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Popular Instructions on the Calculation of Probabilities

The Belgian polymath Lambert Adolphe Jacques Quetelet (1796–1874) was regarded by John Maynard Keynes as a 'parent of modern statistical method'. Applying his training in mathematics to the physical and psychological dimensions of individuals, his *Treatise on Man* (also reissued in this series) identified the 'average man' in statistical terms. Reissued here is the 1839 English translation of his 1828 work, which appeared at a time when the application of probability was moving away from gaming tables towards more useful areas of life. Quetelet believed that probability had more influence on human affairs than had been accepted, and this work marked his move from a focus on mathematics and the natural sciences to the study of statistics and, eventually, the investigation of social phenomena. Written as a summary of lectures given in Brussels, the work was translated from French by the engineer Richard Beamish (1798–1873).

Popular Instructions on the Calculation of Probabilities

Lambert Adolphe Jacques Quetelet
Edited and translated by
Richard Beamish

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POPULAR INSTRUCTIONS

ON

THE CALCULATION

OF

PROBABILITIES.

TRANSLATED FROM THE FRENCH OF

M. A. QUETELET,

PERPETUAL SECRETARY OF THE ROYAL ACADEMY OF BRUSSELS, CORRESPONDING MEMBER OF THE INSTITUTE OF FRANCE, OF THE ROYAL ASTRONOMICAL SOCIETY OF LONDON, OF THE ROYAL ACADEMIES OF BERLIN, TURIN, ETC.

TO WHICH ARE APPENDED

NOTES,

BY

RICHARD BEAMISH, ESQ., C.E., F.R.S., &c.

Mundum numeri regunt.

LONDON:

JOHN WEALE, ARCHITECTURAL LIBRARY,
HIGH HOLBORN.

1839.

EDITOR'S PREFACE.

I HAVE been induced to undertake the translation of this little Work, during my few leisure hours, from the aid which it has afforded me in exhibiting the valuable application of numbers to my pupils, and I am now tempted to publish it, with the omission of the account of a lottery proposed in the Netherlands, in the hope that it may prove equally serviceable to others.

The doctrine of chances has already secured important benefits to the public, in the establishment of Assurance Societies for life, health, and property, and is every day becoming more valued, in its application to the natural and moral sciences. By destroying that arbitrary power with which opinion had been invested,

it leads directly to an humble observation of nature; to an acknowledgment of the fixedness of her laws; and to a conviction of the evils which arise from a disregard of her ordinances.

By correcting the indefinite phraseology which is found to pervade all inquiries not embraced by those sciences, to which the direct application of numbers has been considered necessary, it tends to give regularity and symmetry to every pursuit, and to demonstrate, that the mean results obtained from the concurrence of the same circumstances, are as constant, as the numerical values of the natural philosopher, when determined by the repetition of the same experiments.

To the young men emerging from our public schools or colleges, the "Doctrine of Probabilities" offers many important practical advantages; impressed, as they often are, with an exalted idea of their knowledge of the world and its temptations, and undeceived only when they have become the victims of those who have made this subject their especial study, as applied to games of chance.

Mr. De Morgan, in his admirable Work on Probabilities, most justly observes, "that even those who derive absolute gratification from the

excitement which gaming affords, would hesitate in their indulgence, were they convinced that the contest in which they had engaged was so unequal, that the ruin of their fortune, and too often of their character, depended only on the time devoted to the struggle. Absolutely speaking, young persons are not thoughtless with respect to dangers of which they know the risks. The ill success of others does not deter them, because they attribute it to fortune; and because they have superstitions hanging about them with respect to luck, which are tolerably prevalent in all ages. They think that they are *trying their luck*, as the phrase is; but if they could be convinced, that it is *not* their *luck* which they are trying, but only a *fraction of it*, their opponent having the rest in his pocket, they would shew themselves in this, as in other matters, averse to risks in which it is more than an even chance against them."

Every day's experience shews how much society is yet tinged with the superstitions of a barbarous age: the mass resting still satisfied with the indefinite or deceptive results of a natural perception, rather than seeking to obtain a rational conviction through the medium of numerical calculations.

"Let us call to mind," observes M. De la Place, in his Essai Philosophique sur les Probabilités, "that formerly, and at a period not far distant, an extremely wet or dry season,—a comet, drawing after it a long tail,—eclipses,—aurora boreales, and generally, all extraordinary phenomena, were regarded as nothing but signs of the wrath of Heaven. To turn from them its baneful influence, Heaven was invoked. No prayer was offered, however, to suspend the course of the sun and planets, observation having early declared the inutility of such prayers; but as the former phenomena appeared and disappeared after long intervals, they seemed to be contrary to the order of nature; it was supposed that Heaven, irritated by the crimes of earth, sent forth those prodigies to announce its vengeance. Thus, the long tail of the comet, in 1456, spread terror throughout Europe, already alarmed by the rapid success of the Turks in the eastern empire *. This phenomena, after four of its revolutions, excites amongst us a very different interest. The knowledge of the laws of the system of the world,

* "Pope Calixtus ordered public prayers to be said all over Christendom, in which he exorcised the comet and the Turks."—*Encyclopedia Britannica.*

acquired in the interval, has dissipated these infantine fears, derived from an ignorance of the true relation of man to the universe; and Halley, having recognized the identity of this comet, with that of the year 1531, 1607, and 1682, announced its next return for the end of 1758 or the commencement of 1759." In 1757, Lalande, Clairaut, and Madame Lapaute, wife of a celebrated watch-maker and astronomer, undertook to calculate the disturbing effects of certain of the planets on the movement of this comet: and the result was, that in November 1758, the expected arrival of the comet was predicted for the 13th April, 1759; it was added, however, that from the imperfection of the method of calculation, there might be an error of a month. It was actually observed December 25th, 1758, and it reached its perihelion on the 13th March, 1759. The re-appearance of this comet in 1835, as subsequently predicted, has further tended to confirm one of the grandest discoveries ever made in science.

"Finally," says La Place, "if it be observed that in those things which cannot be submitted to direct calculation, the doctrine of Probabilities offers the most certain approximation to

guide us in our judgments, and the best guarantee against those illusions that so often deceive us; it will be admitted, that there is no science more worthy of our meditations, and none that would render more service, were it introduced into a system of public instruction."

In an Appendix, I have given Tables which will be found not devoid of interest: some derived from the more recent work of M. Quetelet, "Sur l'Homme et le Développement de ses Facultés;" and others from Parliamentary Papers. That "on the Sickness, Mortality, and Invaliding among the Troops in the West Indies," has afforded valuable extracts; as has also the Second Report of the Poor Law Commissioners, in connexion with M. Quetelet's Observations and Tables relative to illegitimate births.

Those relating to crime, in England and Wales, and Ireland, will be found compared with some given by M. Quetelet.

To Sir W. Herschel, Mr. De Morgan, Mr. Edmonds, and other labourers for moral and intellectual advancement, I shall be found also indebted.

Doddershall Park, Aylesbury,
January, 1839.

AUTHOR'S PREFACE.

THIS little Work, which I consign to the public, is the summary of lectures, given for many years by me at the Museum of Brussels, as an introduction to my course of Physics and Astronomy. It seems to me that the calculation of probabilities, unfortunately too much neglected, ought according to the present state of knowledge, to serve as a foundation for the study of all the sciences, and particularly for that of observation. The greater portion of our knowledge rests in effect only on probabilites more or less strong, which are appreciated vaguely by the vulgar, and as it were by instinct; but which the philosopher, or at least the man who aspires to merit that title, ought to know how to appreciate according to certain rules.

Almost all our prejudices arise from the habit of pronouncing on simple appearances, but which will not bear a rigorous examination. Wherever things can be expressed by numbers, numbers have been taken as the guide; ceasing to dispute by counting, we have preferred facts rather than words.

The calculation of probability, which has hitherto had for its object the consideration of games of chance only, takes now a more elevated flight; bringing its light to the statesman, to regulate elections, and to examine the modes of arranging tribunals in the most advantageous manner; guiding the steps of the inquirer in his researches on births and deaths; fixing the basis of assurance societies; casting a new light on the system of our universe; and giving birth to statistics, that formidable arsenal from whence the orator, in mounting the rostrum, may provide himself with arms the most perfect.

The title of this corpuscule sufficiently shews that I have not written it for the learned, who may refer with more success to the works of La Croix, Parisot, the illustrious La Place, &c., to whom I am myself much indebted.

The Lessons Nos. XII. and XIII. are for the greater part extracts from the excellent intro-

duction to the Statistical Researches on the City of Paris, which is due to the most distinguished geometrician of the age: the rule of the lesser square, which had scarcely been employed, save by astronomers versed in the knowledge of the higher mathematics, is there applied with a clearness which renders it available to observers the least accustomed to calculations.

I ought to state, that I suppose a knowledge of the first rules of arithmetic to be obtained, a knowledge which, according to the actual state of instruction in Belgium, may be reasonably expected from all who can read and write. I shall esteem myself most happy if this little Essay renders any service, by drawing attention to a branch of mathematics eminently in harmony with the progress of science.

ON THE

SIGNS EMPLOYED IN THIS WORK.

+ *Plus.* Sign of addition.

− *Minus.* Sign of subtraction.

× *Multiplication.* This is sometimes replaced by a point; thus 3×4 is differently written $3 \cdot 4$, to indicate that 3 is to be multiplied by 4: the numbers 3 and 4 are the two *factors* of the product 12. When the *same* factor is repeated many times in the same product, a more simple notation is employed, thus 3^2 represents 3×3, and 5^3 represents $5 \times 5 \times 5$.

To indicate that one quantity should be divided by another, the first is written above the second, the numbers being separated by an horizontal line, thus $\frac{15}{6}$ shews that 15 is to be divided by 6.

Numbers written in the above manner, are placed under the form of a *fraction;* 15 is the numerator, and 6 is the denominator.

The square of a number is the product of that number multiplied by itself; for example, 25 is the square of 5; 36 is the square of 6.

The square root of a number is such a quantity that in multiplying it by itself it will reproduce the proposed number: for example, 5 is the square root of 25; 6 is the square root of 36. The symbol of the square root is $\surd$: thus $\surd 25$ means, that the square root of 25 is to be extracted; in like manner $\surd 36$ indicates 6, the square root of 36.

To shew that two quantities are equal, they are separated by the sign $=$.

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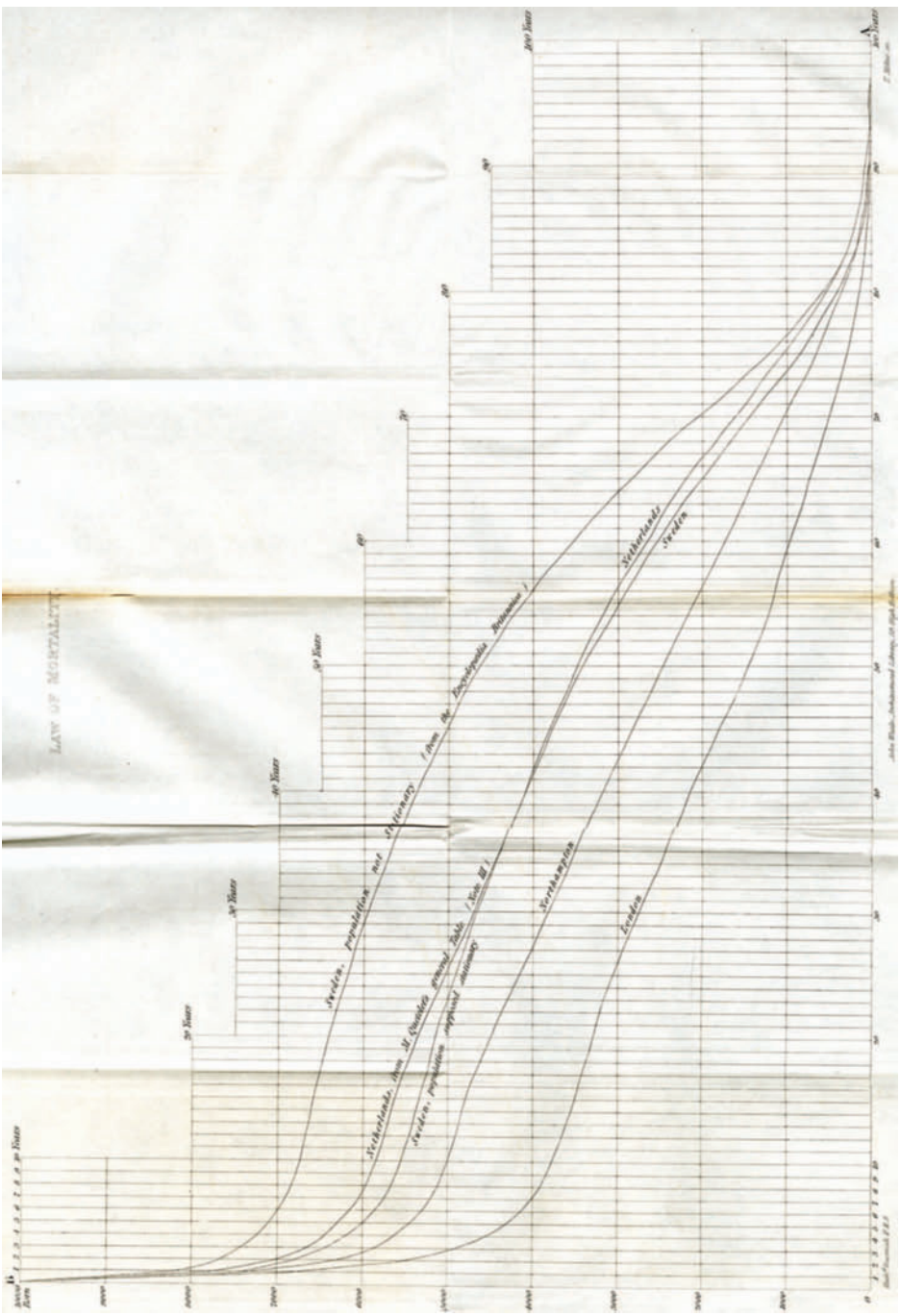

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