Sufficiency Principle. Let the two different observations x and y have the same values $T(x) = T(y)$, of a statistics sufficient for family $f(\cdot|\theta)$. Then the inferences about θ based on x and y should be the same.

Conditionality Principle. If an experiment concerning the inference about θ is chosen from a collection of possible experiments, independently of θ, then any experiment not chosen is irrelevant to the inference.

Example; [From Berger (1985), a variant of Cox (1958) example.] Suppose that a substance to be analyzed is to be sent to either one of two labs, one in California or one in New York. Two labs seem equally equipped and qualified and a coin is flipped to decide which one will be chosen. The coin comes up tails, denoting that California lab is to be chosen. After the results are returned back and report is to be written, should report take into account the fact that coin did not land up heads and that New York laboratory could have been chosen. Common sense and conditional view point say NO, but the frequentist approach calls for averaging over all possible data, even the possible New York data.

The conditionality principle makes clear the implication of the likelihood principle that any inference should depend only on the outcome observed and not on any other outcome we might have observed and thus sharply contrasts with the method of likelihood inference from the Neyman-Pearson, or more generally from a frequentist, approach. In particular, questions of unbiasedness, minimum variance and risk, consistency, the whole apparatus of confidence intervals, significance levels, and power of tests, etc., violate the conditionality principle.

Likelihood Principle. In the inference about θ, after x is observed, all relevant experimental information is contained in the likelihood function for the observed x. Furthermore, two likelihood functions contain the same information about θ if they are proportional to each other.

Birnbaum (1962) Sufficiency Principle + Conditionality Principle $\equiv$ Likelihood Principle

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