First (?) Occurrence of Common Terms in Probability and Statistics—A Second List, with Corrections

H. A. David

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An annotated list is presented containing presumed first occurrences in print of terms commonly used in probability and statistics. The list supplements and provides some corrections to a longer list published in volume 49 of *The American Statistician*.

KEY WORDS: History of statistics; Statistical terminology.

1. INTRODUCTION

This is a second and final list, supplementing under a broader title and occasionally correcting the collection of presumed first occurrences of common statistical terms given in David (1995). The following terms are quite as common as those in the earlier article (D for short) and no claim for completeness of the combined lists is made. Rather, it is hoped that the reader looking through the terms presented here will find some entries of interest.

As stated at greater length in D, the concept underlying a particular term in current use may go back many years. Nevertheless, the first occurrence in print represents a defining point in the evolution of the concept, if not its actual birth. The method of construction of the list and the criteria for inclusion are set out in D. As before, the second edition of the 20-volume *Oxford English Dictionary*, published in 1989 and augmented by Additions Series 1–2, provided a very useful starting point for terms in English and accounts for about 20% of the new entries; only in one instance (Poisson process) is an earlier date given here. Apart from the other sources mentioned in D, the two historical volumes edited by Pearson and Kendall (1970) and Kendall and Plackett (1977) have proved helpful.

2. CORRECTIONS AND IMPROVEMENTS

Asterisks attached to listed terms represent corrections

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or improvements to entries in D. Mostly, the improvement in date is by only a few years. A marked exception is *mathematical statistics*, for which the Danish entry of 1910 has been replaced by a German one cited by Seal (1967) and going back as far as 1867. The entry in English has been improved by just one year; it seems unlikely that this is the first use. Another noteworthy improvement is for *variate*, previously attributed to R. A. Fisher in 1925, but already employed by Karl Pearson in 1909. I am indebted to readers for several of the other asterisks.

Not asterisked are French language dates earlier than those in English given in D for *Bayes theorem* and *median*, provided in Sheynin (1997), and for *Cauchy distribution*; also the German *Parameter*. No foreign language firsts of these terms were attempted in D.

3. COMMENTS ON SELECTED NEW TERMS

A few of the new terms require comments.

Brownian motion. *Oxford* gives only the now superseded *Brownian movement,* which it traces back to 1872. Curiously, Brown in 1828 used *motion* repeatedly in a passage cited by Brush (1968). One suspects that *movement,* long used by later authors writing in English, was a retranslation of the French *mouvement.*

Game theory. Although only a slight variation of the older *theory of games,* it is this form given by Williams (1954) that has caught on. *Theory of games* (von Neumann and Morgenstern 1944) goes back in German to von Neumann (1928) who used the term *Theorie der Gesellschaftsspiele* (parlor games). Even earlier, Borel (1921) studied *la théorie du jeu,* which Savage (1953) translates as *theory of play* and which he regards as the beginning of the theory of games.

Monte Carlo methods. According to a report in *Mathematical Tables and Other Aids to Computation* (1949, p. 546) both method and name were apparently first suggested by John von Neumann and S. M. Ulam.

Petersburg Paradox. Todhunter (1865, p. 220) writes of the problem, "known as the *Petersburg Problem* probably from its appearing here in the *Commentarii* of the Petersburg Academy." Keynes (1921), cited in the following list, is unlikely to have been the first to have introduced paradox. Fry (1928) gives an excellent discussion of the *St. Petersburg paradox.*

	Association	Yule, G. U. (1900, title)
	Autocorrelation	Wold, H. (1938, p. 6)
	Autoregression	Wold, H. (1938, p. 2)
	Bar chart	Brinton, W. C. (1914, p. 229)
	Bayes factor	Good, I. J. (1958, p. 803)
	Bayes's theorem (règle de Bayes)	Cournot, A. A. (1843, p. 108)
	Bayesian	Fisher, R. A. (1950, p. 1.2b)[1]
	Bell-shaped curve	Galton, F. (1876, p. 14)
*	Beta distribution (distribuzione β)	Gini, C. (1911, p. 16)
*	Bimodal	Williams, S. R. (1903, p. 302)
	Bioassay	Wood, H. C. (1912, title)
	Biostatistics	*Webster's Dictionary* (1890)
	Branching processes	Kolmogorov, A. N., and Dmitriev, N. A. (1947, title)
	Brownian motion	Uhlenbeck, E. G., and Ornstein, L. S. (1930, title)
	Cauchy distribution (loi de Cauchy)	Lévy, P. (1925, p. 179)
	Consumer's risk	Dodge, H. F., and Romig, H. G. (1929, p. 614)
	Contagious distribution	Neyman, J. (1939, title)
	Convolution	Winter, A. (1934, title)
	Correlogram	Wold, H. (1938, p. 135)
*	Covariance	Fisher, R. A. (1930, p. 195)[1]
	Cyclic (design)	Bose, R. C., and Shimamoto, T. (1952, p. 164)
	Deviance	Nelder, J. A., and Wedderburn, R. W. M. (1972, p. 374)
*	Dispersion	Galton, F. (1876, p. 13)
	Domain of attraction (domaine d'attraction)	Lévy (1925, p. 252)
	Dynamic programming	Bellman, R. (1953, title)
	EM algorithm	Dempster, A. P. et al. (1977, title)
	Econometrics	Frisch, R. (1933, p. 1)
	Empirical Bayes	Robbins, H. (1956, title)
	Estimability	Bose, R. C. (1944, p. 5)
	Estimating equation	Yule, G. U. (1902, p. 197)[1]
	Galton–Watson process	Harris, T. E. (1963, p. 2)
	Game theory	Williams, J. D. (1954, p. vii)[2]
	Gauss–Markov theorem	Scheffé, H. (1959, p. 14)
	Group divisible	Bose R C., and Shimamoto, T. (1952, p. 154)
	Hat matrix	Hoaglin, D C., and Welsch, R. E. (1978, title)[3]
	Hierarchical Bayes	Good, I. J. (1980, p. 489)
	Hotelling's T^2	Simaika, J. B. (1941, p. 70)
	Identifiability	Koopmans, T. C. (1949, p. 132)
	Incidence matrix	Connor, W. S., Jr. (1952, p. 60)
	Index number	Jevons, W. S. (1875, p. 332)
	Interval estimation	Mood, A. M. (1950, p. xi)
	Inverse binomial sampling	Tweedie, M. C. K. (1945, p. 453)
	Inverse Gaussian	Tweedie, M. C. K. (1947, p. 47)
	Kriging	Matheron, G. (1963b, p. 1259)
	(krigeage)	Matheron, G. (1963a, title)
*	L-estimator	Jaeckel (1971, p. 1021)
	Lag	Hooker, R. H. (1901, p. 487)
	Law of large numbers (la loi des grands nombres)	Poisson, S. D. (1835, p. 478)
	Leverage	Ryan, T. A., Jr. (1978, title)[4]

* Linear model
—, generalized | Nelder, J. A., and Wedderburn, R. W. M. (1972, title)
Linear programming | Dantzig, G. B. (1949, p. 203)
Link function | Nelder, J. A. (1974, p. 327)
lod (log odds) | Barnard, G. A. (1949, p. 116)[1]
Logarithmic series distribution | Kendall, D. G. (1948, title)[5]

Markov chain
(chaînes de Markoff) | Doob, J. L. (1942, title)
Martingale | Doeblin, W. (1937, p. 57)
* Mathematical statistics | Ville, J. (1939, p. 85)
(*Mathematische Statistik) | West, C. J. (1918, title)[6]
Median (valeur médiane) | Wittstein, T. (1867, title)
Minimum chi-squared | Cournot, A. A. (1843, p. 83)
Monte Carlo methods | Fisher, R. A. (1928, p. 251)
Moving average | see Section 3
* Multiple correlation | Yule, G. U. (1921, p. 499)
Multivariate analysis | Pearson, K. (1903, p. 1)
| Bartlett, M. S. (1939, title)

New better than used (NBU) | Marshall, A. W., and Proschan, F. (1972, p. 396)
Neyman–Pearson lemma | Dantzig, G. B., and Wald, A. (1951, title)
Nuisance parameter | Hotelling, H. (1940, title)

Odds ratio | Gart, J. J. (1962, p. 454)[7]

* P value | Deming, W. E. (1943, p. 30)
Parameter | Czuber, E. (1914, p. 392)
Penalized likelihood | de Montricher, G. F., Tapia, R. A., and Thompson, J. R. (1975, p. 1329)
Periodogram | Schuster, A. (1898, p. 24)
Petersburg paradox | Keynes, J. M. (1921, p. 316)[2]
Point estimation | Wilks, S. S. (1943, p. 122)
Poisson process | Feller, W. (1949, p. 405)
Principal components | Hotelling, H. (1933, title)
Probability density (*Wahrscheinlichkeitsdichte) | Markoff, A. A. (1912, p. 155)
Probability generating function | Seal, H. L. (1949, p. 67)[8]
Profile likelihood | Barndorff-Nielsen, O. (1983, p. 351)
Projection pursuit | Friedman, J. H., and Tukey, J. W. (1974, title)

Quasi-likelihood | Wedderburn, R. W. M. (1974, title)

* Random variable | Winter, A. (1934, p. 660)
(*variabile casuale) | Cantelli, F. P. (1916, p. 192)
Ratio estimate | Deming, W. E. (1950, p. xii)
Recovery of interblock information | Yates, F. (1939, title)
Resistance | Andrews, D. F. (1974, p. 523)
Roughness penalty | Good, I. J. (1971, title)

Scatterplot | Kurtz, A. K., and Edgerton, H. A. (1939, p. 151)
Serial correlation | Yule, G. U. (1926, p. 14)
Sign test | Stewart, W. M. (1941, title)
Simple random sampling | Cochran, W. G. (1953, p. 11)
Stationary processes | Cramér, H. (1947, p. 188)
(Station'are stochastische Prozesse) | Khintchine, A. (1934, title)
Subjective probability | Keynes, J. M. (1921, p.281)

Time series | Persons, W M. (1919, p. 123)
Trend | Hooker, R. H. (1901, p. 486)

Variance function	Finney, D. J. (1977, title)
* Variate	Pearson, K. (1909, p. 97)[6]
Variate difference method	Cave, B. M., and Pearson, K. (1914, title)
* Winsorized	Dixon, W. J. (1960, p. 385)
z-distribution	Fisher, R. A. (1924, p. 496)
Zero-sum game	von Neumann, J., and Morgenstern, O. (1944, p. ii)

4. NOTES

[1] Reference supplied by A. W. F. Edwards.

[2] See also Section 3.

[3] The authors attribute the term to J. W. Tukey.

[4] Author states that the word "was floating around at the time."

[5] Williams (1944) uses just logarithmic series.

[6] See also Section 2.

[7] Author writes he may have heard the term from J. Cornfield.

[8] Uspensky (1937) treats "generating functions of probability." The concept is, of course, very much older and goes back at least to de Moivre.

[9] Reference supplied by I. J. Good.

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