29 September 1932.

Dr. E.S. Pearson,
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Dear Pearson:

Thanks for the offprint. One might guess that the sampling without return may be responsible for some of the deficiency of high correlations. For example, a correlation +1 could only occur if the five classes sampled lie on a straight line. The lines running N.E. and S.W. have totals of 6, 12, 18, 24, 30, 36, 30, 24, 18, 12, 6 cards respectively; there are some others with double steps one way or the other, but these must have smaller totals. Take the line with 36; the probability of scoring +1 on this line with replacement is

$$216^{-5}\left\{36^5 - 6^5 - 2.5^5 - 2.4^5 - 2.3^5 - 2.2^5 - 2.1^5\right\}$$

the deductions being the chances of indeterminate correlations. Without replacement it is

$$216^{-5}\left\{\frac{36!}{31!7} - \frac{6!}{1!1} - 2\frac{5!}{0!}\right\}$$

The ratio is about $\frac{35.34.33.32}{36} = .71$, and lower ratios for the other series. In this case ($\rho = .5$) you more 86 per cent. above .9, which is not so select a class, but doubtless affected in some degree in the same direction.

By the way, I have seen your paper for the Royal, and recommended it for publication. You do not mention it, but the cases in which the "best" criteria are invariant, are those in which a "sufficient" estimate exists, and there of course the sufficient statistic supplies the criterion; hence the efficacy of likelihood. The simultaneous test (λ) for mean and variance is less convincing, for as you recognise, any closed curve in the region of the efficient statistics $\bar{x}$ and s^2 has the envelope property, and other alternatives are not unattractive on intuitive grounds; e.g. if P_1 is calculated from "Student's" $\frac{\bar{x} - a}{s}$ and P_2 from the χ^2 test for variance, the criterion $P_1 P_2 <$ constant, has an easily calculable probability, and seems, at least to me, eminently reasonable, though a priori I do not claim it to be necessarily more reasonable than yours.

Yours sincerely,