**Preliminary literature review (just notes at this stage)**

The study of heredity arguably gave rise to modern methods for correlation

Define heritability –

* Falconer (1) p163 – Identical Twins ; maybe also see Visscher (2)
  + Explains the relevance of the comparison between identical twins and non-identical twins: it is assumed that the common environmental effects shared by each kind of twin pair will be similar, such that between group differences may be attributable to genetics.
  + Assuming that
    - non-additive genetic variance is not a factor at play, and
    - that some other confounding has not occurred resulting in dizygotic twins being more similar than would otherwise be expected (example given is blood sharing in fraternal cattle twins in birthing complications --- not sure of human analogy??)
    - then,

‘The difference between the correlation coefficients of identicals and fraternals … could be taken as an estimate of half the heritability’

History of estimation of correlation in modern statistics and genetic analysis

* Gregor Mendel (sweet pea experiments > segregation > heritability)
* Francis Galton's articulation of Mendelian genetics in formal statistical treatment (3, 4) >> also sweet peas and humans (height, bones) >> regression / correlation
* Karl Pearson, extension of Galton’s work on correlation (“Galton’s function” >> bivariate correlation), and drive for numerical accuracy (down to FN David in 1938) (5, 6)
* Student, and ‘probable error of a correlation coefficient’ (7)
* Soper, and approximating the frequency distribution of with (8)
* Ronald Fisher, and approximation of distribution of population correlation coefficient using inverse hyperbolic tangent transformation (Fisher’s ) (9)
* Neyman and Egan Pearson (10) (confidence intervals; and NHST --- relates to questions of power )
* Florence Nightingale David (11) – a concise summary of history of correlation up to 1938, including formulas and notes on various approximations and methods for detecting difference, and a proof of the distribution of for any n and ; and graphical visualisation of ‘chance of rejecting the hypothesis when true’ for different values of r and . Might be inspiration for a contemporary visualisation of our approach.

The above history largely traces back over the references given by David (Student to Neyman & Pearson); however, a useful summary table of historical landmarks is provided in Hauke and Kossowski (12) , as preface to their comparison of Pearson and Spearman (non-parametric) correlation coefficients – which may be relevant later on once I start differentiating these. Darwin connection not a surprise given Galton relationship; but Gauss & JS Mill --- so extending beyond the sphere of genetics there

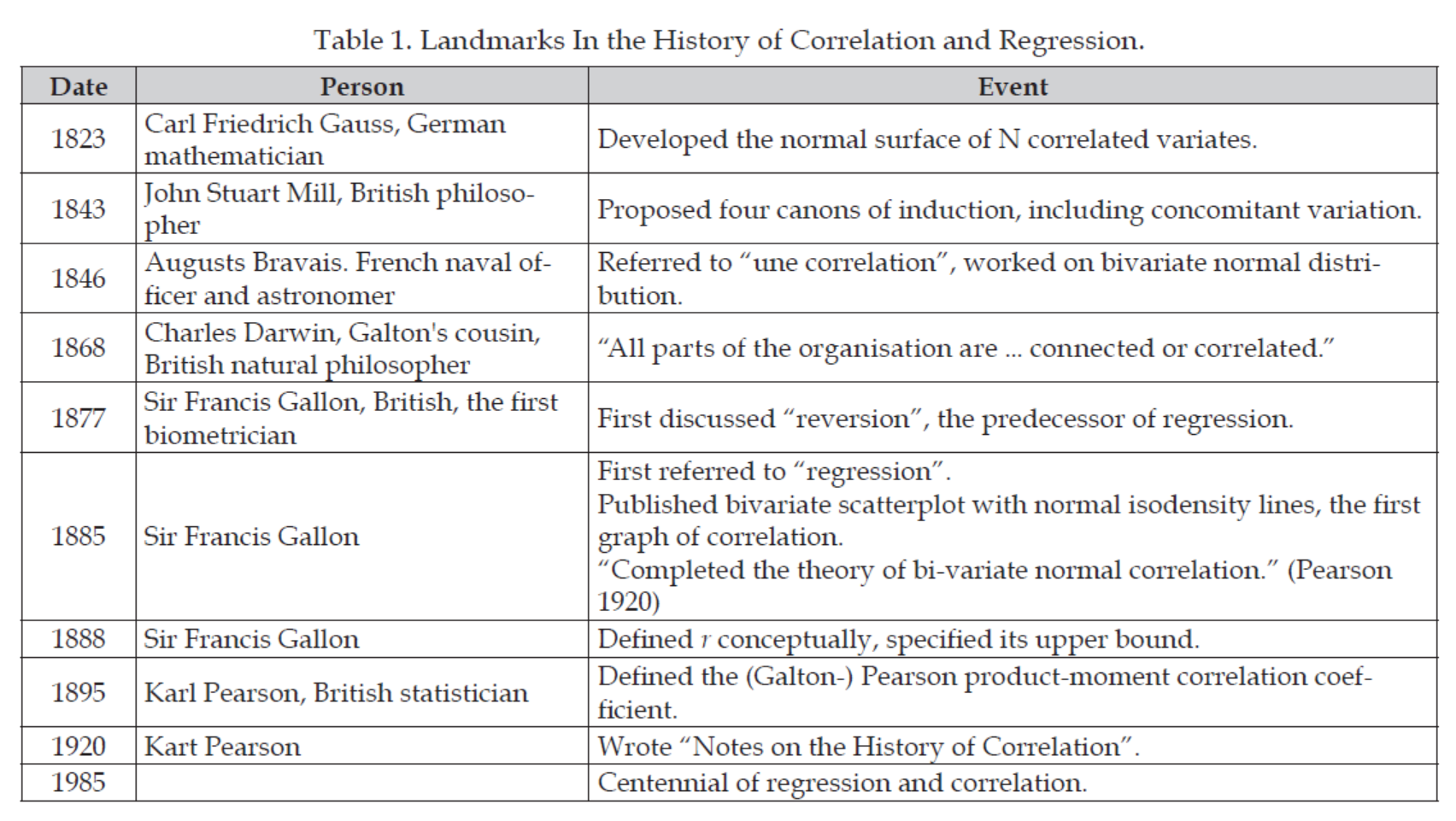


Figure 1. Snapshot from Hauke article - just as a note of the earlier history, which I probably won't trace back myself!

Random effects & Interclass correlation coefficient (ICC) – correlations in context of clustering (like twin pair)

* Fisher and Analysis of Variance
  + From Wikipedia (not a reputable reference I know!; preliminary): “in the ICC, the data are centered and scaled using a pooled mean and standard deviation”
* I think ICC will be apt approach – e.g. used in Castillo-Fernandez et al (13) considering epigenetics of discordant Mz (and Dz) twins, with reference to ‘intra-pair correlation coefficients’ (ICC) in place of in the formula for heritability sourced from Falconer (1)

Non parametric approaches to correlation

* Spearman (14)
  + See review and real data comparison with Pearsons by Hauke and Kossowski (12)
* Kendall's tau A and B

Power

* Neyman and ES Pearson (10)
* Cohen (15)

Methods of estimation

* Approximations
  + Analytic / numerical
    - Fisher’s
    - others
  + Empirical distribution
    - Bootstrap
    - Simulation
    - Permutation

Variance component models for Mz Dz twins (perhaps first?) --- see Falconer (1)

Ratio of Mz/Dz and variance as positive constrained; Mixture of chi(0) and chi(1) distributions - see Visscher 2008 (16)

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