

Student's z , t , and s : What if Gosset had R?James A. Hanley¹, Marilyse Julien² and Erica E. M. Moodie¹¹Dept. Epidemiology, Biostatistics, & Occ. Health, McGill University, Montreal, Quebec, Canada² Department of Mathematics and Statistics, McGill University, Montreal, Quebec, Canada

The year 2008 marks the 100th anniversary of the publication of *The Probable Error of a Mean* by William Sealy Gosset, *nom de plume* "Student." Gosset's work and his relationships with the leading statisticians of his day have been considered by several authorities. Despite the extensive documentation, and the seminal nature of the work, modern-day statistics textbooks give him, and this 1908 article, short shrift. Thus, few of today's students – or their teachers – are aware of the ' z ' statistic whose sampling distribution he actually derived, the mathematical derivation, his simulations to check his work, the material used in the simulations, the table he produced, the "one-line" missing proof supplied by the 22-year old Fisher (still a student himself) or the subsequent switch, in collaboration with Fisher, from the z to the t -statistic. We remind readers of these aspects, and rework his calculations using 21st century computing power. We hope that the next generation of statisticians come to know more about the man and his work than simply that "he worked for the Guinness brewery," and appreciate that not all statistical distributions are derived in a single pass. Research students would do well to use his 1908 article as a model when writing their first statistical article. Supplementary material can be found at <http://www.epi.mcgill.ca/hanley>

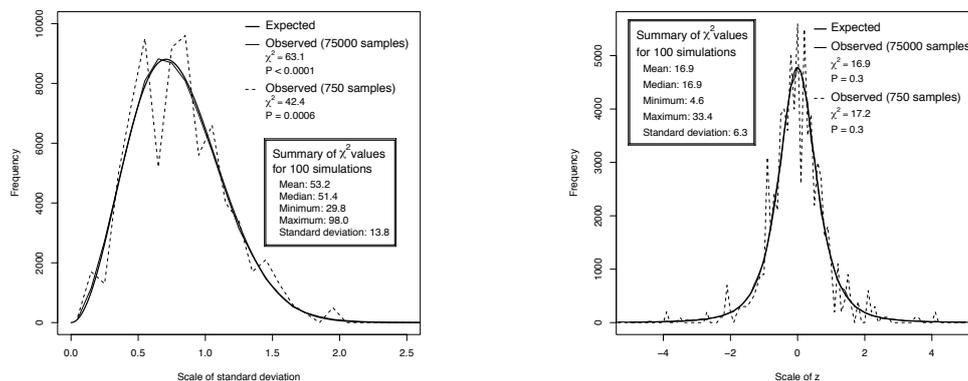


Figure 1: Distributions of s/σ [left] and z [right] in samples of size $n = 4$ from Macdonell's data on heights of 3000 criminals. Dotted line: (re-scaled) distribution of sample statistics obtained from one set of 750 random samples generated by Gosset's procedure. Inset: distribution of 100 chi-square statistics (18 s/σ , 15 z intervals). Thin solid line: distribution of statistics obtained from 75,000 samples of size 4 sampled with replacement from 3000 heights recorded to the nearest 1/8".

BIOMETRIKA.

THE PROBABLE ERROR OF A MEAN.

By STUDENT.