



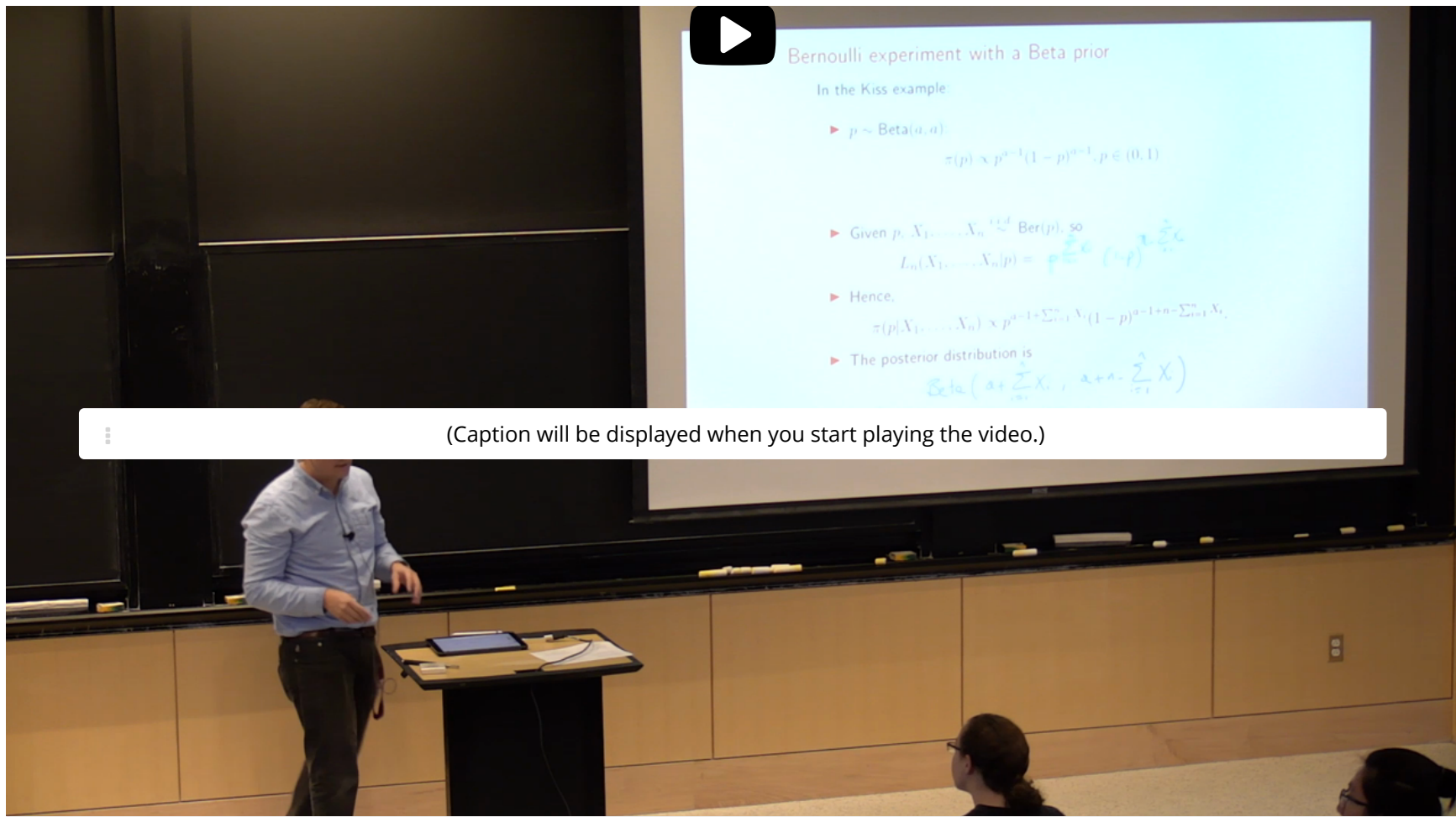
[Lecture 18: Jeffreys Prior and](#)

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> 2. Review of Previous Lecture

## 2. Review of Previous Lecture

### Review of Previous Lecture



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## Purpose of the Prior Distribution

1/1 point (graded)

The previous lecture gave an introduction to the Bayesian approach of statistical inference. One central component is the prior distribution, which in simple terms is a distribution by which the likelihood function is weighted by, in order to produce a posterior distribution. Which of the following statements about prior choice in the Bayesian framework is the most accurate?

- ☐ The prior distribution is to be specified by the researcher in order to forecast the observation values in the experiment, before observing them.
- ☒ The prior distribution is to be specified by the researcher in order to take into account previous knowledge about possible values of the parameter.
- ☐ The prior distribution is to be specified by the researcher in order to decide between different statistical models used for the likelihood function.



#### Solution:

The main idea tested in this concept question is that in our coverage of Bayesian statistics so far, the prior distribution and the likelihood function are treated as separate components. They are only combined together at the end with the Bayes' formula for the posterior.

- **The first statement is incorrect.** While it's true that the researcher does have a prior belief on the possible likely values of the parameter, which in turn affects the distribution of the observation values, this is not the intent of the prior distribution.
- **The second statement is correct.** The primary feature of the Bayesian framework is that it allows the researcher to incorporate previous knowledge about the parameter, and this is done so through the prior distribution.
- **The third statement is incorrect.** Even in the Bayesian framework where there is freedom to specify beliefs about the parameter through the prior distribution, deciding on the statistical model for the likelihood function is a separate step as specifying a prior distribution.

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You have used 1 of 2 attempts

**i** Answers are displayed within the problem

#### Factors in Determining the Prior

0 points possible (ungraded)

When applying the Bayesian framework, we have considerable freedom in specifying the family of our prior distribution. Which of the following factors must we consider in deciding on our prior? (Choose all that apply.)

- ☒ Whether or not we could specify the parameters of the distribution so that its shape approximates our prior belief
- ☒ Whether or not the support of the distribution is realistic based on our context
- ☒ How tractable it would be to compute the posterior distribution and perform inference from it, given the form of the likelihood function



#### Solution:

- **The first statement is correct.** The main purpose of specifying a prior is so that the researcher's prior belief may be weighted together with the observations towards calculating the posterior, which is an informed statement on the possible values of the parameter. As a result, the family of distributions has to be flexible enough so that we could find suitable parameters for the prior distribution to resemble the prior belief.
- **The second statement is correct.** It is also important to consider the support of the prior distribution, because an accurate and useful posterior must not have parameter values that are by definition impossible, even if they fit well calculation-wise. For example, having a full (non-truncated) Gaussian prior to model possible probabilities would give positive probability to clearly impossible parameter values: values that are either negative or greater than 1.
- **The third statement is correct.** As seen in the previous lecture, one useful feature of the Beta distribution is that combining the prior and likelihood does not introduce any new terms; rather, we only need to update the exponents. In general, having a convenient or common posterior distribution would make it more feasible to come up with closed forms for certain inference tasks based on the posterior.

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