Bayesian Statistics and Hierarchical Bayesian Modeling for Psychological Science

Lecture 05

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https://github.com/lei-zhang/BayesCog_Wien

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Review of a paper

After L06

students 1:16

1

After L11

students 1:16

2

Preprints are freely available full manuscripts that have not yet been subject to peer review. Posting a preprint will give you credit for the project, give scientists a platform to give you feedback

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PsyArXiv

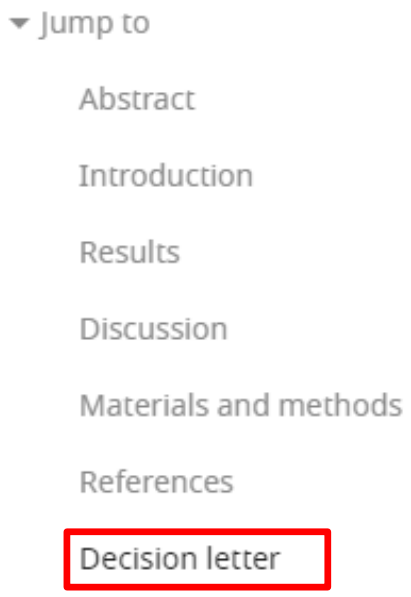
How to review a paper?

- Suppose you are invited by a journal editor to review a paper
- Of course, you have to read it☺, carefully and critically
- Then write a review report to the editor
  - (1) Make a summary. What is this paper about? What was done? What was the conclusion?
  - (2) List your concerns. Is the design appropriate? Are the analyses sound? Do their data support the conclusion? What can be done better?
- For this course:
  - up to 3 pages (12pt, 1.5 space)
  - be independent: okay to discuss HOW to review, but do NOT discuss WHAT to review

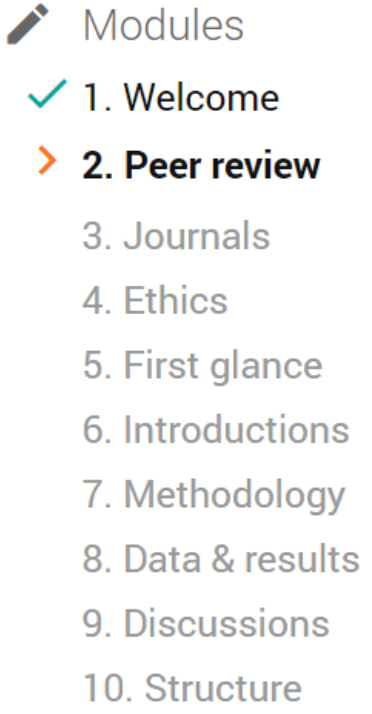
https://github.com/lei-zhang/BayesCog_Wien/tree/master/review_a_paper

Where to learn to review a paper?

- Publicly available review reports:
  - Nature Communications
  - eLife



- Structured online course
  - Publons Academy



https://github.com/lei-zhang/BayesCog_Wien/tree/master/review_a_paper

Where to learn to review a paper?

Best practices for reviewers

Declaring competing interests

A competing interest is anything that interferes with or could be perceived as potentially interfering with, a thorough and objective assessment of a manuscript. Common examples of competing interests may include:

- A recent or current collaborations with any of the authors
- Direct competition or a history of scientific conflict with any of the authors
- An opportunity to profit financially from the work

Do not accept a review assignment if you have a competing interest, or don't feel able to give an objective assessment. If you're unsure whether your relationship qualifies as a competing interest, contact the journal office for advice. If we ask you to complete the review anyway, be sure to declare the competing interest when you submit your review.

Crediting collaborators

If you had help completing the review you must share your collaborator's name with the journal when you submit the review, either by entering it in question 2 under the 'Confidential comments to Editor' section, or via email. Be careful not to include your collaborator's name in text of the review itself.

Confidentiality

Keep manuscripts and correspondence confidential and do not share information about submissions with any one else unless previously agreed with the editor. We expect that reviewers will not make use of any material or take advantage of any information they gain through the peer review process.

Read the PLOS Confidentiality Policy.

Reviewing a manuscript you've previously reviewed

If you reviewed the article at another journal, consider the manuscript as a new submission unless instructed otherwise. Keep in mind that it may have been revised since the last time you evaluated it, and *PLOS ONE's* criteria for publication may differ from those of the other journal. When you submit your review, let the editor know that you reviewed a previous version of the manuscript at another journal.

Time to review

Aim to complete your review within 10 days. If you need more time to perform the review, please email us as soon as possible.

https://journals.plos.org/plosone/s/reviewer-guidelines

Review in action

paper#_lastname_matriculatenumber.docx

paper1_Cook_etal_2018.pdf

paper2_daSilva_etal_2017.pdf

"Title of the paper"

Summary of the paper

In this paper xx et al., investigated xxx…

Strength of the paper

[theoretical contribution, experimental design, methodological endeavor, etc.]

Major concerns

[lacking literatures, inappropriate analyses, conclusion cannot be directly supported by the results etc.]

Minor concerns

[typo, imprecise statistics (e.g., missing degrees of freedom), grammar mistakes, etc.]

- up to 3 pages (12pt, 1.5 space)
- send as PDF via email to me
- New Due!: Sunday 17.05.2020

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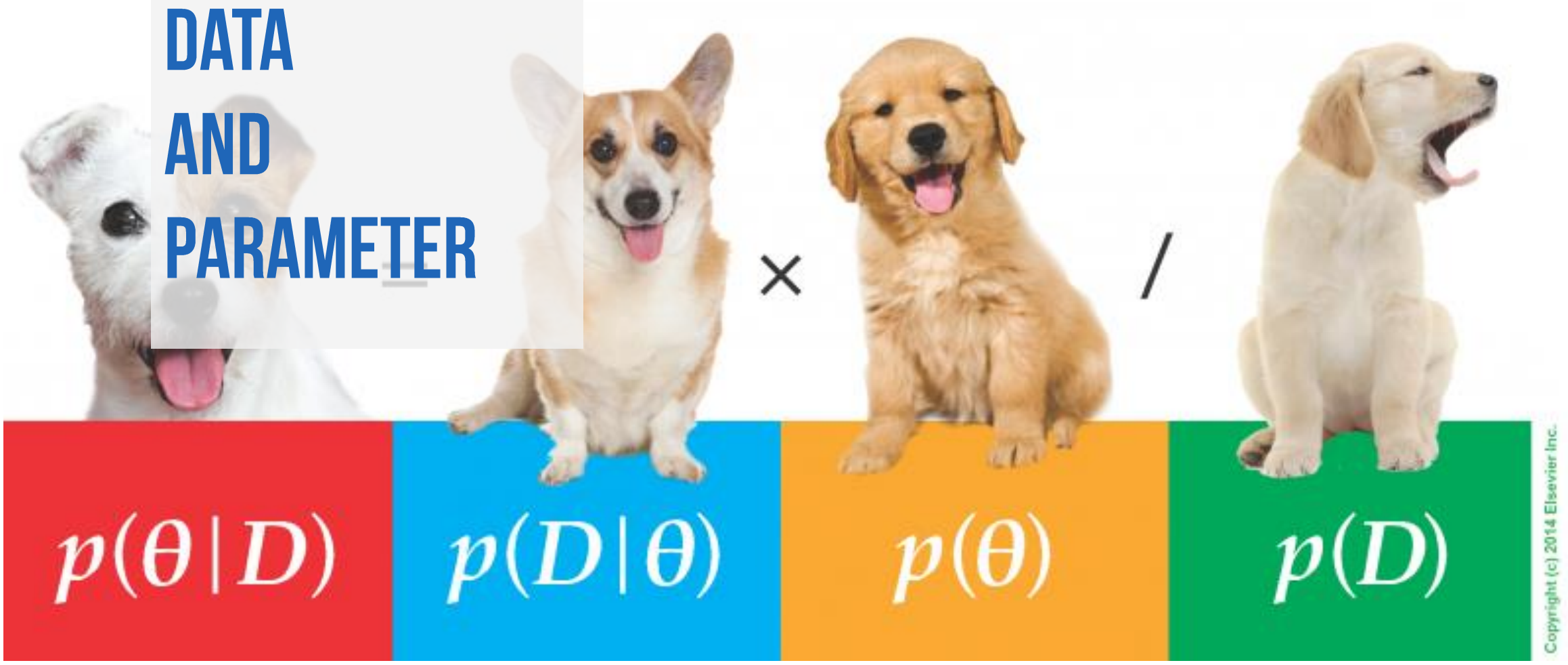
Bayesian warm-up?

LINKING DATA AND PARAMETER



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Linking Data and Parameter

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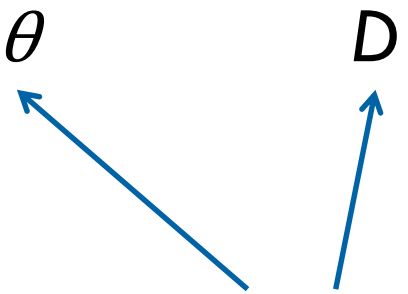

$$p(A|B) = \frac{p(B|A)p(A)}{p(B)}$$

Linking Data and Parameter

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$$p(\theta|D) = \frac{p(D|\theta)p(\theta)}{p(D)}$$

Linking Data and Parameter

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Likelihood
How plausible is the data given our parameter is true?

Prior
How plausible is our parameter before observing the data?

$$p(\theta|D) = \frac{p(D|\theta)p(\theta)}{p(D)}$$

Posterior
How plausible is our parameter given the observed data?

Evidence
How plausible is the data under all possible parameters?

What is $p(\text{Data}|\vartheta)$

- This is the "Model"
- Data is fixed, ϑ varies
- Not a probability distribution
  - the sum is not "one"

L(theta | Data)

Probability of coin landing heads up, θ	Number of heads, X 0	1	2	Total
0.0	1.00	0.00	0.00	**1.00**
0.2	0.64	0.32	0.04	**1.00**
0.4	0.36	0.48	0.16	**1.00**
0.6	0.16	0.48	0.36	**1.00**
0.8	0.04	0.32	0.64	**1.00**
1.0	0.00	0.00	1.00	**1.00**
Total	**2.20**	**1.60**	**2.20**	

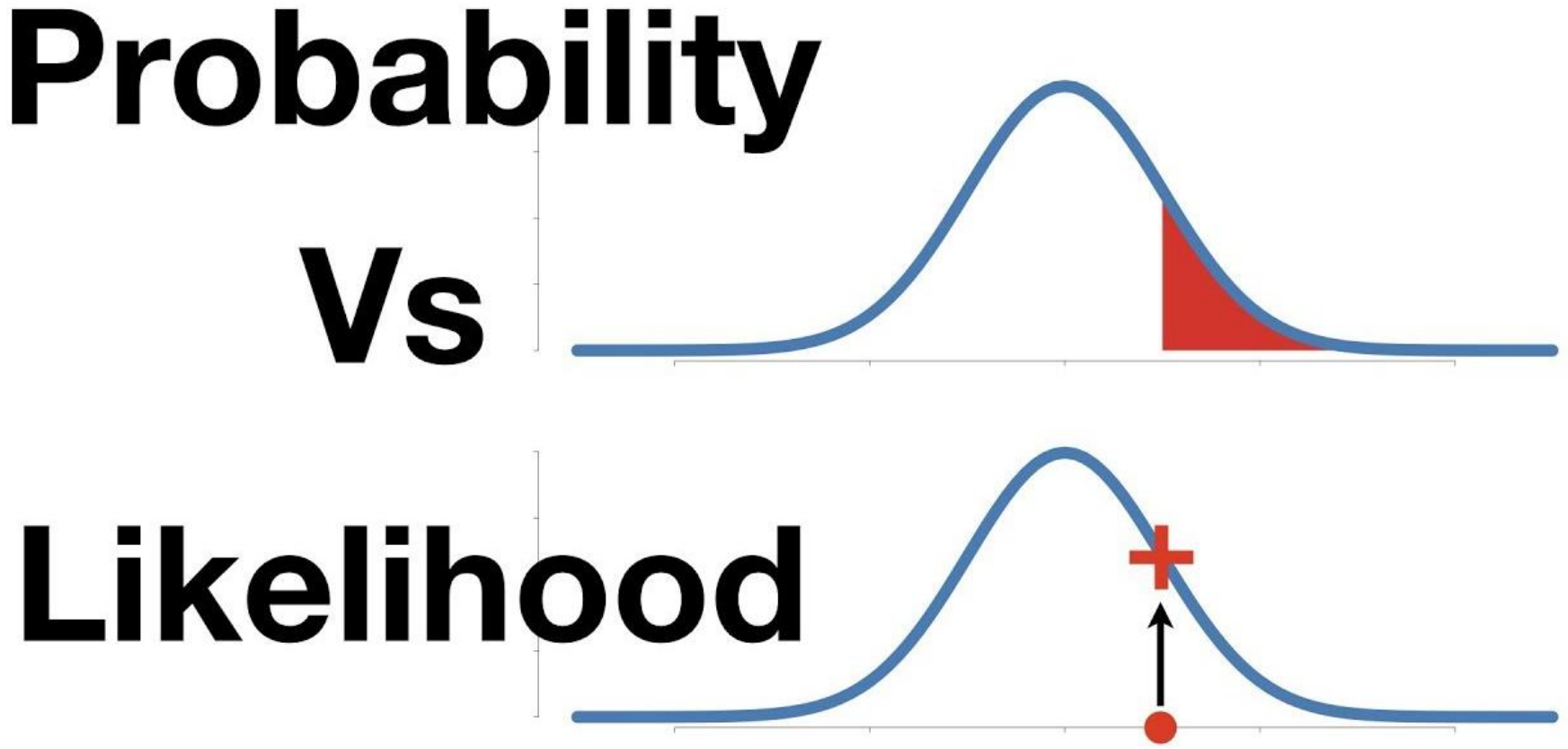
$$Pr(X=0|\theta)=Pr(T,T|\theta)=Pr(T|\theta)\times Pr(T|\theta)=(1-\theta)^2$$

$$Pr(X=1|\theta)=Pr(H,T|\theta)+Pr(T,H|\theta)=2\times Pr(T|\theta)\times Pr(H|\theta)=2\theta(1-\theta)$$

$$Pr(X=2|\theta)=Pr(H,H|\theta)=Pr(H|\theta)\times Pr(H|\theta)=\theta^2.$$

Lambert (2018)

Watch this video!



StatQuest with Josh Starmer
250K subscribers

https://youtu.be/pYxNSUDSFH4

What is $p(\vartheta)$?

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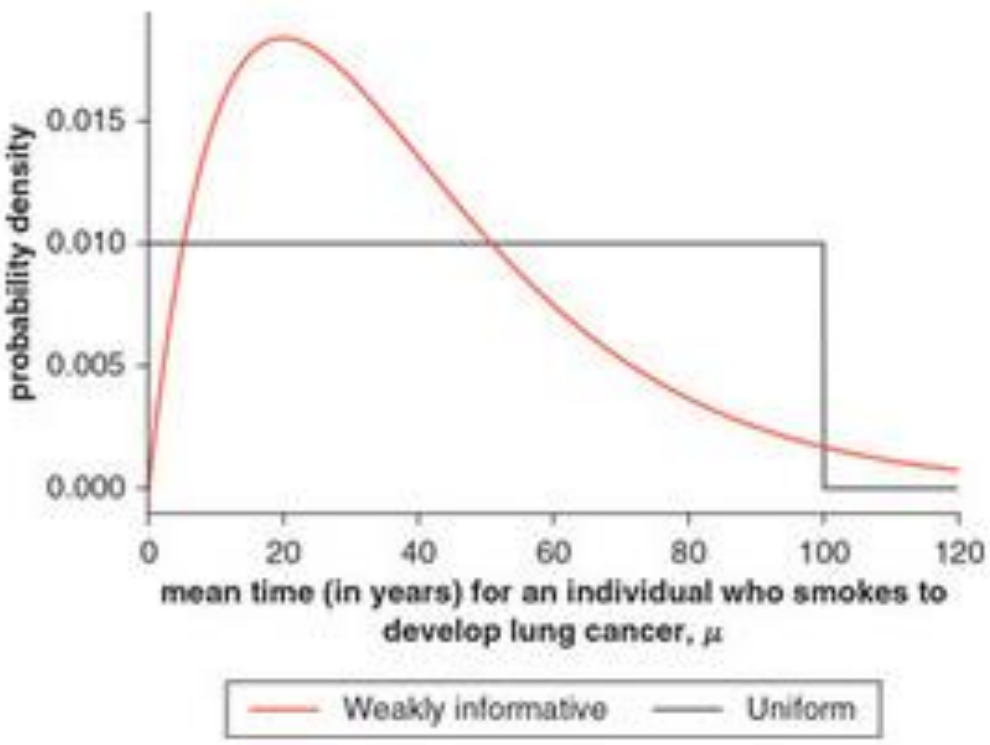

Lambert (2018)

What is *p*(*Data*)?

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discrete parameters

$$p(\theta \mid D) = \frac{p(D \mid \theta)\, p(\theta)}{\sum_{\theta^*} p(D \mid \theta^*)\, p(\theta^*)}$$

$$p(\theta|D) = \frac{p(D|\theta)p(\theta)}{p(D)}$$

continuous parameters

$$p(\theta \mid D) = \frac{p(D \mid \theta)\, p(\theta)}{\int p(D \mid \theta^*)\, p(\theta^*)\, d\theta^*}$$

Why the Bayes' theorem is important?

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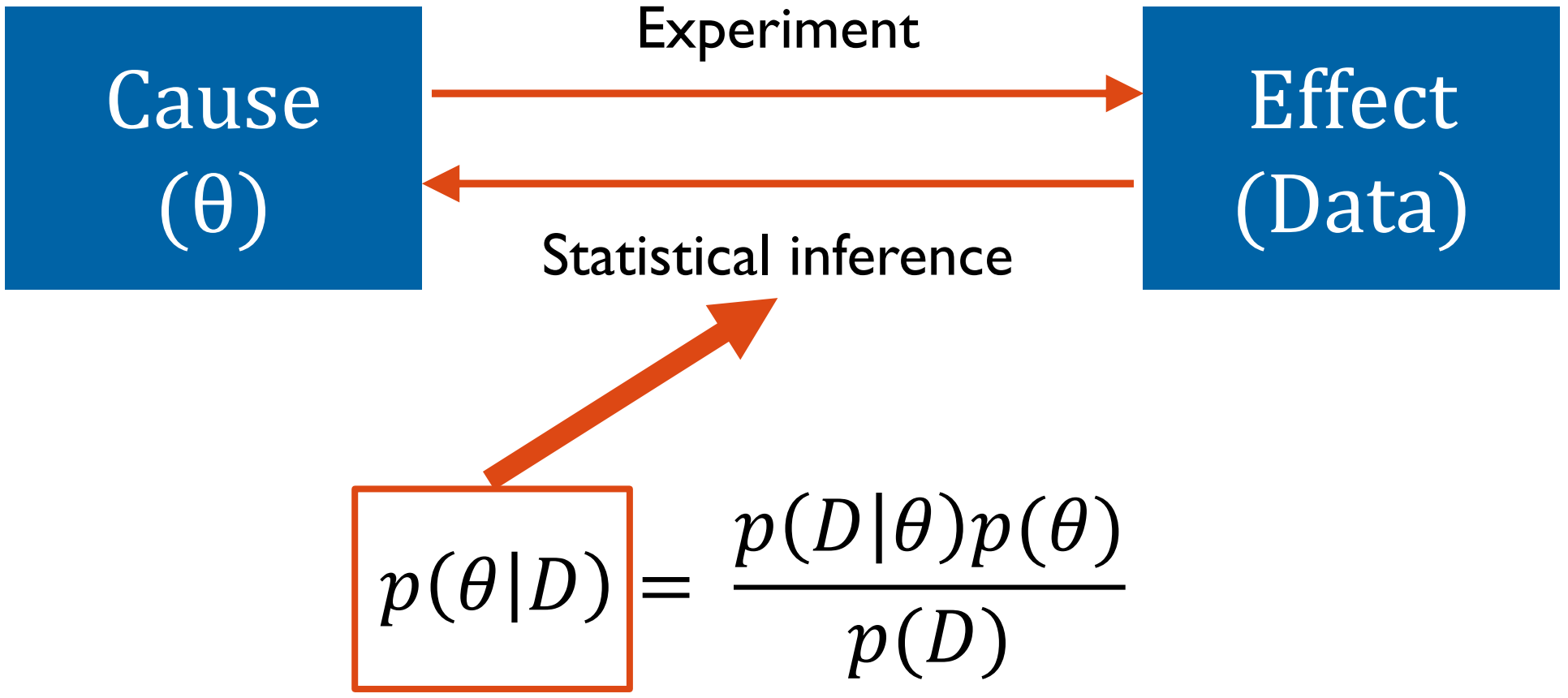

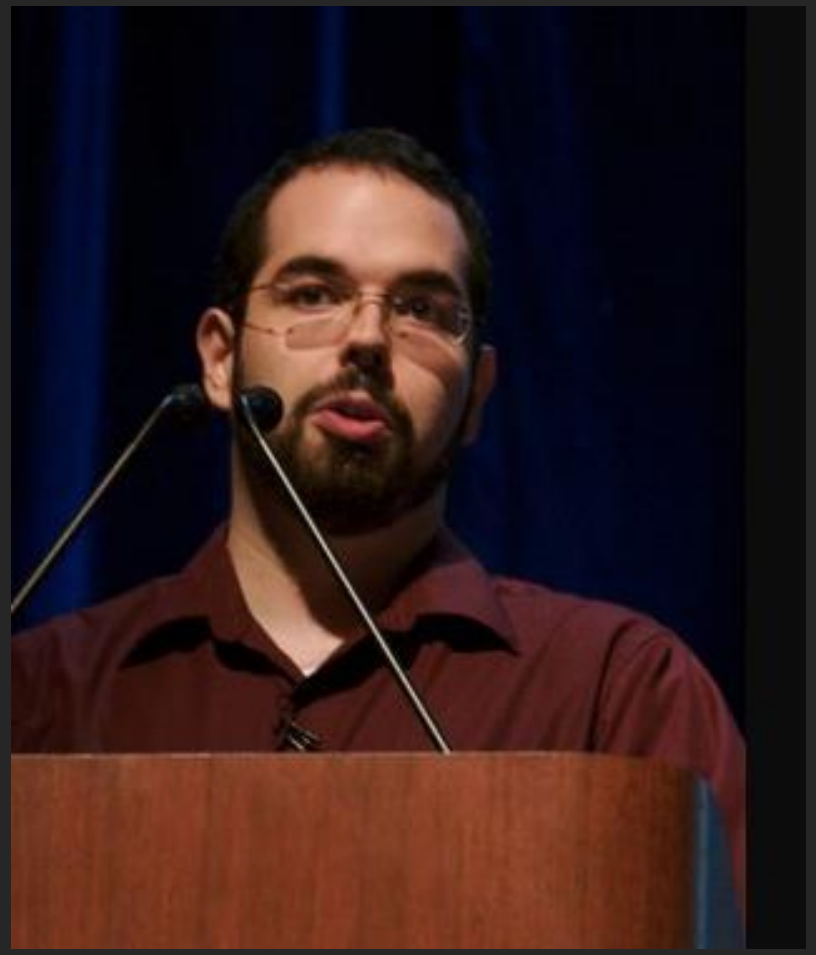

“Probability is orderly opinion and inference from data is nothing other than the revision of such opinion in the light of relevant new information.”

Eliezer S. Yudkowsky

BINOMIAL MODEL

Binomial Model

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- You are curious how much of the surface is covered in water.
- You will toss the globe up in the air.
- You will record whether or not the surface under your right index finger is water (W) or land (L).
- You might observe: W L W W W L W L W
- → 6/9 = 0.666667?
- Is it right? If not, what to do next?

McElreath (2016)

Steps of (Bayesian) Modeling?

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A data story

Think about how the data might arise.
It can be *descriptive* or even *causal*.

Update

Educate your model by feeding it with data.
Bayesian Update:
update the prior, in light of data, to produce posterior
the updated posterior then becomes the prior of next update

Evaluate

Compare model with reality.
Revise your model.

McElreath (2016)

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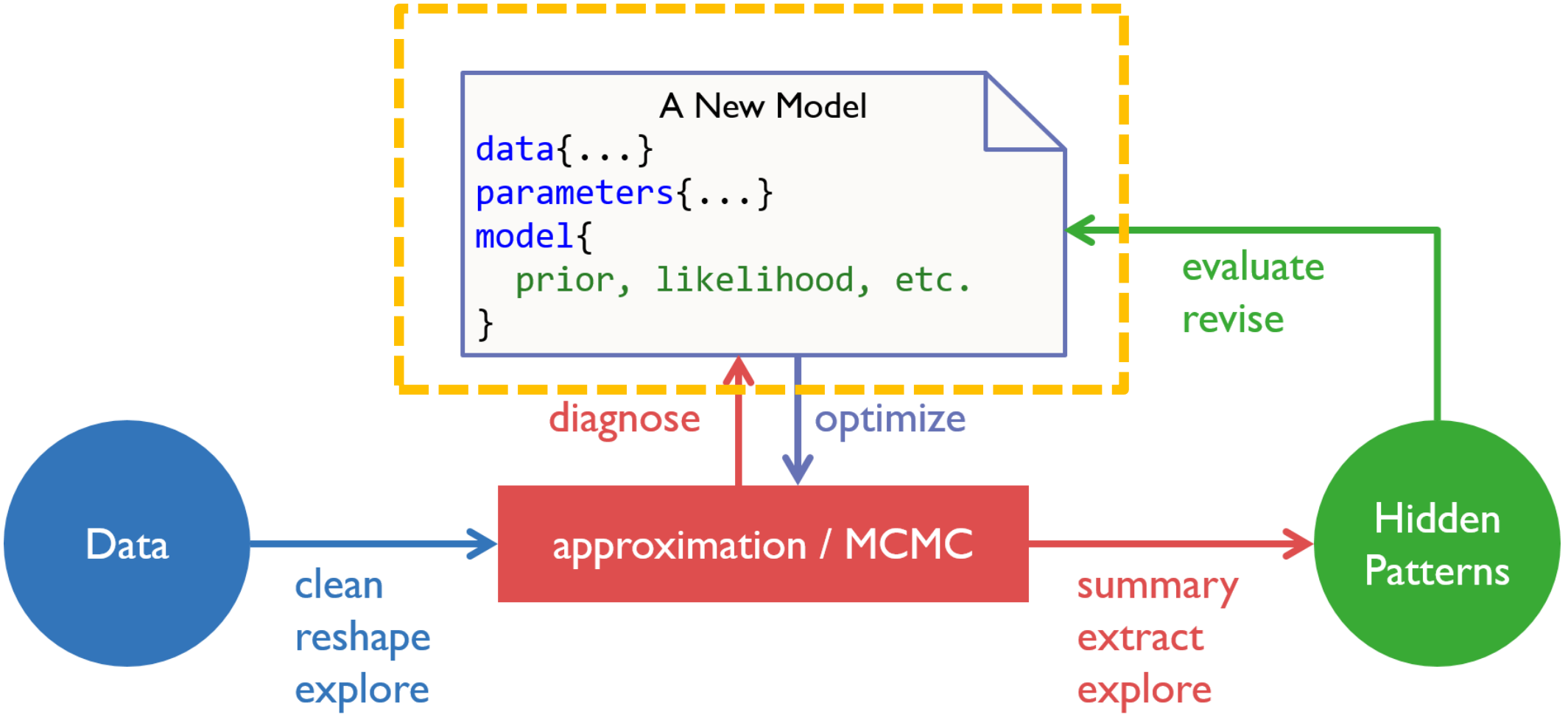

A Data Story of the Globe

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- The true proportion of water covering the globe is ϑ.
- A single toss of the globe has a probability ϑ of producing a water (W) observation.
- It has a probability $(1 - \vartheta)$ of producing a land (L) observation.
- Each toss of the globe is independent of the others.

McElreath (2016)

Components of a Model

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think about the likelihood function (of Binomial):

$$p(\theta \mid D) = \frac{p(D \mid \theta)\, p(\theta)}{\int p(D \mid \theta^*)\, p(\theta^*)\, d\theta^*}$$

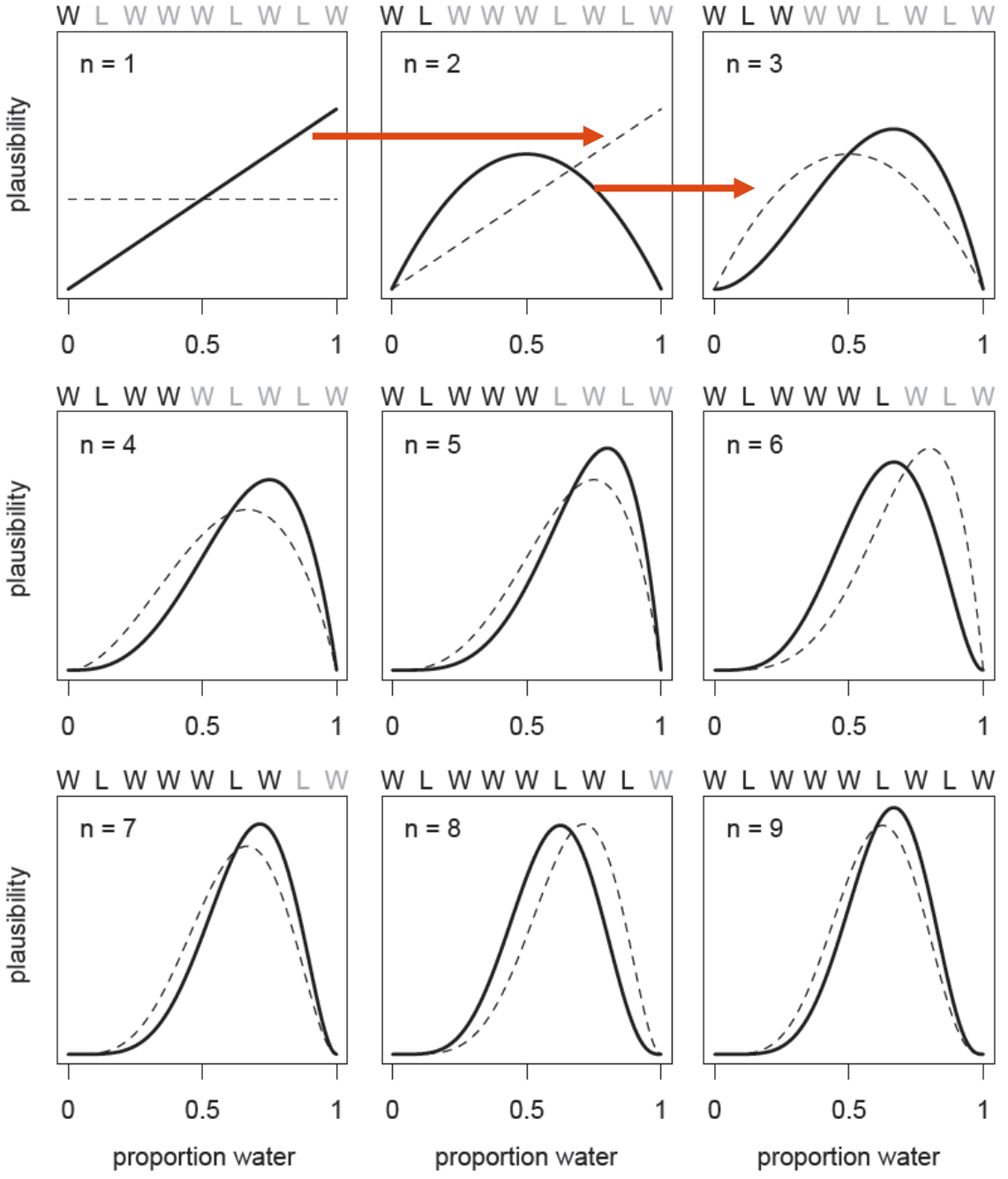
$$p(w \mid N, \theta) = \binom{N}{w} \theta^w (1-\theta)^{N-w}$$

N: total number of observations
w: number of water
ϑ : proportion of water

} known (data)

unknown (parameter)

Update



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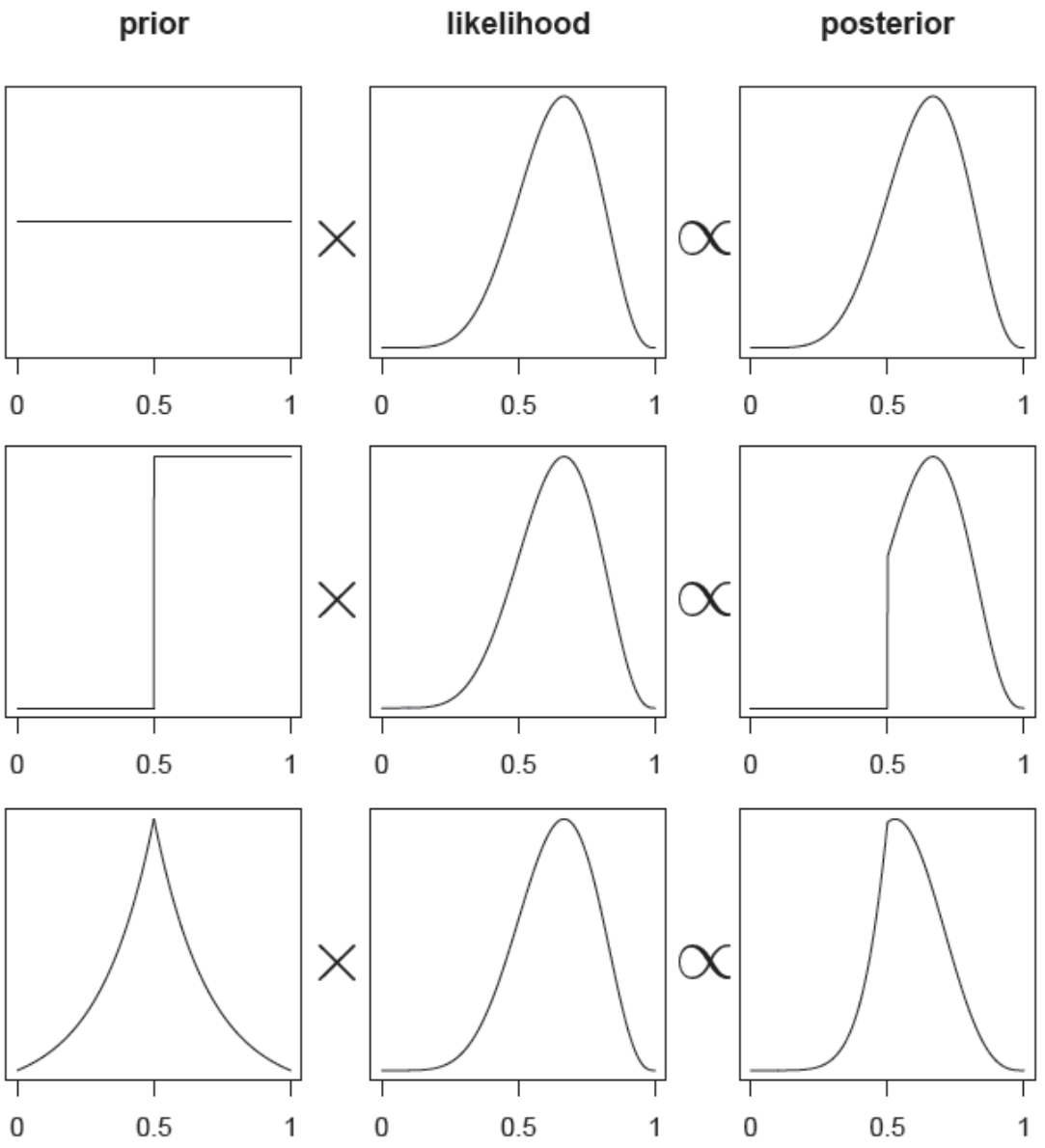
- order doesn't matter
- 2/3 is most likely
- others are not ruled out

McElreath (2016)

Impact of Prior



McElreath (2016)


ANY
QUESTIONS
?

Happy Computing!