types Ridge counts Apex angle Core type Delta type Ridge tracing
Gasti	Taken from Gasti (tenprint) classification for each finger
Born	Pattern type Zone scheme with marked minutiae
Sagredo	Primary from Oloritz ten-print system No delta pattern type One delta pattern type Two delta pattern type Pattern inclination Ridge counts Ridge tracing Delta type
Dresden	Pattern type Ridge counts Pattern inclination
Neben Register of Roscher	Taken from Roscher ten-print classification for each finger
Lyonnese	Pattern type Centro-basal angle from Oloritz Ridge tracing
Barlow	Pattern type Core type Pattern inclination Ridge counts
Jaycox	Pattern type Pattern inclination Core type Ridge characteristics of core
Jorgenson	Pattern type Pattern inclination Ridge counts Core type Delta position Core to delta angle Core diameter (whorl)
Crosskey	Pattern type Core type Ridge counts Presence of scar

patterns were designated by the letter "L" and were further subdivided into four types. Type a subdivision (La) indicated a ridge flow entering and exiting toward the toes. Type b and c subdivisions (Lb and Lc) indicated a ridge flow entering and exiting the big toe-side of the foot. (Type b indicated the right foot and Type c indicated the left foot.) Type d subdivision (Ld) indicated a ridge flow entering and exiting toward the heel of the foot.

Whorl patterns were designated by the letter "W" and were further subdivided into three types. Type w subdivision (Ww) indicated a whorl pattern that was either a plain whorl or a central pocket loop whorl. Type d subdivision (Wd) indicated a double loop whorl. Type x subdivision (Wx) indicated an accidental whorl.

Like the Henry classification, the footprint classification was expressed as a fraction, with the right foot as the numerator and the left foot as the denominator. The fraction was made up of the primary, secondary, final, and key. The primary was the pattern group (O, L, or W) and was always expressed as a capital letter. The secondary was the type of subdivision and was placed to the right of the primary (e.g., Ww). The final was the ridge count of the loop or whorl pattern on the right foot and was placed to the right of the secondary (e.g., Ww 25). The key was the ridge count of the loop or whorl pattern on the left foot and was placed to the left of the secondary (e.g., 25 Ww).

A complete footprint classification looked like:

La 32
25 Wd

5.6.1.2 Chatterjee Footprint Classification System. A system developed by Sri Salil Kumar Chatterjee divided the footprint into the following six areas:

Area 1: Ball of the foot, below the big toe.
Areas 2–4: Interspaces below the toes.
Area 5: Center of the foot.
Area 6: Heel.

Chatterjee used an alpha representation for the pattern in Area 1 and a numeric representation for the pattern in the remaining areas (Table 5–11) (Chatterjee, 1953, pp 179–183).

Table 5–11

Alpha and numeric pattern representations (Moenssens, 1971, p 212).

None	O	0
Tented arch	T	2
Upward-slope loop	U	4
Loop with downward slope	D	6
Central pocket loop	C	7
Twin loop	S	8

The Chatterjee footprint classification was also expressed as a fraction, with the right foot as the numerator and the left foot as the denominator. The primary was the Area 1 pattern designation and the secondary was a five-digit number, representing Areas 2 through 6, and was to the right of the primary.

5.6.2 Classification of Palmprints

The classification of palmprints was a worthwhile endeavor because of the frequency of latent palmprints at crime scenes. Three classification systems were established for palmprints: one in Western Australia, one in Liverpool, England, and another in Denmark.

5.6.2.1 Western Australian Palmprint Classification. This classification consisted of a numeric primary and an alpha and numeric secondary in the form of a fraction (Baird, 1959). The classification was based on the tripartite division of the palm into the interdigital, thenar, and hypothenar areas (Figure 5–1).

Table 5–12

Primary value determination (Baird, 1959, pp 21–24).

Area of Consideration	Value
Interdigital #5 finger delta to ulnar edge	1
Interdigital #4 finger delta to #3 finger delta	2
Interdigital #3 finger delta to radial edge	4
Thenar	8
Hypothenar	16
No pattern in area	0

To obtain the primary classification, the three areas were allotted a value based on the ridge flow in that area (Table 5–12). If there was no discernible pattern in the specified area, a value of 0 was given. Notably, the values were the same as those for the primary in the Henry classification; however, this classification was not dependent on the presence of whorls but on the presence of any type of pattern. Because an arch pattern was typically considered to lack a true pattern area because there was no core and delta, this pattern was only given a value when it was present in the interdigital area. As with the Henry classification, a value of 1 was added to the total.

The secondary classification was divided into two parts. The first division was the type of pattern present in the thenar and hypothenar areas. This subdivision was expressed in the form of a fraction, with the thenar as the numerator and the hypothenar as the denominator. The second division, known as the secondary subclassification, concerned the area between the thumb and the index finger and the interdigital area. The thumb to index area was considered as a part of the thenar and was placed in the numerator; the interdigital area was considered as part of the hypothenar and was placed in the denominator.

The classification formula was written as follows:

$$\text{(primary)} \quad \frac{\text{(thenar) (thumb to index area)}}{\text{(hypothenar) (interdigital)}}$$

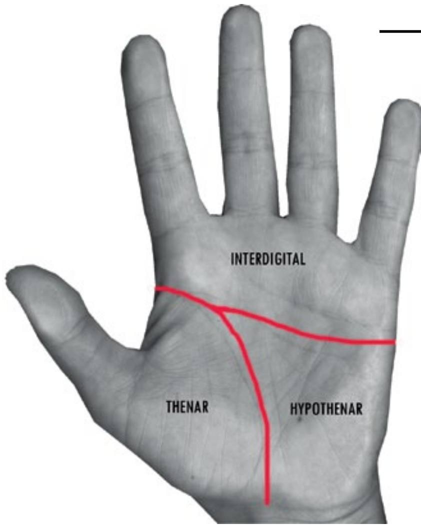

FIGURE 5–1

Tripartite division of the palm.

The Western Australian system used pattern definitions derived from the agencies' known-print classification system, which was a modification of the Henry classification system. The patterns were given specific alpha symbols according to their locations in the palm (Table 5–13). A further subdivision of the secondary classification involved ridge counts and ridge tracings and was expressed as a fraction to the right of the secondary classification.

5.6.2.2 Liverpool Palmprint Classification System. The palmprint classification system that was established in Liverpool, England, was considered a more user-friendly classification system than that used in Western Australia. The Liverpool system also concentrated on the three divisions of the palm.

This system was divided into four parts and consisted of alpha and numeric symbols. The primary division pertained to the cumulative patterns in all three sections: interdigital, thenar, and hypothenar. The secondary division involved patterns in the hypothenar and included a subsecondary classification. The tertiary division involved patterns in the thenar. The quaternary division included patterns in the interdigital section of the palm and had three additional sections: part 1, part 2, and part 3.

This classification used a coding box, where each square contained the alpha or numeric symbol for each part of the classification (Figure 5–2, p 5-17).

Table 5–13

Symbols for secondary classification.

Pattern	Location	Symbol
Arch	Thenar	A
	Thumb-index	None
	Hypothenar	A
	Interdigital	a
Exceptional arch	Thenar	E
	Thumb-index	e
	Hypothenar	E
	Interdigital	e
Joined arch	Thenar	J
	Thumb-index	J
	Hypothenar	J
	Interdigital	J
Joined arch #1	Hypothenar only	J1
Joined arch #2	Hypothenar only	J2
Vertical arch #1	Hypothenar only	V1
Tented arch	Thenar	T
	Thumb-index	t
	Hypothenar	T
	Interdigital	t
Tented arch # 1	Hypothenar	T1
Tented arch # 2	Hypothenar	T2
Radial loop	Thenar	R
	Thumb-index	r
	Hypothenar	R
	Interdigital	r
Radial loop #1	Hypothenar	R1
Radial loop #2	Hypothenar	R2
Radial loop #3	Hypothenar	R3
Radial loop #4	Hypothenar	R4
Ulnar loop	Thenar	U
	Thumb-index	U
	Hypothenar	U
	Interdigital	U
Ulnar loop #1	Hypothenar	U1
Ulnar loop #2	Hypothenar	U2
Ulnar loop #3	Hypothenar	U3
Ulnar loop #4	Hypothenar	U4
Distal loop*	Interdigital	L
Whorl	Thenar	W
	Thumb-index	w
	Hypothenar	W
	Interdigital	w
Central pocket loop	Thenar	C
	Thumb-index	c
	Hypothenar	C
	Interdigital	c
Double loop	Thenar	D
	Thumb-index	d
	Hypothenar	D
	Interdigital	d
Accidental	Thenar	X
	Thumb-index	x
	Hypothenar	X
	Interdigital	x

* Distal loop only noted when there was another pattern present in the interdigital area.

The primary division was formulated by the sum of set values, as determined by the presence of a pattern in the three palmar sections. The numeral 2 was given for the presence of a pattern in the thenar. The numeral 3 was given for the presence of a pattern in the interdigital area. The numeral 4 was given for the presence of a pattern in the hypothenar. The value of 1 was recorded if the palm was devoid of patterns in all three areas. When a palmar area contained more than one pattern, it was given a single value, as if there was only one pattern in the area. When patterns were present in more than one palmar area, the values were added together. The specific summed values also indicated which palmar area contained a pattern (Table 5–14).

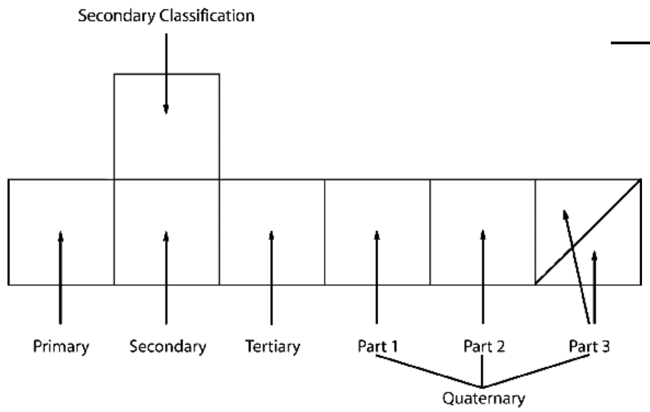

FIGURE 5–2

Coding box for the Liverpool palmprint classification.

Table 5–14

Pattern indication from primary value.

Primary Value	Pattern Indication
1	None
2	Thenar only
3	Interdigital only
4	Hypothenar only
5	Thenar and interdigital only
6	Thenar and hypothenar only
7	Interdigital and hypothenar only
9	Patterns in all three areas

The secondary and subsecondary classification pertained only to the patterns in the hypothenar. Table 5–15 details the patterns and representative symbols that were used in this classification system. If the hypothenar area contained more than one pattern, the coding box was separated by a diagonal line from the lower left corner to the upper right corner, with the left upper half of the box designated for the pattern symbol of the pattern closest to the interdigital area and the lower right half designated for the pattern symbol of the pattern closest to the wrist.

The secondary subclassification involved two distinct subclassifications. For a single loop in the hypothenar, the number of ridge characteristics in the core area was recorded. For a hypothenar devoid of a pattern, the type of delta was recorded (Alexander, 1973, pp 86–90).

Table 5–15

Symbols used in the Liverpool Palmprint Classification System.

Pattern	Symbol
Whorl A (circular)	A
Whorl B (elliptical)	B
Twinned loop	TL
Lateral pocket loop	LP
Central pocket loop	CP
Accidental/composite	ACC
Tented arch	T
Loop core inward	I
Loop core outward	O
Loop core downward	D
Loop core upward	U
Loop core nutant	K
Nondescript	N
Plain arch	N
No pattern	
High carpal delta	H
Low carpal delta	L

The tertiary division pertained to the thenar area of the palm. If there were two patterns in this area, the coding box was again separated by a diagonal line from the lower left corner to the upper right corner, with the left upper half designated for the pattern symbol of the pattern closest to the interdigital area and the lower right half designated for the pattern symbol closest to the wrist.

Part 1 of the quaternary division pertained to the type(s) of pattern in the interdigital area of the palm. If more than one pattern appeared in the interdigital area, the box was separated by three diagonal lines, with the upper left third dedicated for the pattern closest to the index finger and the bottom right third dedicated for the pattern closest to the little finger.

Part 2 of the quaternary division involved a predetermined numerical value indicating the position of the pattern in relation to the fingers (Table 5–16). If more than one pattern was present, the numerals were combined for a single value. If a pattern was between the base of two fingers, the higher value was recorded.

Part 3 of the quaternary division involved the recording of ridge counts for tented arches or loops (inward core, outward core, downward core loops) when only one of these patterns was present in the interdigital area.

5.6.2.3 The Brogger Moller Palmprint Classification System. The Brogger Moller palmprint classification system was formulated by Kaj Brogger Moller of the National Identification Bureau in Copenhagen, Denmark (Moenssens, 1971, p 199). As with the previous two systems, this classification was based on the three defined areas of the palm (i.e., hypothenar, thenar, and base areas). However, this system employed the use of a special measuring glass. This glass contained four separate measuring areas. The areas were defined by three concentric circles measuring 2, 4, and 6 cm from a center dot. Each area was numbered 1 through 4, with 4 marking the area outside the last concentric ring. A second measuring area, known as the 1–6 scale, contained five lines, each 6 cm in length and 3 mm apart. The area between each line was numbered 1 through 6, with 1 representing the top of the scale. A third measuring area, known as the 0–9 scale, looked like a ladder with the right leg missing. This scale contained 10 lines, each 1 cm in length and placed 4 mm apart. Each area between the lines was numbered 0 to 9, with 0 representing the bottom of the scale.

The classification of palm prints under this system was based on the ridge pattern(s) in the three areas of the palm and on the primary, secondary, and tertiary values. The measuring glass was used to determine some of the values (Tables 5–17 to 5–19). The classification was recorded in a table, with the hypothenar on the left, the interdigital in the middle, and the thenar on the right side of the table. For each area, the primary was recorded on the bottom, with the secondary above the primary, followed by the tertiary on the top (Figure 5–3).

Table 5–16

Pattern value for part 2 of the quaternary division.

Under index finger	8
Under ring finger	2

5.7 Computer Automation and Print Classification

As federal, state, and local agencies received and retained more and more known exemplars, the need for a more efficient means of known-print individualization became paramount. The identification service divisions of these agencies were tasked with the manual searching of suspect prints with known prints, often taking months to reach a decision of individualization or nonindividualization. This lengthy turnaround time posed an obvious problem if a suspect could not legally be detained pending an answer from the identification division. The solution to this problem came with the invention of the computer.

5.7.1 Birth of Computerized Classification

The first experiment with computer automation of known-print cards took place at the Federal Bureau of Investigation. In 1934, the FBI's Identification Division was starting to feel the effects of a large known-print database that was becoming increasingly difficult to search manually. The FBI's attempt at automation of known prints involved the

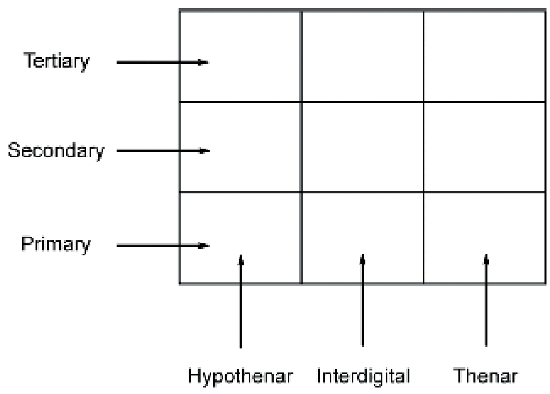

FIGURE 5–3

Brogger Moller palmprint classification box.

Table 5–17

Classification for the hypothenar (Moenssens, 1971, pp 200–205).

Ridge Pattern	Primary	Secondary	Tertiary
No design (carpal delta only)	1	Using circle measurement, dot at carpal delta and read circle where lowest ridge of carpal area falls	None
Distal loop opening toward interdigital, with core pointing to ulnar side	2	Using 0–9 scale, measure distance between carpal delta and core of loop	8 = only when core has distinct inclination toward carpal/radial area
Outward loop opening toward ulnar side, with core pointing toward thenar	3	Using 0–9 scale, measure distance between carpal delta and core of loop	None
Whorls	4	Using 0–9 scale, measure distance between carpal delta and core (for double whorls, using core closest to carpal delta)	None
Double loops	5	Using 0–9 scale, measure distance between two cores	None
Arches	6	1 = arches 2 = tented arches	None
Loops opening toward wrist, with core pointing toward ulnar side of palm	7	Using 0–9 scale, measure distance between core and delta above it	None
Composite patterns (any pattern not conforming to above patterns)	8	None	None

Table 5–18

Classification for the interdigital (Moenssens, pp 206–207).

Ridge Pattern	Primary	Secondary	Tertiary
One loop in base area	1	2 = if loop is between index and middle fingers 3 = if loop is between middle and ring fingers 4 = if loop is between ring and little fingers	Using 1–6 scale, measure height of loop (from deltas to core)
Tented arch	2	1 = arch below index finger 2 = arch below middle finger 3 = arch below ring finger 4 = arch below little finger	Using 1–6 scale, measure height of arch (from base of arch to summit)
Double loops	3	2 = if loop is between index and middle fingers 3 = if loop is between middle and ring fingers 4 = if loop is between ring and little fingers	Using 1–6 scale, measure height of ulnar loop (from deltas to core)
Two loops in same inter-digital area and tented arches and loops in other areas	4	2 = if two-loop combination is between index and middle fingers 3 = if two-loop combination is between middle and ring fingers 4 = if two-loop combination is between ring and little fingers	None
Plain arches	5	None	None
One loop and one tented arch	6	2 = if loop is between index and middle fingers 3 = if loop is between middle and ring fingers 4 = if loop is between ring and little fingers	Using 1–6 scale, measure height of loop (from deltas to core)
Three loops or combinations of three loops and tented arches	7	Three loops = height of loop between ring and middle fingers Combination of three loops and tented arches = height of pattern located next to ulnar side of palm	None 2
Long transversal loop below one or several digital deltas	8	None	None
One or several whorls appear alone or in combina-tions with loops and tented arches	9	2 = if whorl is between index and middle fingers 3 = if whorl is between middle and ring fingers 4 = if whorl is between ring and little fingers	None

Table 5–19

Classification for the thenar (Moenssens, pp 207-209).

Ridge Pattern	Primary	Secondary	Tertiary
No pattern (or plain arch)	1	None	None
Various patterns	2	1 = one proximal loop opens toward radial side with core pointing to web of thumb or center of palm 2 = one proximal loop and one distal loop 3 = one proximal loop and one whorl 4 = one proximal loop and one double loop	Using 0–9 scale, measure distance between core and nearest delta Using 0–9 scale, measure distance between core of proximal loop and nearest delta None None
Patterns with peculiar ridge formations	3	None	None
One distal loop opening toward web of thumb with core pointing downward	4	Using 0–9 scale, measure distance between core and delta (not carpal delta)	None
Three different patterns	5	1 = one single whorl 2 = one whorl and one distal loop 3 = two whorls	None None None
Four different patterns	6	1 = one double loop 2 = one double loop and one distal loop 3 = one double loop and one whorl 4 = two double loops	None None None None
Two collateral distal loops both opening toward web of thumb	7	None	None
Two proximal loops, either both opening toward carpal area or one toward radial area and one toward carpal area	8	None	None
Any pattern not discussed	9	None	None

use of punch cards and sorting machines. Classifications of known-print cards were keyed into the punch cards and sorted according to the information contained on the card. Card-sorting machines could then extract cards containing a specific punched classification, and, from this extraction, examiners could pull the corresponding known-print cards for examination. Although this method was novel at the time, the FBI determined the experiment to be unsuccessful, and it was abandoned (Stock, 1987, p 51).

5.7.2 National Crime Information Center Fingerprint Classification

In 1965, the Federal Bureau of Investigation recognized the country's need for a centralized electronic criminal database. Within two years, the National Crime Information Center (NCIC) was born, connecting 15 metropolitan and state computers with the FBI's NCIC central computer. By 1971, all states and the District of Columbia were connected to NCIC.

The NCIC is made up of millions of records that have been sorted into separate databases. Criminal justice agencies can search these databases for information. One part of the NCIC database is the NCIC fingerprint classification. This alphanumeric classification system is pattern-specific to each individual finger and, unlike the Henry classification system, does not involve the combination of fingers. Like the Henry system, however, NCIC classification can assist only in eliminating or narrowing the search of records for the potential suspect.

The NCIC system consists of a 20-character code, in which each finger—beginning with the right thumb and ending with the left little finger—is represented by two characters (Table 5–20). For example, a person with all plain arches, except tented arches in the index fingers, would have an NCIC classification code of AATTAAAAAAAATTAAAAAA.

5.7.3 First Attempt by FBI To Create an Automated System

In the 1950s, the first commercially available computer came on the market and, by the 1960s, computers had reached the law enforcement community (Ruggles et al., 1994, p 214). Because of previous experience in the use of computer-aided known-print individualization and the continued growth of the fingerprint card databases, an earnest effort was put forth by both local agencies and the Federal Bureau of Investigation to establish a computer program to permanently assist with fingerprint automation.

Table 5–20

NCIC classification codes.

Ulnar loop ridge count (actual ridge count)	01–49
Plain arch	AA
Plain whorl, inner tracing	PI
Plain whorl, meet tracing	PM
Central pocket whorl, outer tracing	CO
Double loop whorl, inner tracing	dI
Double loop whorl, meet tracing	dM
Accidental whorl, outer tracing	XO
Missing or amputated finger	XX

5.7.4 Automation Research in New York

In 1965, the New York State Information and Identification System began research into the use of minutiae to classify fingerprints (Stock, 1987, p 54). The endeavor began with the manual recording of enlarged fingerprint minutiae on clear overlays and progressed to the use of a magnified rear projection system. The extracted minutiae data was then used for the programming of minutiae extraction software. Shortly after the state contracted with a firm for the development of a minutiae encoding system, budgetary restraints caused the program to be eliminated.

5.7.5 The Royal Canadian Mounted Police Automated System

In 1970, the Royal Canadian Mounted Police (RCMP) initiated an automated classification system that used video images of known-print cards. These video images were filed according to the RCMP Henry classification. When a card was submitted for a known-print search, it was classified and that classification was then searched in the video file. The computer would generate a video file containing all the possible matching known-print cards. This file was then compared on screen with the known print in question.

5.7.6 Automation Research at the FBI

In 1963, the FBI reinitiated its research into the complete automation of its criminal known-print repository. At this time, all attention was directed toward known-print automation and solving the Identification Division's backlog pertaining to its known-print individualization service.

In the mid-1960s, initial research confirmed the feasibility of the project and, by the late 1960s, Cornell Laboratories was chosen to build a prototype automatic fingerprint reader (Stock, 1987, p 55). In 1972, this prototype, known as AIDS (Automated Identification System), was installed in the Identification Division in Washington, DC.

The actual classification of fingerprints went through three different phases during program development. The first phase attempted to emulate the Henry classification system's pattern definitions. It was assumed that if a trained fingerprint technician could easily determine a pattern type by looking at computer-generated ridge flow, so could the computer. However, this proved to be time-consuming, even for the computer, and, in the second phase, the Henry system was replaced with the classification code from NCIC.

In the early 1980s, the third and final phase of automatic fingerprint classification was instituted. The system, called AFIS (Automated Fingerprint Identification System), was based solely on the computerized extraction of minutiae. This extraction, in effect, creates mathematical maps of each impression in a finger block and of the card as a whole. Each map contains the computer-determined pattern type (Table 5–21) and minutiae location and direction.

Table 5–21

AFIS pattern classifications (CJIS, p 2).

Description	AFIS Code
Arch	AU
Left-slant loop	LS
Right-slant loop	RS
Whorl	WU
Amputation	XX
Complete scar	SR
Unable to classify	UC
Unable to print	UP

Thus, the computer scientists created a system whereby numbers could be compared. Today, when a suspect's known-print card is submitted to an automated fingerprint identification system, an algorithm compares one mathematical map to another. The conclusion of the comparison is a list of candidates with the highest matching algorithmic number.

5.7.7 Current Developments in Friction Ridge Automation

The computer software technology that resulted from the research at the Federal Bureau of Investigation has led to numerous companies' creation of software packages for the automation of friction ridge impressions. These software packages are independent of the Federal Bureau of Investigation and are available for purchase by any institution. However, with the inception of the FBI's national Integrated Automated Fingerprint Identification System (IAFIS) in 1999 came mandated standards regarding the transmission of digital information incorporated into IAFIS (Criminal Justice Information Services, 1999; Jain and Pankanti, 2001).

5.7.8 Automated Palmprint Classification Systems

Once again, history is repeating itself. This time it is the need for an automated palmprint identification system (APIS). In response, the biometric software community is aggressively pursuing solutions. Numerous companies are providing software packages containing palmprint individualization systems. Integral to the use of a palmprint system is the digital storage of known palmprint cards.

The FBI is currently converting all of its inked palmprint cards to a digital format in anticipation of integrating an APIS function into IAFIS.

5.8 Conclusion

In any scientific field, the combination of mental acuity and technological innovation always creates the desire for bigger and better things. This is certainly true of friction ridge classification systems. As populations grew, the need for a system that was not dependent upon the limited workforce of the law enforcement community became increasingly important. Rudimentary systems grew into advanced systems that now provide the criminal justice community with a workable solution to the problem of identifying recidivists. Advancements in computer microprocessors and programming, and the marriage of friction ridge impressions and computers, have led the fingerprint community to the current day, where a known-print card can be searched in minutes.

5.9 Reviewers

The reviewers critiquing this chapter were Mike Campbell, Michael Perkins, Charles Richardson, and Lyla A. Thompson.

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