

August 12, 1942

Dear Hately Gorington,

I think there can be no doubt that, as soon as you began to count as successes resemblances between objects drawn and others exhibited, not at the same time but within the same series, you very much complicated the whole problem of interpretation. A formal outline of the algebraic position may help, even though it may lead to the conclusion that the method of experimentation cannot easily be worked.

Suppose p is the chance of drawing any particular object at the first trial, then $S(p) = 1$, where the summation is taken over all objects capable of being drawn.

Of these objects, some are exhibited and others are not exhibited. Using the sign \sum for summation over those not exhibited, one may put

$$\sum (p) = S_1$$

$$\sum (p^2) = S_2$$

$$\sum (p^3) = S_3$$

and so on. Then the probability of scoring no success with a single drawing is S_1 . If no success is to be scored with two trial drawings, we may say that the first of these is of some object not exhibited with probability p , and the second any object not

exhibited other than the first, drawn with probability S_1-p ; but

$$\sum p(S_1-p) = S_1^2 - S_2 .$$

Similarly, the probability of scoring no success with three trial drawings is

$$S_1^3 - 3S_1S_2 + 2S_3 ,$$

and there ~~is~~ ^{will be} no difficulty in developing similar algebraic expressions for any number of trial drawings. You will see that the complexity arises not from the multiplicity of the objects exhibited, but from the multiplicity of drawings permitted.

The true functioning of your catalogue in an exact solution is, therefore, to explore for all objects capable of being drawn, their probabilities, and the sums of squares, cubes and higher powers of these probabilities, which sums, of course, will be little affected by the rarer types of drawing. Clearly, however, if the gallery exhibited becomes very extensive, the non-independence of the success of the different drawings made by the same subject is likely to be too important to be overlooked.

In fact, I think in the course of time you have successively taken the step of ignoring something which was, or seemed at that time, unimportant, on the ground that the error was on the safe side, and are now confronted with the situation in which this limitation does, as it obviously might, paralyse the possibilities of the experiment.

Yours sincerely,