# Video Lecture Summary

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This lecture presents three popular methods of hypothesis testing and the criticisms of each approach. There are three popular methods of hypothesis testing

- Fisher's significance testing
- Neyman-Pearson hypothesis testing
- Jeffreys approach

In Fisherian test, a test statistic $T = t(x)$ is chosen so that large values of the statistic indicate evidence against the null hypothesis. A p-value is computed for the test statistic under the null model and the null is rejected when the p-value is below some predetermined value. The p-value is the probability of observing data as or more extreme given that the null hypothesis is true. An alternative hypothesis is not required. This methodology was developed by R. A. Fisher.

In Neyman-Pearson hypothesis testing, a pair of null and alternative hypothesis are compared. The null is rejected if some test statistic is larger than some predetermined critical value. The Type I and Type II errors ($\alpha$ and $\beta$ respectively) are reported. They are respectively the probabilities of falsely rejecting the null hypothesis and falsely accepting the null hypothesis. This is different from the Fisherian philosophy because Neyman and Pearson *insisted* that a null hypothesis cannot be tested alone, by needs to be accompanied by an alternative.

Jeffreys uses Bayes factors (or likelihood ratio) for hypothesis testing. The bayes factor is computed as the ratio of the likelihoods under the null and alternative. That is

$$B(x) = \frac{f(x|\theta_0)}{f(x|\theta_1)}$$

The null is rejected when $B(x)$ is less than 1, and accepted otherwise. Posterior probabilities $P(H_0|x) = \frac{B(x)}{1-B(x)}$ can be computed by assigning equal prior weights on the null and alternative hypothesis. Neither Neyman nor Fisher approved of Jeffreys method.

Berger gave a simple example of how the results of greatly the different methods can vary.