

Mann H B & Whitney D R. On a test of whether one of two random variables is stochastically larger than the other. *Ann. Math. Stat.* 18:50-60, 1947.
[Ohio State University, Columbus, OH]

Let X and Y be two populations. A test statistic U is proposed to test the hypothesis that X and Y have the same distribution against the alternative that the Xs tend to be larger than the Ys. [The *SCI*[®] indicates that this paper has been cited over 380 times since 1961.]

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"In 1946 I was appointed associate professor in the department of mathematics of the Ohio State University. One of my functions was to start a graduate program in mathematical statistics and to be available for consultation to researchers in order to promote sound statistical methods. Shortly after I took up my duties, J. Birkeland, a bacteriologist, presented me with the problem that gave rise to our paper. He had administered a drug to rats which was supposed to protect against the common cold. A group of rats and a control group were then subjected to infection with pneumonia, massive enough so that all rats were expected to die. The time that each rat survived was then recorded and it was desired to test whether the two groups differed significantly in their survival times. What disturbed Birkeland most was the fact that some of the rats did survive.

Taking their survival time as infinite

would make the conventional t-test in-applicable and recording only finite survival times would disregard a very important part of the experiment. Birkeland may have had other misgivings about the applicability of the t-test.

"It was immediately clear to me that a non-parametric test (free of assumptions about the distribution) was called for and also a test which was based on individual comparisons rather than on averages of measurements. I therefore devised the U-statistic. D.R. Whitney, then a graduate student (now director of the statistical laboratory at OSU), assisted me in tabulating the distribution and showing that it approached normality. Fortunately, for samples larger than ten, the distribution was so close to normal that easily available normal tables could be used.

"After completion of the work, it was brought to my attention that an equivalent test had been proposed by Wilcoxon.¹ However, it was the thorough study of the distribution of the U-statistic which made the test easily applicable and very popular.

"The U-test was particularly designed to meet the situation of Birkeland's experiment. It had always been my thought, in which I differ from many statisticians, that tests should be designed to meet specific situations. By trying to detect too large a class of alternatives we often decrease the power of a test to detect the specific class of alternatives with which we are really concerned."

1. Wilcoxon F. Individual comparisons by ranking methods. *Biometrics Bull.* 1:80-3, 1945.