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Professor Markoff's treatise has been translated from the second Russian edition, and his work is now made available to western readers for the first time. It is the work of a pure mathematician, who avoids philosophical difficulties on the one hand and practical applications on the other. But amongst books which treat the Calculus of Probability as a *mathematische Disziplin* (to quote his own preface), Professor Markoff's deserves to occupy one of the highest places. It is, in the first place, a great pleasure to read a treatise which is not influenced by the exhausted French tradition of mathematical probability, and is yet able to emulate the purity and elegance of French mathematical style. Professor Markoff is mainly under the influence of Tchebycheff, whose remarkable theorems on Probability—to which attention was called by the present reviewer in the *Journal*, vol. lxxiv, p. 646—are not very well known outside Russia. He not only makes available a much greater part of Tchebycheff's work than is discussed, for example, by Czuber, but also introduces some highly interesting extensions of it (see especially p. 67). The mathematical technique by means of which Tchebycheff and Markoff reach their conclusions is so distinct from that of other writers that it can fairly be held to constitute a distinctively Russian tradition. Amongst mathematical trifles may be mentioned his solution of the problem "to determine the probability that a fraction, whose numerator and denominator are any rational numbers chosen at random, will not be reducible by cancelling," though I do not feel perfectly sure that it is new.

Professor Markoff is always careful to make his hypotheses quite precise, and to avoid philosophical assumptions. Without solving logical difficulties, therefore, he succeeds in escaping, except in the discussion of Testimony, the commonest logical pitfalls. Although, apart from his extensions of Tchebycheff's work, Professor Markoff's book does not contain much that is notably new, it is throughout of high and distinguished quality.

J.M.K.

4.—*Ueber das Geschlechtsverhältnis bei Zwillingsgeburten*. By Kazimierz J. Horowicz. 39 pp., 8vo. Göttingen: E. A. Huth, 1912.

This Inaugural-Dissertation aims at applying the statistical methods of Lexis to determine the stability of the sex ratios of twins in different Prussian districts. These important methods have been made use of so seldom by practical statisticians that a new exemplification of them deserves a brief notice. The empirical probabilities (or observed frequencies) of the three possibilities at twin births—"two boys," "a boy and a girl," "two girls"—are 0.3209, 0.3780 and 0.3011, these figures being based on the statistics of twin births in Prussia between 1887 and 1907.² Dividing Prussia up into

² These figures agree only moderately with those (quoted by Simon Newcomb) for France, 1898-1900, namely, 0.3369, 0.3541, 0.3090, which point to a higher proportion of "true" twins than in Prussia. But the French statistics only cover 28,312 cases, as compared with 325,079 dealt with by the Prussian statistics.

districts and for periods, Herr Horowicz seeks to determine whether the dispersion about the mean is *normal*—whether, that is to say, it is of a kind that might be not improbably anticipated if we could suppose that the conditions determining sex in these cases are analogous to the conditions which exist in a game of chance. Just as Lexis found that the statistics of sex ratios as a whole satisfy these conditions with wonderful accuracy, so Horowicz finds that the statistics of twin births satisfy them.

The practical value of this investigation is much diminished by the fact that the statistics do not distinguish between “true” twins and twins arising out of two independent conceptions, in the former case the sex of the two being necessarily the same. Assuming, however, that the sex ratios amongst “false” twins are the same as amongst single births, and that the sex of the two are not correlated, it is possible to determine what proportion of the recorded twins were “true” twins. On these hypotheses 24.4 per cent. were “true” twins.

Herr Horowicz thoroughly understands the Lexian methods, and this gives interest to his thesis, although his conclusions are probably of not much biological value. It may be added that his thesis begins with a brief but well-documented account of the development of theories of sex ratio.

J.M.K.

5.—*Manual of railway statistics*. By George L. Boag. 185 pp., 8vo. London: *Railway Gazette*, Queen Anne's Chambers, Westminster, 1912. Price 4s. net.

The author of this little book is at present Assistant Manager of the Great Southern of Spain Railway. And, as the title page tells us, he has had earlier experience on the Lancashire and Yorkshire, the Argentine Transadine, and the Southern Nigerian Railways. The text of his book shows further, not only that he is familiar with the statistical methods adopted on Continental, American and Indian railways, but also, as Mathew Arnold would have said, that he is in the habit of letting his mind play freely round the whole subject. The result is he has written a very valuable little book, and is entirely entitled to expect the fulfilment of his modest hope that it may be useful, “more especially abroad where there are no facilities for reference to libraries, or to friendly colleagues,” and also “as a text book to students attending the railway lectures which are now given at many large centres in England.” From the point of view of these two classes, neither of which generally know of, or can easily lay their hands on the literature of the subject, Mr. Boag has not hesitated to give half his entire space to a reprint of two important documents: the report of Sir Thomas Rees Price, General Manager of the South African Railways, to the International Railway Congress at Berne in 1910; and the Railway Companies (Accounts and Returns) Act, 1911, with the new statutory forms of accounts and statistics appended thereto. And he supplements his reprint of this Act with the schedules proposed by those members of the Board of Trade Departmental Committee on Railway Accounts who endeavoured unsuccessfully to include returns of ton mileage,