

11.2 Prior Knowledge about the Coin

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Suppose that we are not flipping a coin, but we are flipping a flat-headed nail. In a social science setting, this is like asking a survey question about left or right handedness of the respondent, which we know is far from 50/50, as opposed to asking a survey question about male or female sex of the respondent, which we know is close to 50/50.

When we flip the nail, it can land with its point touching the ground (which will be called tails) or it can land balanced on its head with its point sticking up (which will be called heads).

11.2.1 NHST Analysis

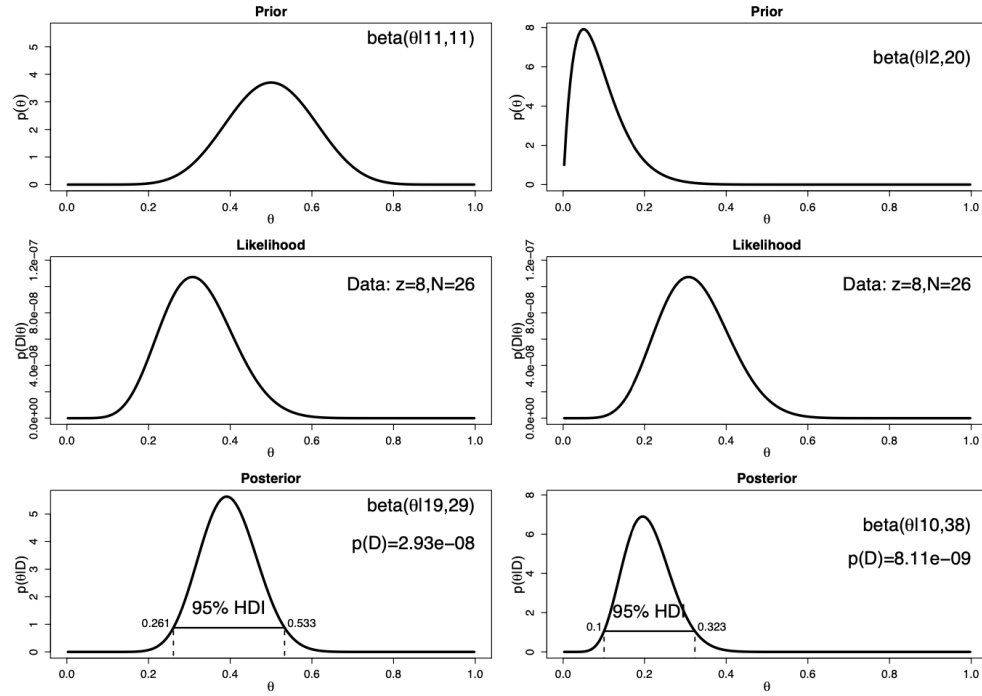
The NHST analysis does not care if we are flipping coins or nails. The analysis proceeds the same way as before. To determine whether the nail is biased, we first declare the experimenter's intentions and then compute the probability of getting 8 heads or more if the nail were fair. As we saw in the previous section, if we declare that the intention was to flip the nail 26 times, then an outcome of 8 heads means we do not reject the hypothesis that the nail is fair.

11.2.2 Bayesian Analysis

The Bayesian statistician starts the analysis with an expression of the prior knowledge. We know from prior experience that the narrow-headed nail is biased to show tails, so we express that knowledge in a prior. In a scientific setting, the prior is established by appealing to publicly accessible and reputable previous research. In our present toy example involving a nail, suppose that we represent our prior beliefs by a fictitious previous sample that had 95% tails in a sample size of 20. That translates into a $\text{beta}(\theta|2, 20)$ prior distribution. If we wanted to go through the trouble, we could instead derive a prior from established theories regarding the mechanics of such objects, after making physical measurements of the nail such as its length, diameter, mass, rigidity, etc.

11.2.2.1 Priors are Overt and Should Influence

Prior beliefs are not capricious and idiosyncratic. Prior beliefs are overt, explicitly debated, and consensual. A Bayesian analyst might have personal priors that differ from what most people think, but if the analysis is supposed to convince an audience, then the analysis must use priors that the audience finds palatable. It is the job of the Bayesian analyst to make cogent arguments for the particular prior that is used.



Some people might wonder, if subjective priors are allowed for Bayesian analyses, then why not allow subjective intentions for NHST? Because the subjective intentions in the data collector's mind do not influence the data and therefore should not influence the analysis. Subjective prior beliefs, on the other hand, are not about how beliefs influence the data, but about how the data influence beliefs: Prior beliefs are the starting point from which we move in the light of new data.