Lab book club -
"Statistical Rethinking" by Richard McElreath

Chapter 1 and overview of the `rethinking` package

20200526
diaorch

Chapter 1. The Golem of Prague

1.1. Statistical golems: "starting with bridge building and ending with basic physics"
1.2. Rethinking: "science advances by falsifying hypotheses"? And why the author thinks it won't work?
1.2.1. Hypotheses are not models.
1.2.2. Measurement matters.
1.2.2.1. Observation error.
1.2.2.2. Continuous hypotheses.
1.2.3. Falsification is consensual.
1.3. Three tools for golem engineering
1.3.1. Bayesian data analysis
1.3.2. Multilevel models.
1.3.3. Model comparison and information criteria.
1.4. Summary

`rethinking` package overview

An example of linear regression with two categorical variables, in RMarkdown

With `stats::lm()`, `brms::brm()`, and `rethinking::quap()`

To revisit lm() and BRMS, see lab wiki for slides from previous lab meetings

2020-05-18 -- Peter Freddolino -- Lightning talk: Regression methods

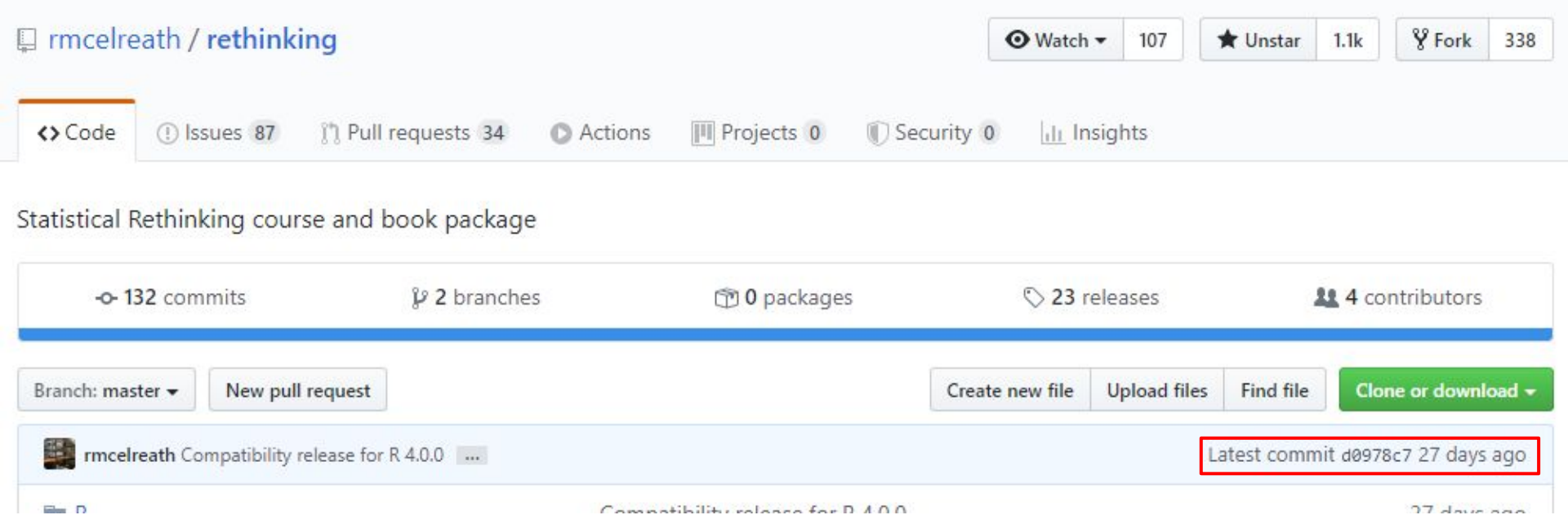
2019-07-22 -- Peter Freddolino -- Bayesian analysis of experimental data with BRMS (Additional files)

Disclaimer: still under construction (as we all do)

- GitHub to the RMarkdown source file
- Rendered HTML here

The package is evolving (and starred for 1.1k times)

https://github.com/rmcelreath/rethinking



Chapter 1 Figures

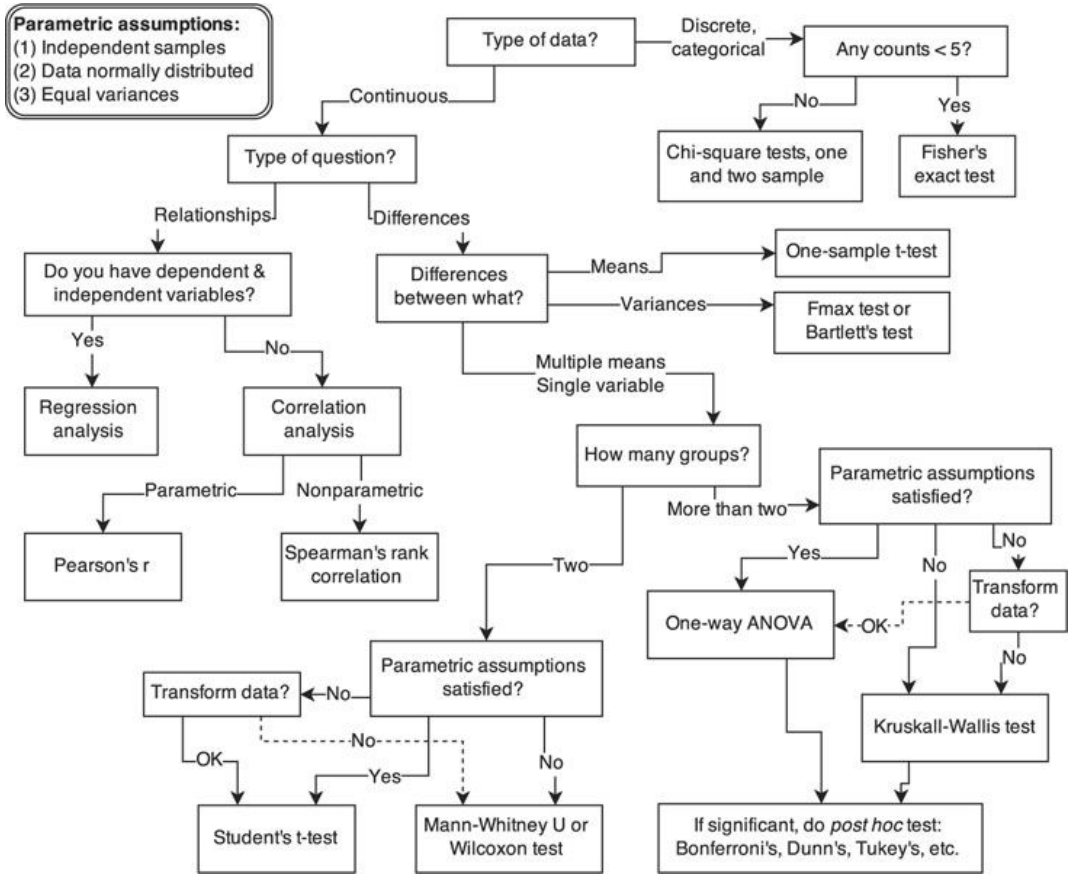
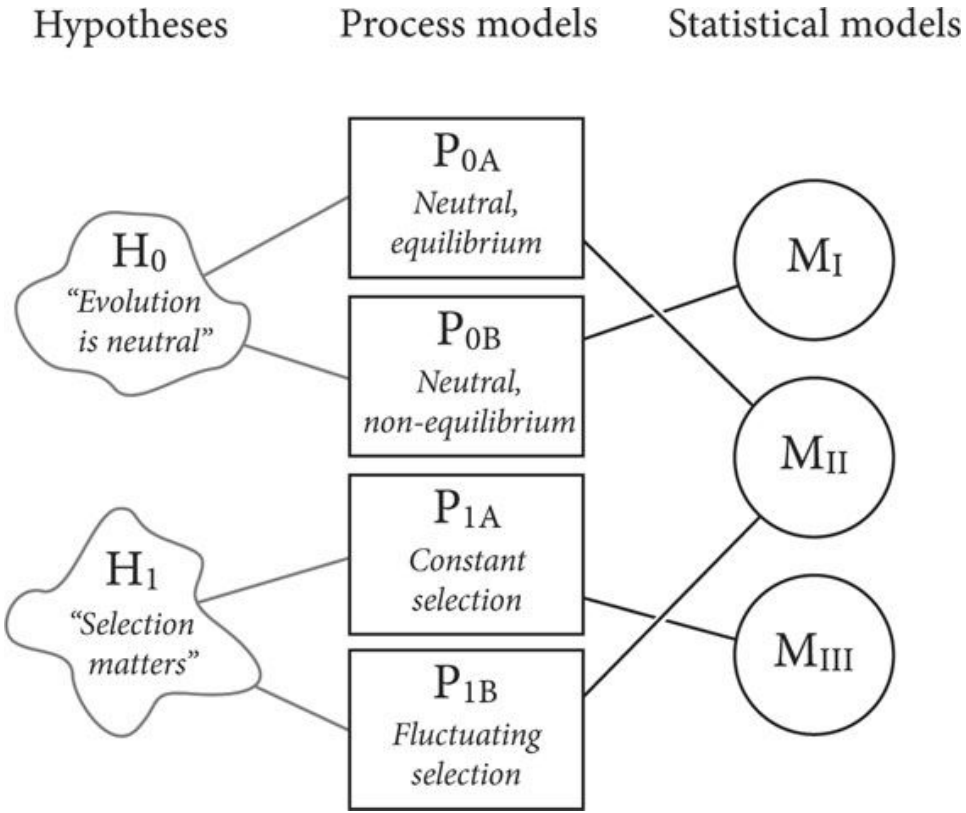


FIGURE 1.1.
Example decision tree, or flowchart, for selecting an appropriate statistical procedure. Beginning at the top, the user answers a series of questions about measurement and intent, arriving eventually at the name of a procedure. Many such decision trees are possible.



"Verbal conjunctions, not precise models"

FIGURE 1.1.
Relations among hypotheses (left), detailed process models (middle), and statistical models (right), illustrated by the example of "neutral" models of evolution. Hypotheses (H) are typically vague, and so correspond to more than one process model (P). Statistical evaluations of hypotheses rarely address process models directly. Instead, they rely upon statistical models (M), all of which reflect only some aspects of the process models. As a result, relations are multiple in both directions: Hypotheses do not imply unique models, and models do not imply unique hypotheses. This fact greatly complicates statistical inference.

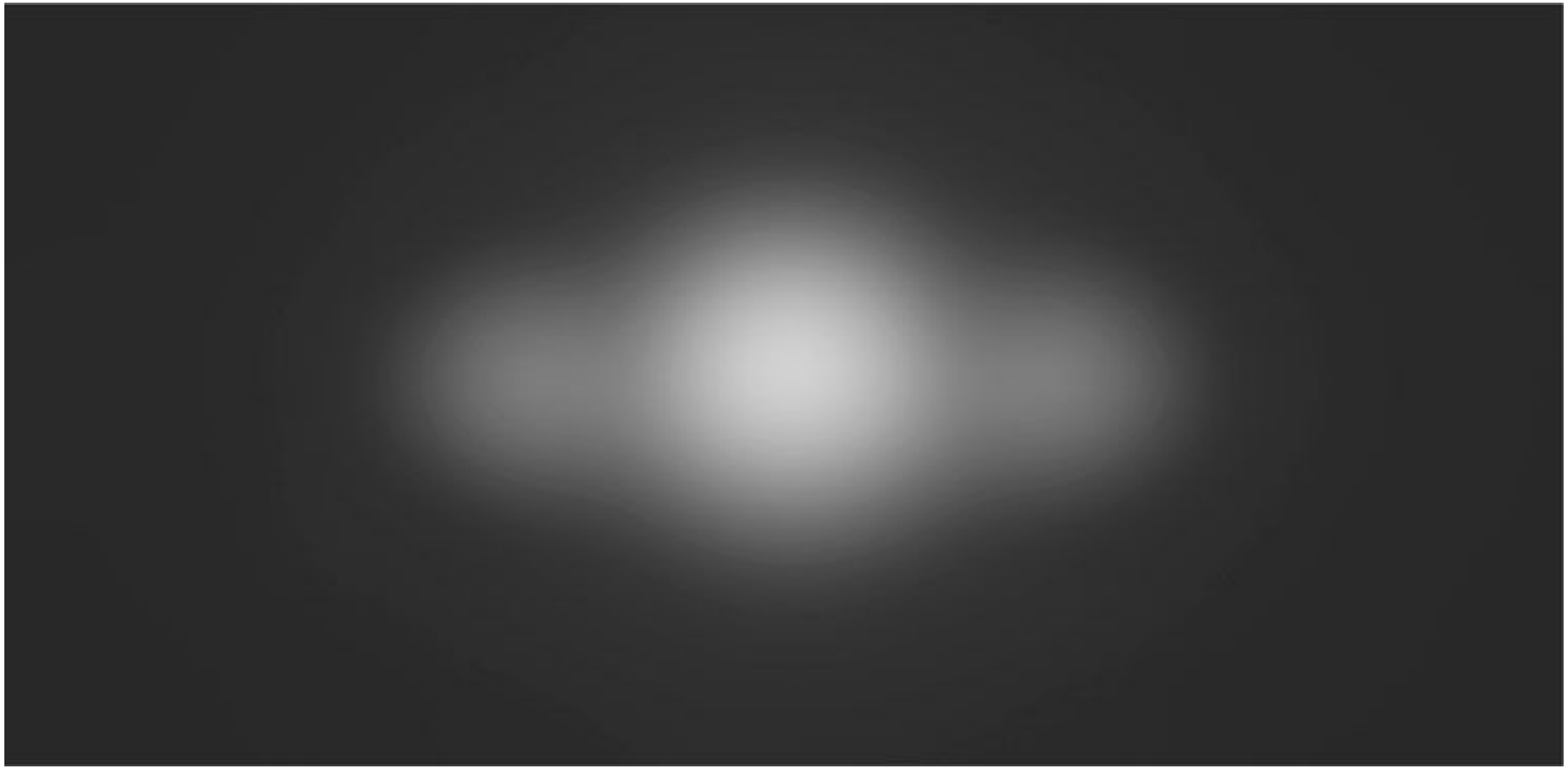


FIGURE 1.3.
Saturn, much like Galileo must have seen it. The true shape is uncertain, but not because of any sampling variation. Probability theory can still help.

`rethinking` tutorial (PDF)

2. Model specification examples

The sections to follow present examples of different standard model types. Each example contains a mathematical specification of the model, as well as working R code to implement it using `map2stan`. Many of these models will work equally well in `map`, provided there are no hyperparameters that MAP estimation cannot handle correctly. All of these model types are explained in more detail in the textbook. The material here is a technical reference.

[These sections will be filled out with examples eventually. Please bear with me as I find time to work on it.]