Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 479.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Statistical Tests

IN a letter to NATURE of August 24, Prof. Karl Pearson states: "From my point of view, the tests are used to ascertain whether a reasonable *graduation* curve has been achieved, not to assert whether one or another hypothesis is true or false."

This assertion must come as a surprise to many who are familiar with Prof. Pearson's writings. It should not, however, be permitted to divert attention from the points raised in Mr. Buchanan-Wollaston's letter of August 3, for whatever may have been Prof. Pearson's original intention in introducing the term 'goodness of fit', and in publishing a table of the distribution of χ^2 (the theoretical form of which had been previously determined by Helmert in 1875), it is certain that the interest of statistical tests for scientific workers depends entirely from their use in rejecting hypotheses which are thereby judged to be incompatible with the observations.

It is certain, too, from many passages which could be cited from Prof. Pearson's own writings, that he has himself used the χ^2 test, not only in connexion with the graduation of frequency curves, but also as a means of testing the truth of theories or hypotheses. As one example, I may mention an appendix of five pages entitled "On the Test of Goodness of Fit of Observation to Theory in Mendelian Experiments" (*Biometrica*, **9**, pp. 309–314). In this paper he insists very clearly, and quite in accordance with modern usage, taking the extreme case $P = 0$, that either the theory or the observations must be rejected.

Mr. Buchanan-Wollaston's point that the χ^2 test, like the other tests of significance, is cogent for the rejection of hypotheses, but, in the opposite case, by no means cogent for their acceptance, deserves to be widely appreciated. For the logical fallacy of believing that a hypothesis has been proved to be true, merely because it is not contradicted by the available facts, has no more right to insinuate itself in statistical than in other kinds of scientific reasoning. Yet it does so only too frequently. Indeed, the "error of accepting an hypothesis when it is false" has been specially named by some writers "errors of the second kind". It would, therefore, add greatly to the clarity with which the tests of significance are regarded if it were generally understood that tests of significance, when used accurately, are capable of rejecting or invalidating hypotheses, in so far as these are contradicted by the data; but that they are never capable of establishing them as certainly true. In fact that "errors of the second kind" are committed only by those who misunderstand the nature and application of tests of significance.

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