

# Bayesian Analysis of Data

Key Steps, following Krushcke, 2015 / Hobbs et al 1015

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December 29, 2023

# Outline

Krushcke 2015

Step 1: Identify Relevant Data

Step 2: Define Descriptive Model

Step 3: Specify Prior Distribution

Step 4: Bayesian Inference

Step 5: Posterior Predictive Check

Hobbs et al 2015

Bayesian Data Analysis: Gelman et al. 2017/20 Steps

# Bayesian Analysis Steps: Krushcke, 2015

1. Identify relevant data and measurement scales.
2. Define a descriptive model for the data.
3. Specify a prior distribution on parameters.
4. Use Bayesian inference to allocate credibility.
5. Check posterior predictions against data.

# Step 1: Identify Relevant Data

- ▶ Determine measurement scales.
- ▶ Identify predictor and response variables.

## Step 2: Define Descriptive Model

- ▶ Choose a mathematical form for the model.
- ▶ Ensure parameters align with theoretical goals.

## Step 3: Specify Prior Distribution

- ▶ Obtain audience approval for the prior.
- ▶ Ensure the prior reflects prior knowledge.

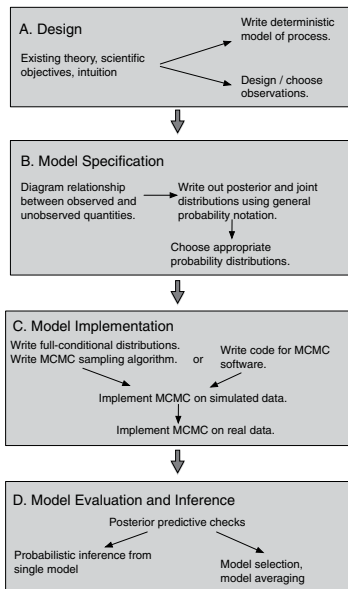
## Step 4: Bayesian Inference

- ▶ Use data to update beliefs (Bayesian inference).
- ▶ Interpret the posterior distribution.

## Step 5: Posterior Predictive Check

- ▶ Verify that posterior predictions match observed data.
- ▶ Consider alternative descriptive models if needed.





# Steps in Bayesian Data Analysis: Gelman et al. 2017/20

## 1. Setting up a Full Probability Model

- ▶ Joint probability distribution for all observable and unobservable quantities.
- ▶ Consistent with knowledge about the scientific problem and data collection process.

## 2. Conditioning on Observed Data

- ▶ Calculate and interpret the posterior distribution.
- ▶ Conditional probability distribution of unobserved quantities given the observed data.

## 3. Evaluating Model Fit and Implications

- ▶ Assess how well the model fits the data.
- ▶ Examine the reasonability of substantive conclusions.
- ▶ Evaluate sensitivity to modeling assumptions from step 1.

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