

Class 1: Models in science

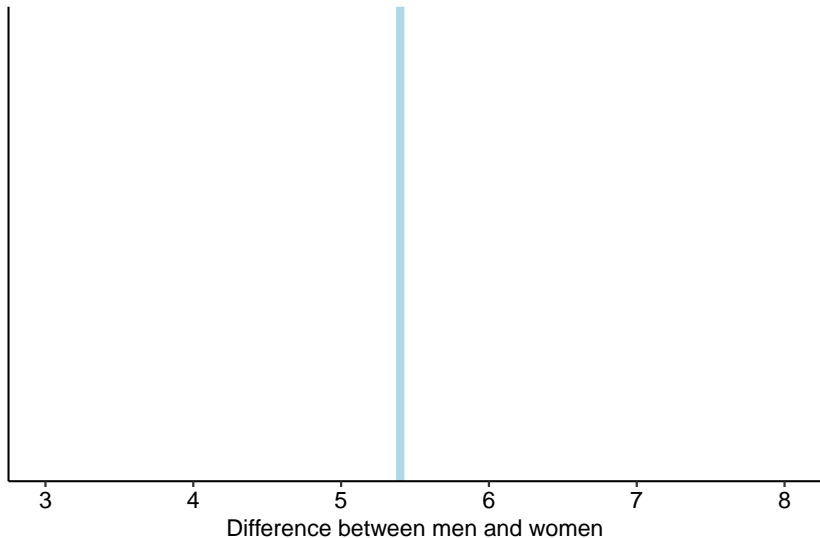
Typology of statistics

- ▶ **Frequentists:** From Neyman, Pearson, Wald. An approach you learned during basic statistics course. Is based on an imaginary sampling distributions and sharp decision rules (NHST = Null Hypothesis Significance Testing).
- ▶ **Bayesians:** From Bayes/Laplace/de Finetti. An approach that recently gains increasing popularity. Is based on an assumption that our knowledge regarding parameters is uncertain and can be always updated by new data.

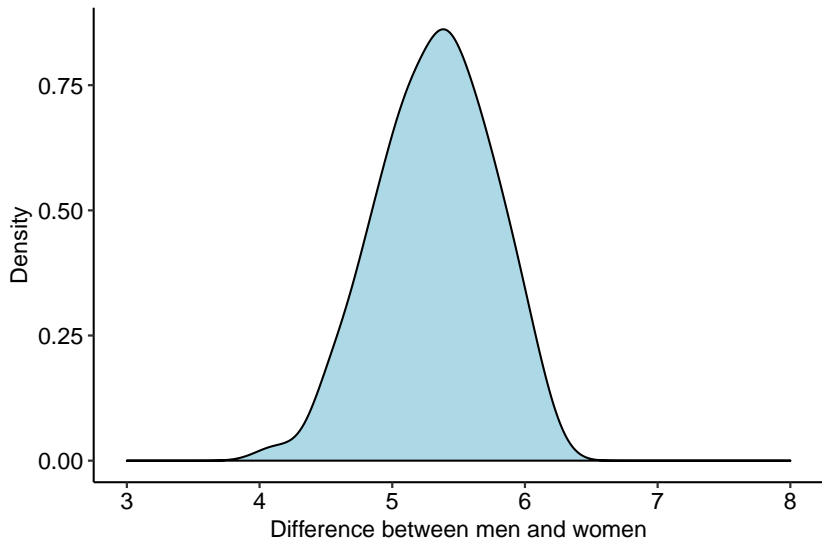
Critical differences between Bayesian and Non-Bayesians: *Fixed/Variable*

- ▶ **Frequentists:** Data are random IID sample from a continuous stream, but parameters are fixed.
- ▶ **Bayesians:** Data are observed and therefore fixed, but parameters are unknown and described distributionally.

Critical differences between Bayesian and Non-Bayesians: *Fixed/Variable*



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Critical differences between Bayesian and Non-Bayesians:

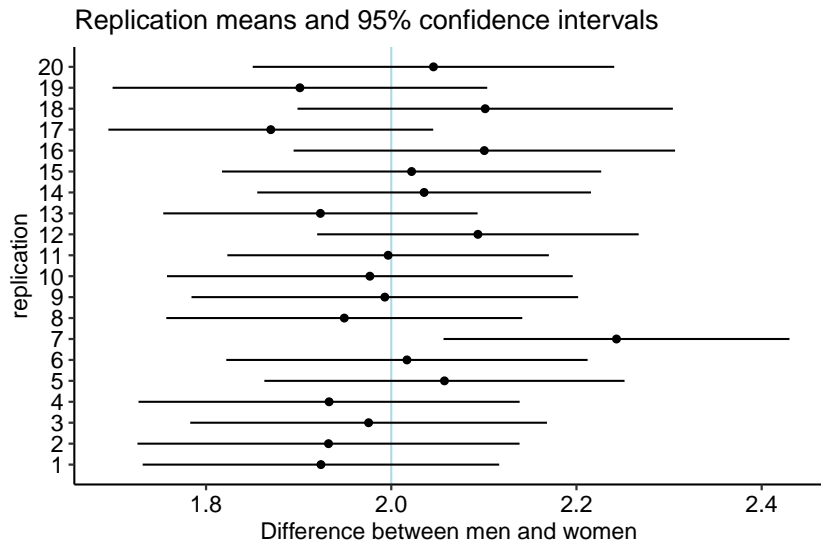
Interpretation of probability

- ▶ **Frequentists:** Probability is observed result from an infinite series of trials performed under identical conditions.
- ▶ **Bayesians:** Probability is the researcher 'degree of belief' before or after the data are observed.

Critical differences between Bayesian and Non-Bayesians: *Model summaries*

- ▶ **Frequentists:** Point estimates and standard errors. Confidence intervals: 95% CI indicating that 19/20 times intervals covers the true parameter value.
- ▶ **Bayesians:** Various ways of describing posterior distribution (means, medians, quantiles). Credible intervals, HPDIs (highest posterior density intervals).

Critical differences between Bayesian and Non-Bayesians: *Model summaries*



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Bayesian Intervals

