Francis Galton

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Francis Galton (1822-1911) was among the most influential psychologists of the 19th century. He did pioneering work on the correlation coefficient, behavior genetics and the measurement of individual differences. He introspectively examined the question of free will and introduced the lexical hypothesis to the study of personality and character. In addition to psychology, he did pioneering work in meteorology and introduced the scientific use of fingerprints. Whenever he could, he counted.

Sir Francis Galton (Feb 16, 1822 - Jan 17, 1911) was among the preeminent psychologists of the 19th century. Born to a wealthy English family he was able to devote his life to a variety of scientific inquiries. Although best known to psychologists for his pioneering work on the correlation coefficient and the study of individual differences in intellectual ability, he also did fundamental research on behavior genetics, meteorology, and the use of fingerprints for identification.

Galton was born on February 16, 1822 near Sparkbrook (now part of the inner city of Birmingham, England) to a successful Quaker family who manufactured guns during the early 1800s. Through his maternal grandfather, Erasmus Darwin, he was a half cousin of Charles Darwin. Galton was the youngest of seven children and his early childhood memories reflected the love of his family as they inculcated him with a love of literature, science, and mathematics. Based on Karl Pearson's four volume biography of Galton, Terman (1917) analyzed Galton's intellectual accomplishments as a child and estimated Galton's mental age as a child as roughly twice his physical age. That is, at age five he was reasoning as would a normal ten year old, and by the time he was eight, had accomplished what a normal 16 year old could do. Thus Terman estimated Galton's IQ as surpassing 200.

Although trained in mathematics and medicine at Cambridge, when he was 22 the death of his father and the resulting inheritance allowed him to forgo continuing in medicine and instead to satisfy the desire to travel he had acquired as a brilliant if somewhat cavalier student. In 1845 Galton travelled through Egypt (which at the time included Sudan) and went slightly beyond Khartoum and briefly explored the upper regions of the White and the Blue Nile, before continuing on to Syria, Lebanon and exploring the Jordan River towards the Dead Sea. Such travels, which by end of the 19th century would seem a natural part of a young person's "Grand Tour", at the time were considered exotic and temporarily satisfied his wanderlust. Galton spent the next few years enjoying the idle life of a country squire, hunting and fishing while simultaneously reading and thinking about science.

In 1850 he proposed to the Royal Geographical Society to undertake (and finance) an exploration of South West Africa. For the next two years his journeys in what is now Namibia led him through previously unexplored (by Europeans) regions. His writings describing the perils of lions, elephants and his dealings with marauding and feuding tribesmen were extraordinarily detailed and yet remain to this day enjoyable to read. He measured longitude by the lunar distance method used by sailors without access to accurate chronometers; latitude by the traditional use of a sextant to measure the elevation of stars; and elevations of mountains by the temperature of boiling water. Upon his return to England he

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wrote up a descriptive narrative of his travels (*The narrative of an explorer in Tropical South Africa*, 1853) as well as a thoughtful survival guide for the traveller (*The art of travel*, 1855). The acclaim he received for his travels and his writings led to his election to the RGS and led him to devote his considerable energies in scientific pursuits rather than his previous life of hunting with his country friends.

By 1862 his interests had turned to meteorology; by organizing data collection all over western Europe he was able to distinguish between cyclonic (where the winds blow counter clockwise) and anticyclonic weather patterns. The style of maps he developed to show these patterns of low and high pressure zones are used to this day. His interest in meteorology led him to be a member of the meteorological council for 34 years where he continued to advance the science of meteorology.

Galton's interest in meteorology illustrates his fascination with numbers. His personal maxim was to "Count where ever you can" and he did so by observing everything from the number of fidgets observed during a lecture to personal ratings of the beauty of women throughout the United Kingdom. He developed simple instruments to help him record his observations, such as pricking a pin into a note card in different locations as he listened to a lecture and observed people fidgeting.

Inspired by reading *On The Origin of Species* by his cousin, Charles Darwin, Galton published a number of articles examining how scientific, literary, and legal talent tended to run in families. He considered the obvious explanation of social class and social opportunity but marshalled evidence such as that even among the elite students who attended Cambridge the top scorers on English or Mathematics examinations were much more frequently related than expected by chance. His analysis resulted in several volumes studying the sources of eminence, the first of which *Hereditary Genius: An Inquiry into Its Laws and Consequences* (1869) elaborates his evidence that talent runs in families and that the effect is weaker the more remote the relationship. Galton proudly reports in his biography (*Memories of my life*, 1908) the letter he received from Darwin expressing great enthusiasm for the book. A subsequent volume on the topic of the sources of scientific eminence led to him to consider the sources of talent due to *nature* or *nuture* (his terms) as well as the power of the twin design to study genetics.

Having read the work of Quetelet on the distribution of many natural phenomenon, Galton was most taken with the idea of what has come to be called the normal curve and variation around the central tendency. He designed and had built a mechanical apparatus, a *quincunx*, to demonstrate how the normal normal curve is the result of many independent random events. Based upon these observations was his letter to *Nature* in 1874 proposing a basic metric (his "common statistical scale" which was conceptually equivalent to the modern *z score*) which expressed deviations from the median in terms of the probable error (or half the interquartile range). To Galton, the advantages of the median and the interquartile range were that they were easier to find by casual observation than were the mean and standard deviation.

Subsequent work with the genetics of height in humans and size in the garden pea led him to introduce the concept of *reversion to mediocrity* (regression to the mean) and to the concept of the regression slope relating parent to offspring. With a flash of insight based upon the different slopes of parent to child and child to parent, he derived the *co-relation* index (1888). Subsequent work by Pearson, Wentworth, and Yule led to the formalization of this concept as what we now know as the *Pearson Product Moment Correlation Coefficient*.

His later research on individual differences (1891) led to his introduction of using fingerprints as a means of identification. Galton realized that for fingerprints to be useful there needs to be evidence for constancy across the life span, that there is suitable variation in fingerprints to define someone uniquely, and finally, that one could develop a lexicon of fingerprints, such that an expert could identify them. He was able to demonstrate that all three conditions held.

His interests in measuring individual differences led him to arrange (at his own expense) to collect data at the International Exposition of 1894 in London. He arranged to measure "Keenness of Sight and of Hearing; Color Sense, Judgment of Eye; Breathing Power; Reaction Time; Strength of Pull and of Squeeze; Force of Blow, Span of Arms; Height, both standing and sitting; and Weight". The success of his measurements at the International Exposition led him to continue collect similar data at a museum for the next six years.

In considering which individual differences are important for understanding and describing character, Galton reviewed his basic genetic approach, the use of the *twin method* in quantitative genetics, and reported on his own introspection on the little amount of his behavior that exemplified *free will* rather than on the normal consequences of habit and situation (*Measurement of Character*, 1884). He continued his discussion of determining the relevant aspects of character by consulting Roget's *Thesaurus* and found at least 1,000 words that differed slightly in meaning when describing character. This is probably the first test of the *lexical hypothesis* that has come to fruition in much of the current work on the structure of personality. In this same brief paper, he also considered how to apply psychophysical and behavioral measures to the study of emotion and desire.

Any discussion of Galton must include his advocacy of eugenics (*Eugenics: Its definition, scope, and aims.*, Galton, 1904): "EUGENICS is the science which deals with all influences that improve the inborn qualities of a race; also with those that develop them to the utmost advantage. The improvement of the inborn qualities, or stock, of some one human population will alone be discussed here." This talk, read to the Sociological Society in London, was met with both the support and criticism of biological models of behavior that continue to this day. Although Galton advocated for positive selection by encouraging the marriage and reproductive success of the physically and intellectually talented, subsequent application of eugenic principals in the United States of forced sterilization and in Germany of genocide left society with an unwillingness to consider Galton's more positive suggestions for disseminating the knowledge of the laws of heredity. For unfortunately, his worry that over zealous actions would do harm and cause the science to be discredited has come to pass.

To dismiss Galton for his advocacy of eugenics is to ignore the lifetime contributions of perhaps one of the greatest scientific minds of the 19th century. If he had merely contributed the correlation coefficient, his impact would have been substantial. But he went far beyond that by starting the fields of behavior genetics, introducing the nature/nurture distinction, formalizing the study of ability, introducing the lexical hypothesis, and much more. He justifiably is known as one of the great polymaths of the 19th century.

See Also

Correlation; Regression; Behavior Genetics; Eugenics;

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