Today

- Recap & questions from homework
- Pair programming

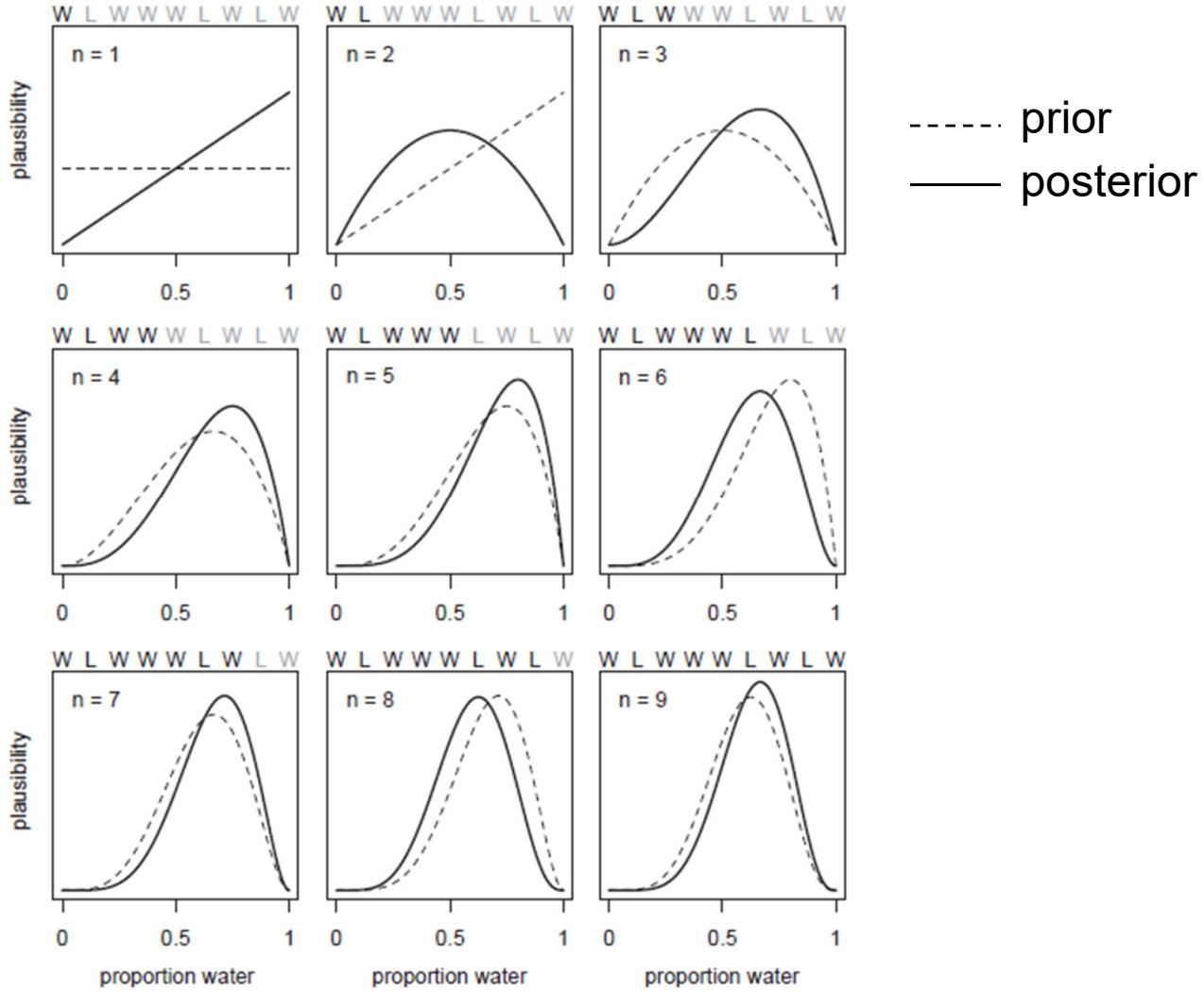
GitGUI & Gitk

- MacOS
  - install via homebrew
  - https://git-scm.com/downloads/mac
  - `$ brew install git-gui`

Main concepts McElreath 2

- Golem = algorithm
- Small world (model) vs large world (reality)
- Likelihood: counting all the ways data could have happened
- Bayesian updating: prior x likelihood
  - using counts (marbles)
  - using probabilities (marbles; divide by sum of numerator)
  - using distributions (p_water via Earth toss)

Bayesian updating



Pair programming

- Chapter 2
  - Coding Bayesian updating
  - Questions: 2M1, 2M2

Components of model

1) Likelihood
   - "data story" = data generating process
   - from first principles, or “off the shelf”
2) Parameters
   - quantities that don't change
   - to be estimated
3) Prior distribution
4) Posterior distribution (inference)
   - histogram *is* the posterior

Bayesian inference

$$P(B|A) = \frac{P(B)P(A|B)}{P(A)}$$

Bayes' rule for two events A, B

"Posterior"

$$P(\theta|y) = \frac{P(\theta)P(y|\theta)}{P(y)}$$

Model

Data

"Prior"

Likelihood

Total probability of the data

Apply Bayes' rule to convert the likelihood into what we really want to know: the probability of the model given the data

P(y): probability added up or integrated over all of the models

$$P(y) = \sum_{\theta} P(\theta)P(y|\theta)$$

Discrete parameter

$$P(y) = \int P(\theta)P(y|\theta)\, d\theta$$

Continuous parameter

Grid approximation

Algorithm

load data

define grid of parameter values

for each parameter value

    compute prior probability

    compute likelihood

    numerator = prior x likelihood

denominator = sum of numerators

for each parameter value

    posterior probability = numerator / denominator

plot posterior probability vs parameter values

unstandardized posterior

total probability

posterior distribution

Numerical integration