

January 28, 1941

Dear Riddell,

Many thanks for your paper on Megalocornea and the t test. I am sending back a revised version of the series of tests you make in Table 2. As regards your examples, as a model for Ophthalmologists a few important points had been disregarded in the calculations as you left them. I suppose the general arrangement is taken from Mainland, and I want to regard you as the sole judge of the appropriateness of that. My own procedure, when there are two samples, would be to obtain the mean square (estimated variance) and then to omit the step of finding its square root (estimated standard deviation) which you follow by applying a rather complicated formula. From the mean square, e.g. .029948 for a single observation, I should divide by 4 to find the mean square for the mean of 4 persons, .007487, and likewise for the mean of 6, .004991. Add these together to find .012478, and then only take the square root, which is to be divided into the actual difference observed, 1.083.

The other points are more important, though I do not think any of your conclusions are wrecked. In the comparison between the two methods of measurement which have been applied to the same

eyes, the precision with which the two instruments have been compared does not depend on either the variation between different people or the variation between the two eyes of the same person. Consequently, you have underestimated the precision of the comparison by allowing these two ingredients to enter into your estimate of error. Actually you are only concerned with the 16 differences between the two methods of measurement applied to the 16 eyes which have been measured in each way. These 16 differences are treated as a single sample, unlike the other cases where two samples are involved. The treatment is extremely simple, and the arithmetic happens to be even simpler.  $t^2$  is the ratio of the mean square for 1 degree of freedom to the mean square for the remaining 15, so that the only recognisable work in the problem is that of finding the square root of this number.

It is, of course, because differences between different persons are irrelevant to this test that I have thrown together columns 1 and 3 on one side and 2 and 4 on the other, omitting the two persons in (3) which were not measured by the 2nd method.

In the other cases, where comparisons are made between groups of persons, differences between different people of the same group are of course relevant contributions to error, but differences between the two eyes of the same person are not, since both eyes must always be in the same group. I have therefore carried out an analysis, recognisably similar to yours, using the mean eye diameter of each person. The values of  $t$  are large, and the difference is clearly significant, except in the comparison of the unaffected persons with your control series where it lies

between .5 and .6. I am sending back the paper with the revised calculations so that you may have it handy for reference while looking at these, and can revise any comments you make on the tests. I should, however, be glad to have it all back as soon as you can manage it to send on for publication.

Please remind me about the haemophilic grandfathers, as there seems to be no note of them in this Department.

Yours sincerely,

Mss returned & original tables

4 tables (new)