

23rd February 1934. . .

Mr. P. Lyle,
Wancote,
Compton,
Guildford.

Dear Mr. Lyle,

I am glad to see that the χ^2 distribution fitted so well. The other method you mention, using probability paper, is one of considerable interest. When the data really are normal to a higher precision than the observations are able to detect the method of fitting by mean and mean square has the theoretical advantage, though not to a very striking extent. When the data are not normal the line on probability paper will be curved and the form of this curve is often found convenient in comparing the normality of data of different kinds.

But the real use of straight lines fitted to points plotted on probability paper comes when the data are not really cumulative, and when we want to fit them to theoretical frequencies derived from the Galton ogive, i.e. the probability integral of the normal curve. For example if you test a boy jumping by giving him 100 shots at each inch

from 4 ft. to 5 ft. he may clear the rod nearly every time at the lower heights but the failures will increase in frequency as the rod is raised higher. If you plot these frequencies on probability paper against the height, the line, if the experimental conditions are uniform, will be nearly straight, showing that the Galton Ogive satisfactorily represents the proportionate frequency of failure at the different heights. Such data are not cumulative, for it might happen that the subject fails twice at the lowest height but only once at the next stage. In fact the deviations from expectation of the different points will be independent, which they are not in the case of cumulative data.

Similarly in Toxicology the proportion of animals e.g. insects, killed at different concentrations of a spray fluid or fumigant may be plotted against the concentration, and we shall usually get a straight line on probability paper if the logarithm of concentration is used. One may say then that the logarithm of the concentration needed to kill is normally distributed in the population of insects. In fitting the straight line the points are weighted to allow partly for the varying numbers of insects used at varying concentrations, partly for the fact that a given number of insects has a greater weight at the 50% point than elsewhere.

Dr. Bliss, in my department, is working on the practical applications of this method and would, I am sure, be glad to discuss with you the processes he has developed.

Yours sincerely,