

In Biometrics We Trust?

“The Spirit of Biometrics”

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S. Stigler, “The Problematic Unity of Biometrics”, *Biometrics* (2000)

- “What is biometry? Our modern subject of biometry is amazingly diverse; so much so that the question could be raised as to whether or not it has sufficient unity to constitute a single discipline.”
- William Whewell (1831)
 - “...there is a problem in Biometry (if you choose to call your calculations on lives by a Greek name) which may perhaps be included in something you have done.... It is this: "It is said to be ascertained that to put off to a later period of life the average age of marriage does not diminish the average number of children to a marriage. This being assumed, to find the effect on the increase of the population produced by a given retardation of the average age of marriage."

What is “Biometrics”?

1. Computation of population growth – Whewell (1831)
 - Thomas Malthus, “An Essay on the Principle of Population”, (1798-1826)
2. Study of the length of life --- Moreau Morris (1875)
3. “The application to biology of the modern methods of statistics”
 - F. Galton in *Biometrika* (1901)
 - Charles Darwin, “Origin of the Species”, (1859); “Descent of Man” (1871)
4. “The active pursuit of biological knowledge by quantitative methods” – R.A. Fisher in *Biometrics* (1948)
5. “The field concerns itself with using fingerprints, voice patterns or other physiological traits to verify a person’s identity” – New York Times, 24/09/81
 - IBM, “Consideration of Data Security in a Computer Environment”, (1970)
6. “The application of statistical methods to biological data” – Oxford English Dictionary, 10th Edition, 2002

The Biometrics of Galton/Pearson (1901)

- Establishing a scientific basis for Darwin's theory of evolution
 - Resistance to Darwin from scientific community
 - Non-experimental
 - Non-quantitative
 - Not falsifiable
 - Response: “Pre-Cambrian Rabbit”
- Supporting eugenics
 - Pearson held Galton Eugenics Chair at University College London
 - Low reproduction rates of upper classes causing genetic degradation
 - Legislative implementations in US
 - California a leader – “Sterilization for Human Betterment” (1929)
 - Opposed by Catholic Church
 - Nazi Eugenic Sterilization Law of 1933 for all with “hereditary” disabilities

US Supreme Court Ruling in *Buck v. Bell* (1927)

- Concerning the forced sterilization of 17 year-old Carrie Buck, a second generation “moron” with a baby daughter
- “...the public welfare may call upon the best citizens (to sacrifice) their lives. It would be strange if it could not call upon those who already sap the strength of the State for these lesser sacrifices (mandatory sterilization)...in order to prevent our being swamped with incompetence. ...The principal that sustains vaccination is broad enough to cover the cutting of the Fallopian tubes”
- “Three generations of imbeciles are enough” -- Justice Oliver Wendell Holmes

“The Spirit of Biometrika”, *Biometrika*, Vol. 1, No. 1 (1901)

“It is almost impossible to study any type of life without being impressed by the small importance of the individual. In most cases the number of individuals is enormous, they are spread over wide areas, and have existed through long periods. Evolution must depend upon substantial changes in considerable numbers and its theory therefore belongs to that class of phenomena which statisticians have grown accustomed to refer to as mass-phenomena. A single individual may have a variation which fits it to survive, but unless that variation appears in many individuals, or unless that individual increases and multiplies without loss of the useful variation up to comparatively great numbers—shortly, until the fit type of life becomes a mass-phenomenon, it cannot be an effective factor in evolution “

The Outlook of That “Spirit”

- The centrality of the “effective factors in evolution” and “the fit type of life”
- The “small importance of the individual”
- The importance of the population
- Using statistical methods to uncover mass-phenomenon
 - Common phenomenon within a class across individuals
- Establishing levels of variation between and within populations
 - A “class” is a population

ISO/IEC SC37 Definition

“Biometrics” -- the automated recognition of individuals based on their biological and behavioral characteristics --- ISO/IEC 2382-37:2012 (pending)

The Spirit of Our Biometrics

- No concern for evolution or the genetic future of the population
- The supreme importance of the individual
- Discarding the common characteristics of the population
- Using statistics to establish levels of variation between and within individuals
 - A “class” is an individual at different times in different environments

Some Important Consequences of Our Definition

1. Biometrics without identity
2. Recognition, not “verification” or “identification”
Old concepts!
3. No taxonomy of “behavioural” and “biological”
4. Non-recognition can be as important as recognition
– The Zen of Biometrics
5. Non-automated approaches out of scope
6. Biometrics without enrolment
– Example: Speaker counting

Supporting this New “Spirit” with a New Journal

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Conclusion

- Our field of “biometrics” is rooted in very different (in some ways opposite) principles than the older, more established field.
- Our field is, however, not immune from the possibilities of misuse of the technologies.
 - The potential for abuse remains
- We must learn from the darker applications encouraged by our predecessors and remain vigilant and introspective regarding our responsibilities.