GRAND HOTEL,
NEWCASTLE UPON TYNE, 2.

Jan 9. 1939

Dear Fisher,

About the question of $ns^2 = \Sigma(x-\bar{x})^2$ or $(n-1)s^2 = \Sigma(x-\bar{x})^2$. In response to wails from my class last term I have decided that a probability book from me is due, & have started it. I don't want to make unnecessary departures from the usual practice, & in particular I am adopting the notation of using italics for estimates & Greek letters for quantities to be found — it was a matter of random selection after getting fed up with σ & σ' that made me adopt the opposite practice. However I'm bothered about n or $n-1$. The argument for $n-1$ is, I think, that it brings the mode of the z distribution to $z=0$. With n there is a bias, though the formulae are similar enough for one to have to look pretty carefully to see the difference. The z distribution goes over into my theory in an estimation problem: given one set of deviations, what is the probability of a given scatter in a new series of observations & means where there is reason to expect σ to be the same?

On the other hand in the method of least squares what comes in is $\left\{1+n\frac{(\alpha-a)^2}{\Sigma c^2}\right\}^{-(n-m+1)}$, and in significance tests for one new parameter the same thing with index $-(n-m+2)$; where in the former m is the total number of parameters found, in the latter the number of old ones; ~~Sout~~ c is a residual. So it is really $\Sigma c^2/n$ that concerns, the m appearing only in the index, & taking $\Sigma c^2/(n-m)$ will complicate the algebra badly. Also it's the sort of algebra that I usually get wrong.

So it rather looks as if I shall have to stick to n. ~~If~~ I should then have to say add $\frac{1}{2}\log\frac{n_1(n_2-1)}{n_2(n_1-1)}$ & use your table, or else cook the table myself — which again I should probably get wrong. In any case I think $\sqrt{\frac{\Sigma c^2}{n(n-m)}}$ will have to be given as the estimated standard error of α, and tables of 5% & 1% limits in estimation problems & of $K = 1, \frac{1}{3}, \frac{1}{10}, \frac{1}{30}$ in significance ones in terms of α/s_α. Do you see any reasonably compact alternative?

I suppose you don't know anybody that would like the job of working out $\underline{K}$ for $n-m<5$. It will go into a rather filthy single integral, & will I suppose be wanted some time. Anyhow I should like to see myself how it behaves.

There is another bother about the tests for several degrees of freedom. Two of Wishart's lads, Finney & Lawley, had this half done when I found a nasty little correction that was liable to mount up, so it's been left pro. tem. — the formulae published include the correction.

I expect to be here till next Monday. Hope you can read this — I've just smashed my spectacles & can't see comfortably under about four feet.

Yours

Harold Jeffreys