

# A brief history of stats tests and the statisticians behind them.

## Mann Whitney U test

H. B. Mann, & D. R. Whitney (1947) "On a Test of Whether one of Two Random Variables is Stochastically Larger than the Other," *The Annals of Mathematical Statistics, Ann. Math. Statist.* 18(1), 50-60

The Mann-Whitney U test is used for independent measures designs and where the data is at least ordinal.



Henry Berthold Mann (1905 - 2000) was a professor of mathematics and statistics at Ohio State University. Mann earned his Ph.D. degree in mathematics in 1935 from the University of Vienna and immigrated to the United States in 1938, and lived in New York, supporting himself by tutoring students. He developed an interest in statistics, particularly in the analysis of variance, and in the problem of designing experiments with a view to their statistical analysis.



Donald Ransom Whitney (1915—2001) was an American statistician. Having obtained his MA at Princeton, Whitney spent much of the Second World War teaching navigation to newly commissioned officers. After the war he obtained his doctorate at Ohio State University [OSU] under the supervision of Henry Mann. The subject of his research was the non-parametric Mann–Whitney test (published in 1947). Whitney remained at OSU throughout his career, retiring in 1982

## Wilcoxon Signed Ranks test

Wilcoxon, F. (1945). Individual Comparisons by Ranking Methods. *Biometrics Bulletin*, 1(6), 80-83. doi:10.2307/3001968

The Wilcoxon signed-rank test is used for repeated measures designs and where the data is at least ordinal.

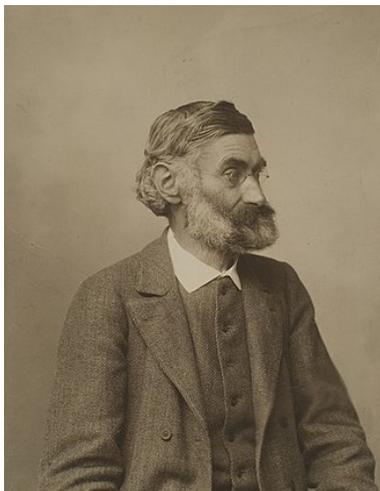


Frank Wilcoxon (1892 – 1965) was born to American parents in County Cork, Ireland. He grew up in Catskill, New York, but received part of his education in England. He graduated from Pennsylvania Military College and gained a Ph.D. in physical chemistry from Cornell University in 1924. Wilcoxon entered a research career, working at the Boyce Thompson Institute for Plant Research from 1925 to 1941. He then moved to the Atlas Powder Company, where he designed and directed the Control Laboratory, before joining the American Cyanamid Company in 1943.

## Chi-Square test

Abbe, E. (1863). *Über die Gesetzmässigkeit der Vertheilung der Fehler bei Beobachtungsreihen*. Ges. Abh. 2, 55-81.

The chi-square distribution is used for goodness of fit of an observed distribution to a theoretical one. It is used for independent measures designs and where the data is nominal.



The deduction of the  $\chi^2$  distribution is due to Ernst Karl Abbe (1840-1905). Abbe was a German physicist, optical scientist, entrepreneur, and social reformer. He was also a co-owner of Carl Zeiss AG, a German manufacturer of scientific microscopes, astronomical telescopes, planetariums, and other advanced optical systems.

## Binomial sign test

Arbuthnot, J. (1710) "An argument for Divine Providence, taken from the constant regularity observed in the births of both sexes" *Philosophical Transactions of the Royal Society of London*. 27 (325–336): 186–190

The Binomial sign test is used where the data is at least nominal and repeated measures have been used.



John Arbuthnot (1667-1735), a Scottish physician, satirist and polymath is credited with the first use of significance tests. In 1710, Arbuthnot examined birth records in London for each of the 82 years from 1629 to 1710. In every year, the number of males born in London exceeded the number of females. If the null hypothesis of equal number of births is true, the probability of the observed outcome is  $0.5^{82}$ , leading Arbuthnot to conclude that the probability of male and female births were not exactly equal.

## Spearman's Rank Correlation test Rho (r)

Spearman C. (1904). "The proof and measurement of association between two things". *American Journal of Psychology*. 15 (1): 72–101.

Spearman's Rho test is used for a relationship between two co-variables, where the data is at least ordinal.

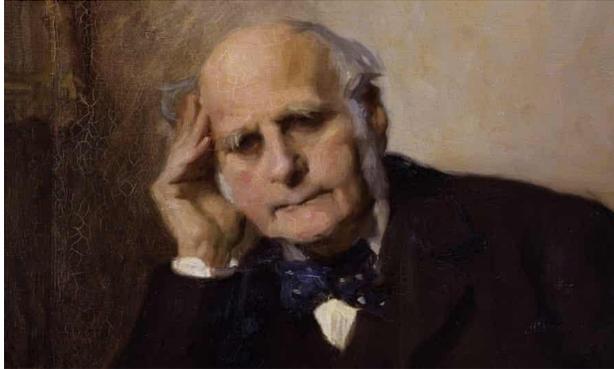


Charles Spearman, (1863 – 1945) was an English psychologist known for work in statistics, as a pioneer of factor analysis, and for Spearman's rank correlation coefficient. He also did seminal work on models for human intelligence, including his theory that disparate cognitive test scores reflect a single General intelligence factor and coining the term g factor.

The integration of intelligence testing into the eugenics movement created a place for psychologists in the diagnosis, schooling, housing, treatment, and control of those deemed "feeble-minded".

In declining health, he took his own life by throwing himself from a fourth floor window of University College Hospital.

### Sir Francis Galton (1822 - 1911)



Galton created the statistical concept of correlation and widely promoted regression toward the mean. He was the first to apply statistical methods to the study of human differences and inheritance of intelligence, and introduced the use of questionnaires and surveys for collecting data on human communities. He was a pioneer of eugenics, coining the term itself in 1883. We tend to associate eugenics with Nazi Germany and the Holocaust, but it was in fact Galton's

seductive promise of a bold new world filled only with beautiful, intelligent, productive people. Francis Galton is rightly criticised for advancing this immoral, racist non-science. But remember, his ideas were mainstream. To find out more, [read here](#).

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