Towards the theory of the Biometric State

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The Puritan wanted to work in a calling; we are forced to do so. For when asceticism was carried out of monastic cells into everyday life, and began to dominate worldly morality, it did its part in building the tremendous cosmos of the modern economic order. This order is now bound to the technical and economic conditions of machine production which to-day determine the lives of all individuals who are born into this mechanism, not only those directly concerned with economic acquisition. Perhaps it will so determine them until the last ton of fossilized coal is burnt. In [the 17th century Presbyterian scholar, Richard] Baxter's view the care for external goods should lie on the shoulders of the "saint like a light cloak, which can be thrown aside at any moment." But fate decreed that the cloak should become an iron cage. Max Weber *Protestant Ethic and the Spirit of Capitalism* [Written in 1904]

Objectified intelligence is also that animated machine, the bureaucratic organization, with its specialization of trained skills, its division of jurisdiction, its rules and hierarchical relations of authority. Together with the inanimate machine it is busy fabricating the shell of bondage which men will perhaps be forced to inhabit some day, as powerless as the fellahs of ancient Egypt. Max Weber *Economy and Society* [Written in 1917] 1402

We live in the era of a 'governmentality' first discovered in the eighteenth century. This governmentalization of the state is a singularly paradoxical phenomenon, since if in fact the problems of governmentality and the techniques of government have become the only political issue, the only real space for political struggle and contestation, this is because the governmentalization of the state is at the same time what has permitted the state to survive, and it is possible to suppose that if the state is what it is today, this is so precisely thanks to this governmentality, which is at once internal and external to the state, since it is the tactics of government which make possible the continual definition and redefinition of what is within the competence of the state and what is not, the public versus the private, and so on; thus the state can only be understood in its survival and its limits on the basis of the general tactics of governmentality. Michele Foucault "Governmentality" [1978]

Modern societies attain a level of system differentiation at which increasingly autonomous organizations are connected with one another via delinguistified media of communication: these systemic mechanisms – for example, money – steer a social intercourse that has been largely disconnected from norms and values, above all in those subsystems of purposive rational economic and administrative action that, on Weber's diagnosis, have become independent of their moral-political foundations … Jurgen Habermas. *The Theory of Communicative Action Volume Two. Lifeworld and System: A Critique of Functionalist Reason* [Written in c. 1980] , 154

It has been a century since Max Weber made his prophetic warning about the emergence of the iron cage of the capitalist ethic.[1] In the decades since,Weber's focus on the problem of rationalization—an autonomous, instrumental, rationality most powerfully at work in modern bureaucracy that binds the rational, technical, mastery of people and things to the "irrationality of class domination"[2]—has moved to the centre of Western social science theory.

Michel Foucault's studies of the disciplinary effects of the sites of institutional confinement—the asylum, the hospital, the prison, the workshop and the school—have added to the political and theoretical significance that disciplines now accord the problem of bureaucratic rationalization. (This is the case despite the important Nietzschean variation of Foucault's work, aptly captured in his aphorism: "my problem is to see how men govern (themselves and others) by the production of truth."[3]) In recent years, scholars have begun to explore what Foucault called the "tactics of governmentality" in some detail.

James Scott's study of the modern states' struggle to eliminate, or ignore, the secrets of local complexity is, I think, probably the most influential of these. At the core of this account was the bureaucratic elite's effort to make the intricacies of local systems – land ownership, patterns of settlement, individual names—comprehensible from the centre. Maps, especially cadastral maps, were "designed to make the local situation legible to the outsider." Similarly, the almost global introduction of personal surnames was part of a process that incorporated individuals into the mass of "written, official documents."[4] Scott attributes the catastrophic results that have followed from the introduction of many of the most ambitious efforts of social engineering in the 20th century not to science itself, as Foucault may have done, but to the power of an aesthetic "of modern rural production and community life," and an over-reaching desire to "discipline virtually everything within their ambit." This emphasis on the in-built inadequacies of what Scott calls authoritarian high-modernism is an important rider to the generally alarming account of the powers of bureaucratic rationality. (Alas that the price for the failures he has described is rarely extracted from the bureaucrats who initiate

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[1] Max Weber. *The Protestand Ethic and the Spirit of Capitalism.* Translated by Talcott Parsons. (New York: Charles Scribner, 1958) 181. The "iron cage" metaphor was not, in fact, Weber's, but a mistranslation of the phrase "shell as hard as steel." Parsons adopted the iron cage metaphor from the "Man in the Iron Cage" in Bunyan's *Pilgrim's Progress*. Peter Baehr. "The 'Iron Cage' and the 'Shell as Hard as Steel': Parsons, Weber and the *Stahlhartes Gehäuse* metaphor in *The Protestant Ethic and the Spirit of Capitalism.*" *History and Theory* 40 (May 2001) 153-169.

[2] Jürgen Habermas. *The Theory of Communicative Action Volume One: Reason and the Rationalization of Society*. (Boston: Beacon Press, 1984) 144.

[3] Michel Foucault. "Questions of Method" *The Foucault Effect: Studies in Governmentality*. Edited by Graham Burchell, Colin Gordon and Peter Miller. (London: Harvester Wheatsheaf, 1991) 79.

[4] James C Scott. *Seeing like a State: 45, 67.*

them.) But in general Scott follows Weber, and some of the most influential theorists of the modern state (Michel Foucault, Anthony Giddens, Edward Said), focussing on a simplified and standardized form of reading and the political significance of "the files" as key tactics of government.[5]

Yet, given the overall importance of the power of bureaucratic rationality in his theory, Weber is surprisingly unforthcoming about the work of "the files." The most influential theoretical explanation of the political effects of official documentation comes from Michel Foucault's study of punishment. He describes a "power of writing" as a kind of documentary glue that binds individuals to the disciplinary currents of the bureaucracy, and sets in motion the development of what he calls the "clinical sciences."

> The examination that places individuals in a field of surveillance also situates them in a network of writing; it engages them in a whole mass of documents that capture and fix them. The procedures of examination were accompanied at the same time by a system of intense registration and of documentary accumulation. A 'power of writing' was constituted as an essential part in the mechanisms of discipline… It is probably to be found in these 'ignoble' archives, where the modern play of coercion over bodies, gestures and behaviour has its beginnings.[6]

This idea—of an official documentary web that both defines and constrains the state's population—provides a good summary understanding of the work of the modern state.[7] And yet it may already be well out of date.

A new kind of state

The new government form that is emerging around us, which I think can usefully be described as the biometric state, is organised very differently from its documentary predecessor. In its most extreme form, the biometric state has three defining characteristics that distinguish it from other forms of state, even those (like Nazi Germany, the Netherlands, Argentina and contemporary Malaysia) that make extensive use of biometric data. The first of these is compulsory and universal biometric registration. All states capture biometric data, mostly from individuals who move through the criminal justice system, sometimes from welfare grantees. But the biometric

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[5] Weber *Economy and Society* 957. Anthony Giddens. *The Nation-State and Violence: Volume Two of a contemporary critique of historical materialism.* (Cambridge: Polity Press, 1985) 172-181. Giddens phrasing is very careful, and he is certainly alert to the prospect that the state's interest in information-gathering need not be textual. Said's study of the discourse of imperialism repeatedly makes the point that Orientalism was a political "library or archive." See *Orientalism* 32, 41, 94-6. Foucault's observations of the "power of writing" have been particularly influential

[6] Michel Foucault *Discipline and Punish: the Birth of the Prison.* (Harmondsworth: Penguin, 1977) 189, 191.

[7] See *Little Tools of Knowledge: Historical Essays on Academic and Bureaucratic Practices.* Edited by Peter Becker and William Clark. (Ann Arbor: University of Michigan Press, 2001) 2-28.

state requires, as a condition of its operation, the capturing of at least one unique biometric identifier from every adult (citizen and non-citizen) within its territory. Nor is the simple act of capturing biometric information sufficient—the biometric state seeks to bind these individual records to a universal population register: a single, centralised and dynamic store of vital statistical information about the entire population. This population register will be organised by a biometric index, using statistically unique record identifiers from the biometric data captured from individuals. Three administrative "tactics" attend this new informational structure. The first is the idea that the unique biometric identifiers will allow for the merging of all the information that the state retains on individuals, and the second that this information will be available at a "single view," in a database table, a smart-card or a "book of life."[8] The last of these "tactics" is the idea that biometric surveillance will close the documentary and bureaucratic gap between real, biological, individuals and the mechanisms of administration.

What, then, is at stake in the development of the biometric state? For most individuals the developments around the new forms of electronic surveillance are framed by the debate about privacy. But the issue of privacy is, in most respects, a red-herring—drawing us away from the much larger and more important question. How will the biometric state affect the relationship between the most powerful institutions in the modern world – corporations, states and the markets that surround them—and the life-courses of individuals. The question, in other words, is Weber's problem of rationalization. Here I want to flag three possibilities.

Biometric technologies have been designed, for over a century, to supplant writing—they are a strikingly pure example of what Habermas presciently (but rather vaguely) described as "delinguistic steering media." If, as seems very likely, biometric tools retain these anti-textual characteristics, the introduction of the biometric technologies we are currently witnessing will change the nature of the state Weber described. The introduction of biometrics in the three formally unrelated areas of state documentation, computer security and payment card authentication may well produce forms of administrative power that bare no meaningful resemblance to Foucault's "network of writing." Electronic biometric databases perform the functions of "delinguistic steering media" with much more energy and efficiency than any similar 20th century technology. (They can, of course, also fail with much more force.) An international regime of bureaucratic administration (and a parallel commercial system of financial transaction histories) organised biometrically, explicitly stripped of language, may further weaken the already sickly hold of communicatively formed norms and values in all of these societies, leaving unchecked the obsession with the pursuit of "external goods," and its early 21st century equivalent: an unblemished credit history.

Spare a moment for the officials. The biometric state will not shatter the bureaucratic state, but it may greatly diminish the authority, status and discretion of the bureaucracy. In the first instance, biometrics will place many of the most important decisions affecting the fate of individuals—access to credit, travel privileges, judicial

[8] See Peter Becker. "Is Hanis finally happening?" ITWeb 31 March 2005. Accessed at http://www.itweb.co.za/sections/quickprint/print.asp?StoryID=150860 11 April 2005.

status—in the "hands" of computer algorithms. Added to this is the fact that, notwithstanding the enormous funds that states have been spending on information technologies, bureaucrats have only a very poor grasp of the workings of networked database applications. Outsourcing of the development, and management, of information processing systems is the norm across the world, and the result is that the bureaucrat is now, much more than when Weber first wrote about it, "only a small cog in a ceaseless moving mechanism which prescribes to him an essentially fixed route of march."[9] Biometric databases also squash the local political domain that has underpinned so much bureaucratic authority in the 20th century, energetically transferring decision making, and many layers of automated surveillance, to the centre.

There is a third possibility. The biometric state may simply fail. There are good precedents for this kind of collapse in two of the most extravagant efforts of this kind in the last century: the Nazi *Volkskartei* or population register, and the Apartheid *Bewysburo* or bureau or proof that makes up part of the story of this book. It would be foolish to speculate about what the consequences of this kind of failure might be, but two facts are clear enough. In South Africa the failure of the biometric project has left little space for the introduction of an alternative system of bureaucratic administration, and costs of the failure are borne primarily by those who acquiesce in the operations of the system. Those who most determinedly seek to defeat the biometric system, the targets of the state's surveillance strategy, will be the primary beneficiaries of its failure.

The origins of fingerprint biometrics

The state that Lord Alfred Milner made in South Africa after 1900 was built using tools of government that had been developed in England, France and India in the 19th century. The South African state came to rely, especially, on tools of identification that had been sharpened in the effort to control a new category of delinquent: the habitual criminal or recidivist. In the first half of the century European courts had began to use archival tools to track the movement, identities and crimes of convicted felons. The first of these tools were bound registers, indexed alphabetically by surname that recorded convictions in the French courts. These documentary records encouraged the turn away from the use of branding, and other physical markers, as official indicators of criminal history. "The marking of the criminal record," Simon Cole has suggested, "replaced the marking of the criminal body."[10] As late as 1879 the British police began to compile a single volume *Register of Distinctive Marks* (1879) in an effort to use physical marks on the body—scars, tattoos, birthmarks—to establish the identity of known criminals.[11]

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[9] See Paul Foot. "Medes and Persians." *London Review of Books* Volume 22, Number 1. 2 November 2000. Weber *Economy and Society* 988.

[10] Cole *Suspect Identities* 13 -16, quote from 16.

[11] Cole *Suspect Identities* 27, Sengoopta *Imprint of the Raj: How Fingerprinting was born in colonial India.* (London: Macmillan, 2003) 14.

The great mass of information trapped in the bound registers was of little use in the officials' effort to design punishments matched to the biographies of the accused. "All these innumerable documents, collected with a great deal of care and effort, lie in the judicial registers as in catacombs," Arnould Bonneville, inventor of recidivism, complained in 1844, "whence it is almost impossible to extract information needed from them in a timely manner."[12] Bonneville's solution to the vast pool of untapped information hiding in the court registers was the introduction of the card index, a tool that allowed the data that the state gathered on individuals to escape the physical confines of the bound volume, connecting events across time and allowing, at least in theory, the registry (now become a room) to expand indefinitely.

How, in the absence of the medieval tools of branding, clipping and tattooing, were 19th century policemen to maintain the connection between the documentary record and the accused, when all that maintained it was a fickle name? Alphonse Bertillon, working as a clerk for the Paris Police in the 1870s, solved these problems by applying anthropometrics—the statistics of the body—to the process of identifying "incurable vagrants," building a tool that allowed the police to follow the criminal "across time" by indexing the body itself. [13] It was Bertillon's work that established the practical basis of biometry by specifying in minute detail the procedures that should be used to measure, describe and record eleven different parts of the body. Bertillonage, as the global system of criminal identification was called in the 1890s, injected the tools and racist preoccupations of phrenology and craniometry, the fields of anthropology that sought to assess personality and intellect by measuring the contours, size and shape of the skull, into the heart of the modern bureaucracy. Biometrics followed closely behind.

The agent of the modern state's dependence on fingerprinting was Francis Galton, the founder of eugenics, author of the statistics of regression and correlation, and patron of the new field of biometrics. Galton was obsessed throughout his life with the project of building the "perfect eugenic state", determining the relationship between heredity and genius was the key to realising this plan.[14] From the late 1870s he became convinced that Bertillon's precise anthropometry would allow him to establish the statistics of biological inheritance. In 1882 he published a plan for an "anthropometric laboratory" that would allow the English gentleman to have his "family and himself measured physically and mentally."[15] He built the new lab—"an area 6 feet by 36 feet, crammed with instruments of his own design"—for the International Health Exhibition in 1884, and then kept it running in South Kensington to gather detailed anthropometric statistics for most of the next decade.[16] As part of the effort to find a key marker of heredity and

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[12] Quoted in Cole *Suspect Identities* 16.

[13] Cole *Suspect Identities* 33, 48.

[14] Ruth Schwartz Cowan. "Francis Galton's Statistical Ideas: The Influence of Eugenics." *Isis*, Vol. 63, No. 4 (Dec., 1972), 509-528.

[15] John C. Kenna. "Sir Francis Galton's Contribution to Anthropology." *The Journal of the Royal Anthropological Institute of Great Britain and Ireland*, 94:2 (Jul. - Dec., 1964), 85.

[16] Sengoopta *Imprint of the Raj* 95

identity the laboratory began to collect fingerprints from its subjects some time after 1888. It was over a decade later that the new lab, now housed at University College London, acquired the impressive title of the Biometric Laboratory, at the same time as the new journal *Biometrika*. Under the influence of Galton's disciples, Karl Pearson and W F R Weldon, biometrics increasingly became concerned with the large scale statistical problems, and prescriptions, of eugenics. If the modern discipline of statistics was the legitimate heir of this strange marriage of anthropometry and eugenics, fingerprinting was an accidental child. It may yet have more powerful political effects than the other members of the biometric family.

Fingerprinting spread through the British Empire from the East. The experience of authenticating documents with fingerprints certainly long pre-dated British colonial administration, and the Chinese and Indian workers themselves may have brought the practice of fingerprinting to South Africa. The early registers that officials used to collect information about the workers arriving in the Durban harbour after 1904 consist of meticulously laid out tables of Chinese script with a small fingerprint punctuating each line. The very elegance of these tables suggests that the clerks, and the workers, were well practiced in the bureaucratic use of fingerprints as personal identification. But Galton's plans for the administrative use of fingerprints were of a different political order, and the key sources for the development of his system were the observations of a missionary based in Japan, and the experiences of a rent-collecting magistrate in the India.

If there was a prize for the first use of fingerprints in the building of a biometric register it would gone to the missionary, Henry Faulds. He lay down the first clear guidelines for the actual printing of fingers, and he tried to show that fingerprints could be used as racial markers a full decade before Galton turned to that project. It was Faulds who drew Galton's attention to the possibilities of collecting the "for-ever-unchanging finger-furrows of important criminals."[17] But the long running and bitter dispute about the origins of the fingerprinting system in Britain—a dispute that pits Faulds against Galton—is of very little moment to the history of biometrics in South Africa. Here, more than anything else, it was the administrative experience of colonial India that underwrote the development of fingerprinting.

The use of fingerprinting for bureaucratic administration was a colonial innovation: it emerged from the difficulties of upholding contractual law in Bengal in the 1860s, and predated Faulds' attempts to build a system of identification in Japan. Sir William Herschel, the Chief Magistrate of Hooghly, resorted to "taking the signature of the hand itself" in an effort to frighten "the man who had made it from afterward denying his formal act." Faced with the same kind of relentless subversion of the documentary order that would later confront administrators on the Witwatersrand, for Herschel fingerprints came to serve as a "written" substitute for the systemically unreliable "signatures of the natives." After seventeen years of using handprints as a ritualised

[17] Henry Faulds. "On the skin-furrows of the hand." *Nature*, October 8, 1880, and Cole *Suspect Identities* 74.

supplement to the signature in the enforcement of contracts, he ordered the collecting of fingerprints as a common means of fixing and individualizing written identities.[18]

In the monographs and papers that Galton published between 1892 and 1895—*Finger Prints*, a supplementary chapter called *Decipherment of Blurred Finger-Prints*, and *Finger Print Directories*—he drew on this administrative history to demonstrate the key point that fingerprints were unchanging. It was these works that prompted the widespread institutional enthusiasm for fingerprinting in the English colonial world. Galton's scheme had many arresting features, but at its heart it was designed as a tool for strengthening the imperial bureaucracy. He publicised a system for the collection, reading and indexing of fingerprints designed to solve the problems of colonial policing, and it was rapidly taken up by the police in India. It was from there that it found its way to South Africa. .

Galton's particular cunning lay in generalising and popularising this tool for closing the gap between the subject and the bureaucratic record. "The need of some sound system is shown to be greatly felt in many of our dependencies," Galton drolly observed, "where the features of the natives are distinguished with difficulty; where there is little variety of surnames; where there are strong motives for prevarication … and a proverbial prevalence of unveracity." While he was generally attentive to the isolation and confusion of the imperial bureaucrats, he was careful to repeat throughout his study that the diagnostic skills required for a working fingerprinting system were widely and cheaply available, "to be found in abundance among ordinary clerks."[19]

On the face of it this argument—that almost anyone could be taught how to take, interpret and classify fingerprints—seemed absurd. There is nothing particularly self-evident about fingerprints. To establish the viability of fingerprints as a mechanism for establishing and fixing the identity of very large numbers of people, and to supplant alternative systems, like Bertillon's anthropometric photography, Galton needed to rid the identity of each fingerprint of all ambiguity and establish a mechanism for storing each fingerprint record that would allow for rapid and accurate recovery. He did this by focusing on the seam that cuts through the complex patterns on the finger, leaving in place a single dominant pattern. "After a pattern has been treated in this way", Galton reassured his readers, "there is no further occasion to pore minutely into the finger print, in order to classify it correctly." The single remaining pattern, skewered by the intersection of the three corners of the seam, was then classified as one of three archetypes: Arch, Loop or Whorl. While Galton's scheme allowed for an almost infinite elaboration of sub-classifications (for example, the Forked Arch, Eyeletted Loop, Ellipses Whorl) these three basic categories gave him a mechanism for converting each finger into a letter, A L or W. "The bold firm courses of the outline," he explained, "are even more distinct than the largest capital letters in the title page of a book." It was a simple matter, thereafter, to make each hand into a word that could be classified alphabetically.

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[18] Galton. *Finger prints.* (London: Macmillan, 1892) 27-8. See also Herschel in *Nature* xxiii, p23 (Nov 25, 1880) cited in Galton. Sengoopta *Imprint of the Raj* 54-78.

[19] Galton. *Finger prints.* 14, 15.

Here lay the key to the unusual power of Galton's system: his fingerprinting classification provided a simple mechanism for converting the obscure qualities of the body into a textual object, subject to the normal procedures of indexing that were being used widely by the documentary bureaucracy. (Bertillonage did something very similar but required a much more complex examination.) It was Galton who popularised the stunning claim that properly classified fingerprints will produce a mathematically unique identifier for every human being—what we today would call a unique biometric identifier. In theory, and in practice, Galton provided a means whereby "a fingerprint may be so described by a few letters that it can be easily searched for and found in any large collection, just as the name of a person is found in a directory." Fingerprints, unlike names, were physically bound to the person they denominated, and free of the ambiguity and manipulation that characterised naming. They provided, as Galton put it, "a sign manual that differentiates the person who made it, throughout the whole of his life from the rest of mankind…" [20]

But Galton's system didn't really work. In even relatively small populations the three letter, ten digit words his system used did not form unique labels, and in large populations (of tens of thousands of people) his classifications produced large groups of identical records. To sort these groups of duplicates he did produce a further set of sub-classifications but they were so tricky to use that he could not agree even with his own assistant on their application. It was this complexity, and uncertainty, of classification that prompted the British Home Office in 1893 to retain the more straightforward and tedious measuring rituals of Bertillon's anthropometrics as the basis of criminal identification. And, despite the claims of his earlier book, in 1900 Galton himself was still anxious about abandoning the elaborate certainties of Bertillonage for the single-step solution of fingerprinting.[21] It was, in the meantime, the experience of colonial government in India that produced the unique "sign manual" that Galton had announced a decade earlier.

Colonial government, as English administrators sometimes acknowledged, had some advantages of simplicity over Home Rule. One of these areas of advantage in India, at least before 1849, was in the handling of the problem of the "habitual criminal." Before that date, the most serious criminals had their sentences tattooed onto their foreheads: life prisoners bore their names, sentences and the date of conviction, those convicted of belonging to the cult of assassins were marked by the word *Thug*, and, before 1817, forgers were imprinted with the Persian word for "liar" or "cheat." But after 1850, under the weight of the humanitarian concerns of the English public, and new informational expectations of government, administrators in India came to rely on registration processes similar to those of their metropolitan colleagues.[22]

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[20] *Ibid.*

[21] Cole *Suspect Identities* 80

[22] Singha "Settle, mobilize, verify: Identification practices in Colonial India." *Studies in History* 16:2 (2000) 165-167, 187-8.

The process of registration in India culminated in the publication of the Criminal Tribes Act of 1871. Under the terms of this law, entire nomadic and pastoralist communities were defined as criminals by descent. The law bound these people to particular places by entering their names into registers maintained by the district magistrates. The law required individuals who wanted to move away from their recorded place of residence to apply for a pass that specified an itinerary and duration of travel, listing the specific police stations that the bearer was required to visit during this period away from the district. In the villages falling under the act government appointed headmen were required to conduct inspections every evening to ensure that individuals had not absconded without permission. And the penalties for violating the terms of the act were similarly harsh.[23]

The problem, at least as far as Edward Henry, Inspector General of the Bengal Police, was concerned, was that the subjects of this draconian order tended not to play by the rules. The state's extravagant plans for surveillance could only work if the targeted individuals stuck to the names in the magistrates' registers. Often they did not. Towards the beginning of the 1890s, Henry began to implement Bertillon's system of identification and registration. "With anthropometry on a sound basis," he reported, "professional criminals of this type will cease to flourish, as under the rules all persons not identified must be measured, and reference concerning them made to the Central Bureau."[24] Very quickly the Bengal police built up a register of the "principal criminals in the several jails of the Province." After reading *Finger Prints*, Henry worked on a hybrid of the Galton and Bertillon systems: using measurements to locate an individual record his identification technique relied on matched thumb-prints to establish individual identity. But establishing a consistent set of Bertillon measurements across 120 different sites in Bengal remained a serious, and continuing, problem.[25]

After initiating correspondence with Galton and visiting his London laboratory in 1894 Henry was convinced that fingerprinting could eliminate the errors produced by his operators, and significantly reduce the cost of identification by dispensing with Bertillon's expensive brass instruments. Two of his subordinates, Azizul Haque and Chandra Bose, began to research a workable system for the classification of fingerprints. The Henry System that emerged from this collaboration made significant changes to Galton's classification, replacing his three types (Arches, Loops and Whorls) with just two (Loops and Whorls) and classifying the fingers in five paired sets, each of which could be one of four possible classifications. Henry's system allowed for a basic classification of 1024 possibilities (4^5) and these could be neatly arranged into a cabinet that had 32 rows and 32 columns. For further sub-classification his system relied on the uncontroversial procedures of ridge-tracing and ridge-counting. The labels generated under his system could be neatly represented mathematically, and they seemed to do away with the difficult interpretative problems of Galton's sub-classifications. From the

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[23] Sengoopta *Imprint of the Raj* 126-129.

[24] Sengoopta *Imprint of the Raj* 128.

[25] Sengoopta *Imprint of the Raj* 130-4

middle of 1897 this system of identification became mandatory for the processing of prisoners across the vast territory of British India. The huge subject population covered by the new system soon conferred a mantle of success. In 1900 Henry was called to London to advise the Belper Committee on the introduction of fingerprinting in Britain. In the same year he published the workings of his system in *The Classification and uses of Finger Printing*, the definitive manual of twentieth century finger printing.[26]

After persuading the British Home Office (over Galton's objections) to adopt fingerprinting for the identification of criminals, Henry was requested by the Colonial Secretary, Joseph Chamberlain, to accompany General Lord Roberts to South Africa to establish the new Transvaal Police Force.

The rest, as they say, is History.

[26] Cole *Suspect Ientities* 81-7, Sengoopta *Imprint of the Raj* 138, 205-216.

Research on keystroke dynamics biometrics has been increasing, especially in the last decade. The main motivation behind this effort is due to the fact that keystroke dynamics biometrics is economical and can be easily integrated into the existing computer security systems with minimal alteration and user intervention.Â Review Article | Open Access. Volume 2013 |Article ID 408280 | https://doi.org/10.1155/2013/408280. Pin Shen Teh, Andrew Beng Jin Teoh, Shigang Yue, "A Survey of Keystroke Dynamics Biometrics", The Scientific World Journal, vol. 2013, Article ID 408280, 24 pages, 2013. https://doi.org/10.1155/2013/408280. Show citation. A Survey of Keystroke Dynamics Biometrics. [subject] biometric function; market research data; and competitive intelligence from a wide range of sources. In formation management deals with the value, quality, ow-nership, use and security of information in the context of organizational performanceâ€ [1]. The life-cycle of infor-mation includes 1) creation and acquisition; 2) mana-gement of information, e.g., creation of (biometric and forensic) databases, storage, retrieval, sharing and disse-mination, leading to and including full-fledged informa-tion systems; and purposeful.Â For the remainder of this paper the biometric of interest is the human face with predic-tions on face identities, and reasoning and inference as the aggregate means to make predictions. There has been much realization that face recognition is still lacking. Biometrics are automated methods of recognizing a person based on a physiological or behavioral characteristic. Biometric technologies are becoming the foundation of an extensive array of highly secure identification and personal verification solutions.Â During Enrollment a sample of the biometric trait is captured, processed by a computer, and stored for later comparison. Biometric recognition can be used in Identification mode, where the biometric system identifies a person from the entire enrolled population by searching a database for a match based solely on the biometric. Learn how biometrics work, along with the different types and examples of biometrics. Find out more about biometric vulnerabilities and privacy issues.Â It is costly to get a biometric system up and running. If the system fails to capture all of the biometric data, it can lead to failure in identifying a user. Databases holding biometric data can still be hacked. Errors such as false rejects and false accepts can still happen.