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St John's College
Cambridge.
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Dear Fisher,

It is liable to be hard to follow old birds like Bayes and Laplace. People of that period often spent a chapter on a piece of mathematics that we should do in a page, and then slid over fundamental points with hardly a mention. Laplace's casualness about references in this case makes it harder. But I think the real question is, did the critics of B. and L. from 1840 to 1900 or so understand them, or were they just attacking misinterpretations of them ? In any case the misinterpretations have a long history, but they arose when B. and L. were not in a position to defend themselves. So far as I know K.P. was the only person that ever tried to <u>use</u> inverse probability and a frequency definition at the same time. I got my own first ideas from Todhunter's Algebra, the first relevant passage in it being practically a translation of Laplace, and it never occurred to me that any other interpretation than the one I make now could possibly be intended. I think it is relevant that I should regard a frequency definition of the prior probability as even more nonsensical than you do ; you at least think it worth criticizing, whereas I should not think it worth mentioning if people didn't keep inflicting it on me. But if there was such a great difference between Bayes and Laplace and me as you suggest I should expect that reading them would make me feel sick, and it doesn't. I can't see anything in them that is not perfectly intelligible in terms of my own ideas, and I think the reasonable explanation is that they had the same fundamentals.

I don't agree that Laplace's 'provided all the cases are equally possible' is a verbal subterfuge; ~~but as~~ I should call it an indication that he had thought a bit more carefully than his predecessors. You strengthened my belief in this recently by referring me to De Moivre about something else. He starts off with a simple definition in terms of numbers of possible cases, as innocently as Neyman does. Laplace must have known of this, and the extra clause must mean that he saw that De M.'s definition didn't do what is needed. On the latter, so long as ~~xxx~~ no face of a die is absolutely incapable of being thrown, the probability of any face is exactly 1/6 whatever other information we have. Laplace's allows for the possibility that if we get 50 sixes in 100 throws the p. of a 6 may be more than 1/6, even if all the others have actually occurred. Again, suppose we have two boxes, one containing a white ball and a black one, the other a white one and two black ones. Choose a box at random and then pick a ball at random out of it. What is the probability that the ball ~~is~~ will be white ? Answer, $\frac{1}{2}\cdot\frac{1}{2}+\frac{1}{2}\cdot\frac{1}{3}=\frac{5}{12}$. But on De Moivre's definition the assessment would be 2/5 - which I don't for a moment suppose he would actually say, but the only way of avoiding it is to recognize that the two white balls are not 'equally possible'. That is, even within the range of direct methods, a probability is not a mere matter of counting possible alternatives, and Laplace knew it.

Bayes's expectation theory is a bit muddled, because his rules correspond to what Laplace called mathematical expectation, but he is speaking of expectation of benefit, which is L's moral expectation. The distinction when the benefits to be added are in terms of money was actually brought out in Daniel Bernoulli's discussion of the Petersburg problem about 30 years before Bayes. Bayes's argument will still work, however, if the benefits compared or compounded are such as not to interfere with each other ; e.g. the benefits to me of two dinners the same night would be far from independent, but those of a letter from you and a bike ride might be nearly so. Ramsey's theory attends to this point, but it is a bit cumbrous.

I'm afraid that more people than you think have the idea that what you say in Stat.Meth. is meant for me ; and ~~at x~~ I should guess that about 20 times as many people have read S.M. as have tried any of my stuff. If you could find room for a remark that it isn't I should be very grateful. The sixth edition has about half a page blank at the end of the first chapter, which could hold a warning sentence easily .!

Yours ever,

Harold Jeffreys