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An Analysis of the Controversy Over Classical One-Sided Tests

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When applying classical tests of the null hypothesis in scientific settings, there has been considerable controversy over the choice between a one-tailed versus a two-tailed test. Scientific acceptance of the one-sided testing procedure revolves around its judgment of the legitimacy of postulating a one-sided alternative hypothesis. Since such a judgment is often subjective, the issue has led to heated debate that to this day remains unresolved. In this presentation I will analyze the main elements in the controversy, examine the procedures from a Bayesian viewpoint, and find a classical approach that is consistent with the Bayesian paradigm. I take the view that classical procedures that are reasonable always correspond to an equivalent Bayesian procedure. Using a Bayesian decision framework, I show that there is no reason to double the P-value when moving from a one-sided to a two-sided problem. I then show that within the classical framework, Neyman's three-decision rule does not require the doubling of the p-value and is consistent with a Bayesian approach. I conclude that, for most comparative clinical trials, adoption of Neyman's three-decision rule is possible, and would abolish the controversy over use of one-sided tests.