Some Modern Statistical Methods: their Application to the Solution of Herring Race Problems.

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With a Foreword by

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THE aim of statistical methods is to make available the whole of the information supplied by a body of data, in its logical bearing upon whatever theories are under discussion. In subjects to which such methods have been long developed, and for which highly adequate methods have been elaborated, the majority of readers will already understand what processes must have been applied to the observational material to elicit its meaning, and the results of elaborate calculations may be presented compactly in an intelligible form made familiar by convention. Attention may thus be concentrated on the results rather than on the methods, and the computer has no other anxiety than to carry out his part of the work with the high standard of competence already established. In subjects, on the other hand, in which new types of observational data come up for discussion, or in which information of new kinds is being sought, neither the research worker, nor his readers, enjoy the same advantages. Very much labour must be expended in discovering the limitations, both qualitative and quantitative, of the available material, in discovering to what questions it is not capable of giving an answer, labour which, while necessarily fruitless of positive results, may be necessary to clear the air of illfounded views, and in any case supplies the only possible foundation for designing the nature and extent of future observational programmes. Again when positive results are indicated, supplementary mathematical researches will often be found necessary to develop new tests of significance, appropriate for excluding sampling errors of unfamiliar types. All this makes such work not only difficult to do, but difficult to assimilate when done.

In the herring vertebra problem Mr. Wollaston has introduced a fundamental simplification by showing that, with samples of the sizes available, all apparent differences, in the form of the frequency distribution observed, are to be ascribed solely to differences in the mean vertebra number. The body of samples examined shows no signs of departure from a collection of grouped normal samples. What is even more remarkable, it appears that the variance, or measure of variability, within these samples, does not differ significantly from sample to sample. The whole intricate problem of treating these distributions is thus reduced to that of finding a satisfactory method of estimating the mean for such heavily grouped material, and this Mr. Wollaston has done in the first half of the paper .

The second half is devoted to a discussion of the observed variation in the mean vertebra number, according to the stage of maturity, and the geographical position of the sample. Again the greater part of the work necessarily consists in exploring the limitations of the data, or in elaborating statistical methods competent to overcome these limitations. There can be no doubt of the statistical reality (significance) of the differences in mean value observed, and it appears that they can be analysed into simply additive parts ascribable respectively to stage of maturity, and to region of origin. As Mr. Wollaston insists, such an analysis should not be treated as final, but rather as affording a rational basis on which to base more decisive observations.

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