

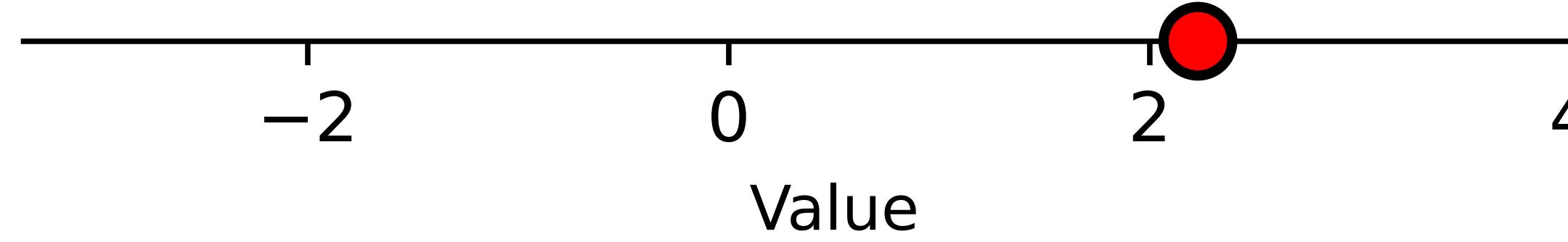
A BRAIN PHACK PROJECT

BRAINHACK DONOSTIA 2025

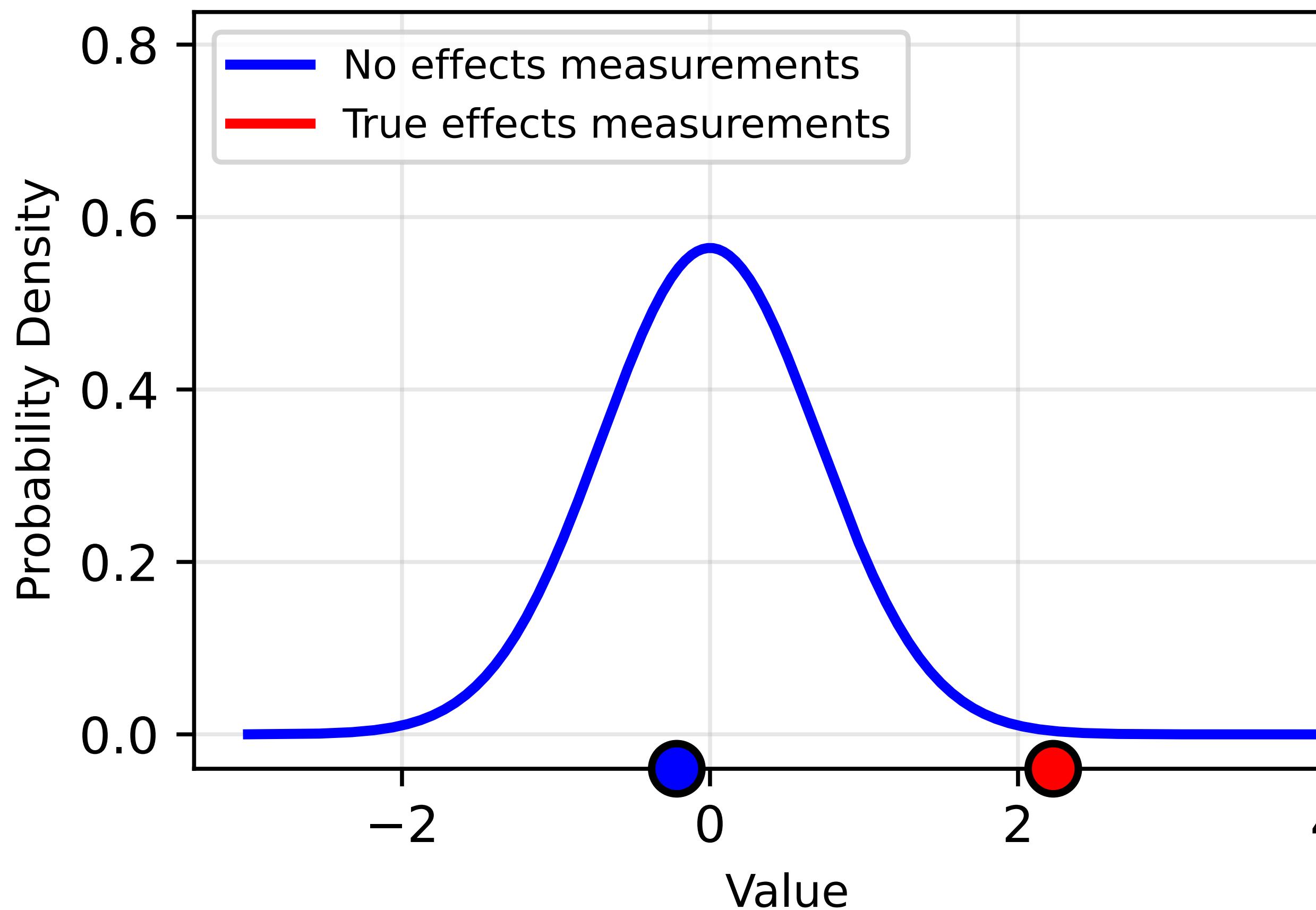
github.com/qtabs/abrainphackproject



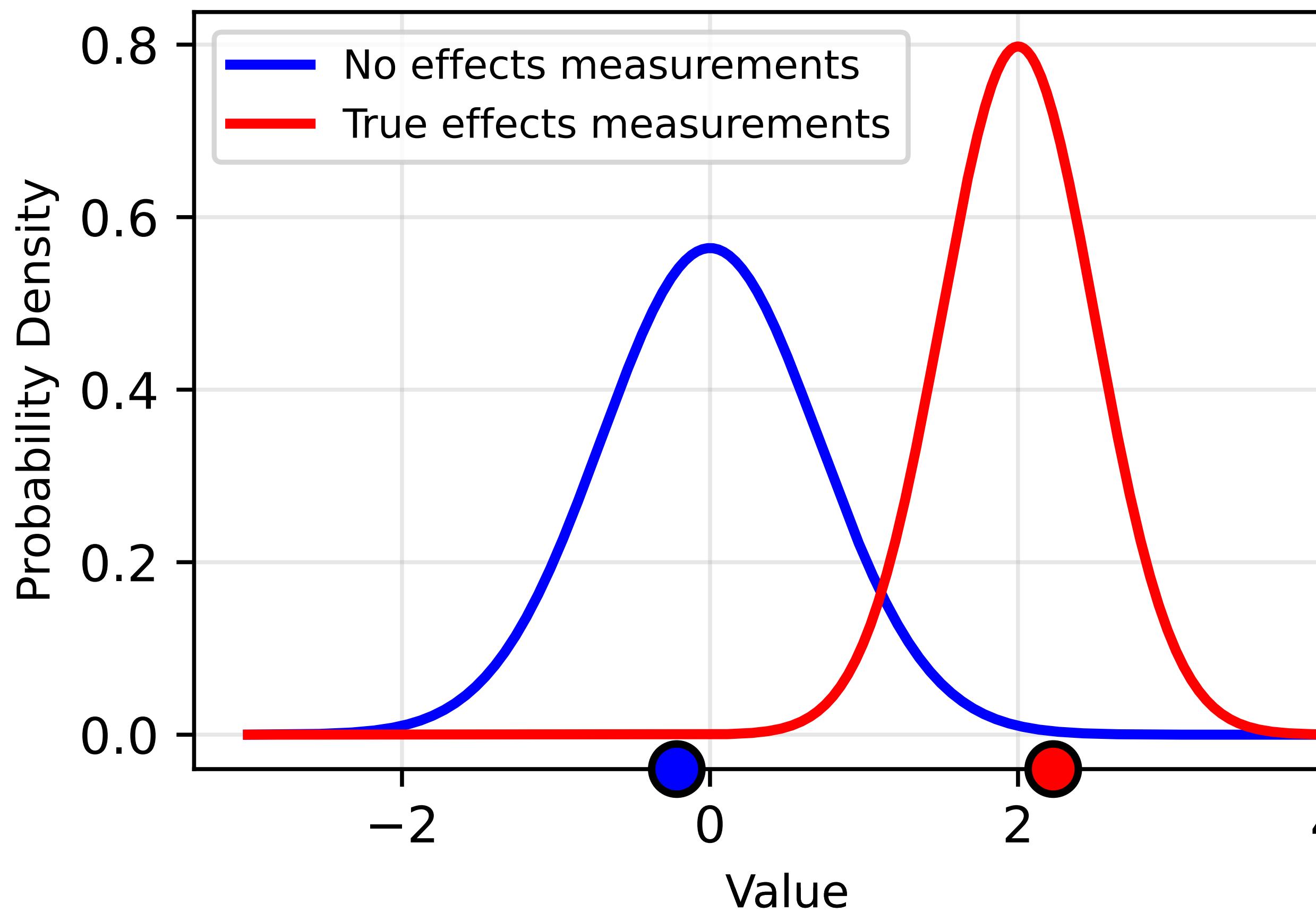
Classical statistical hypothesis testing



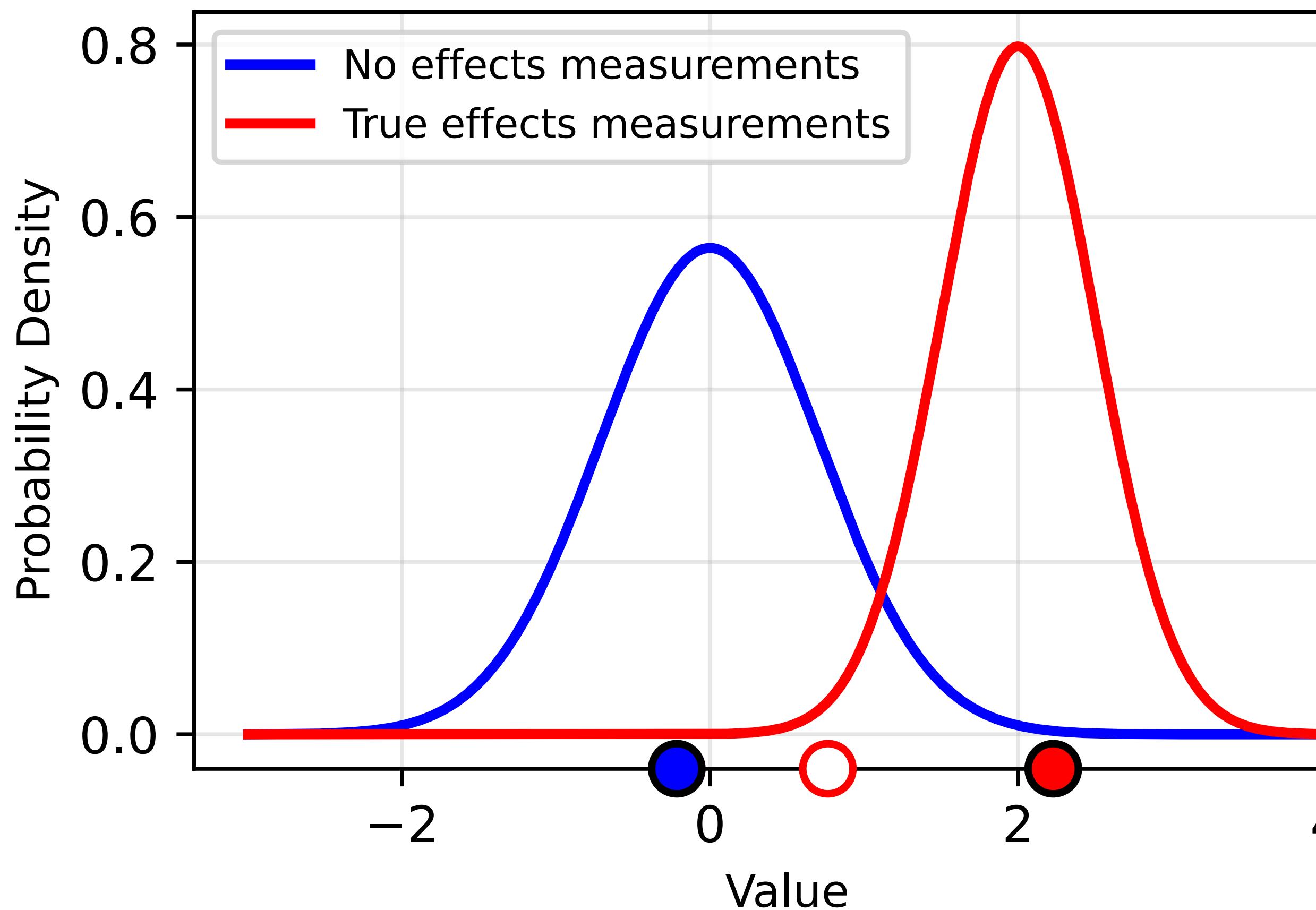
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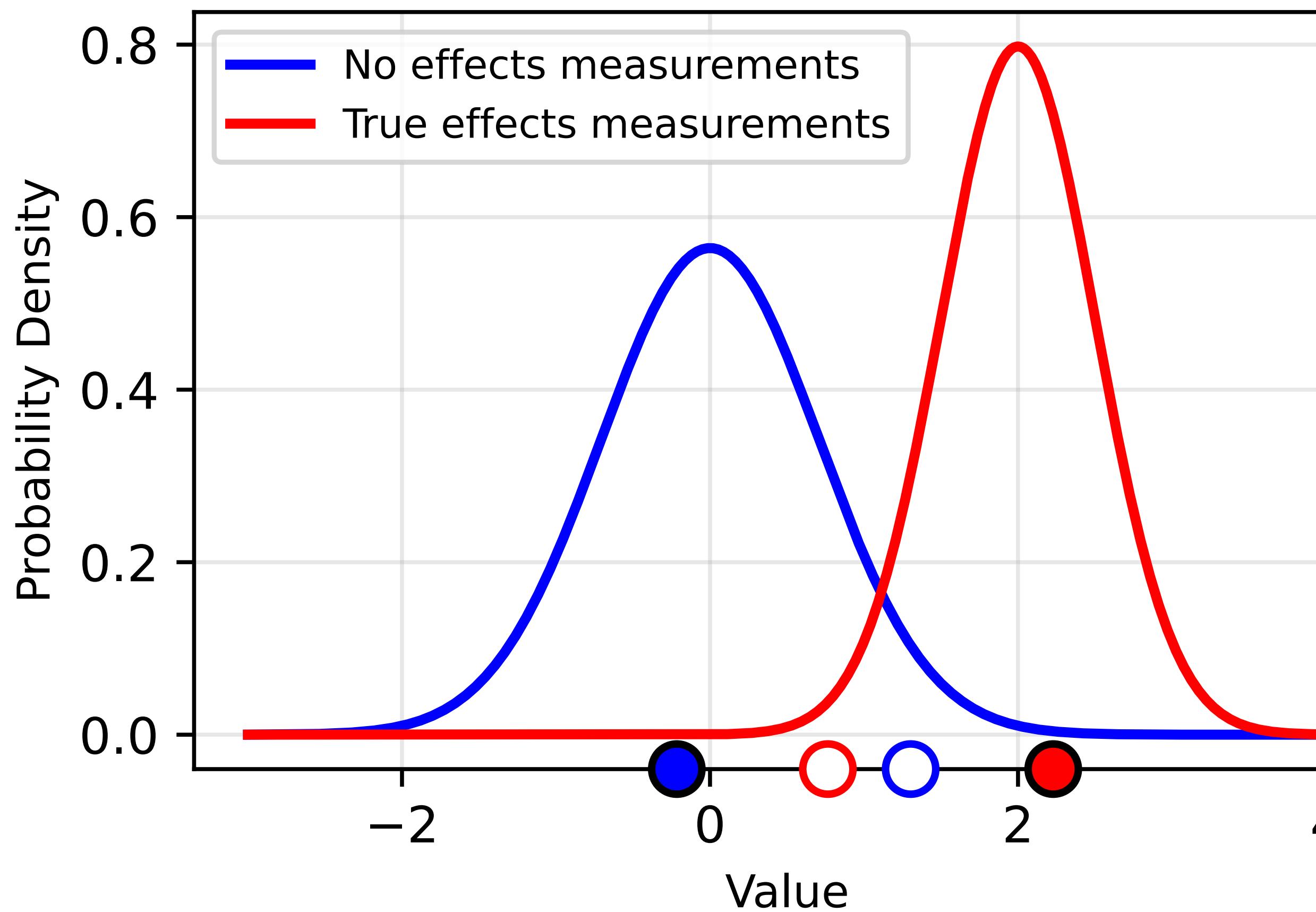
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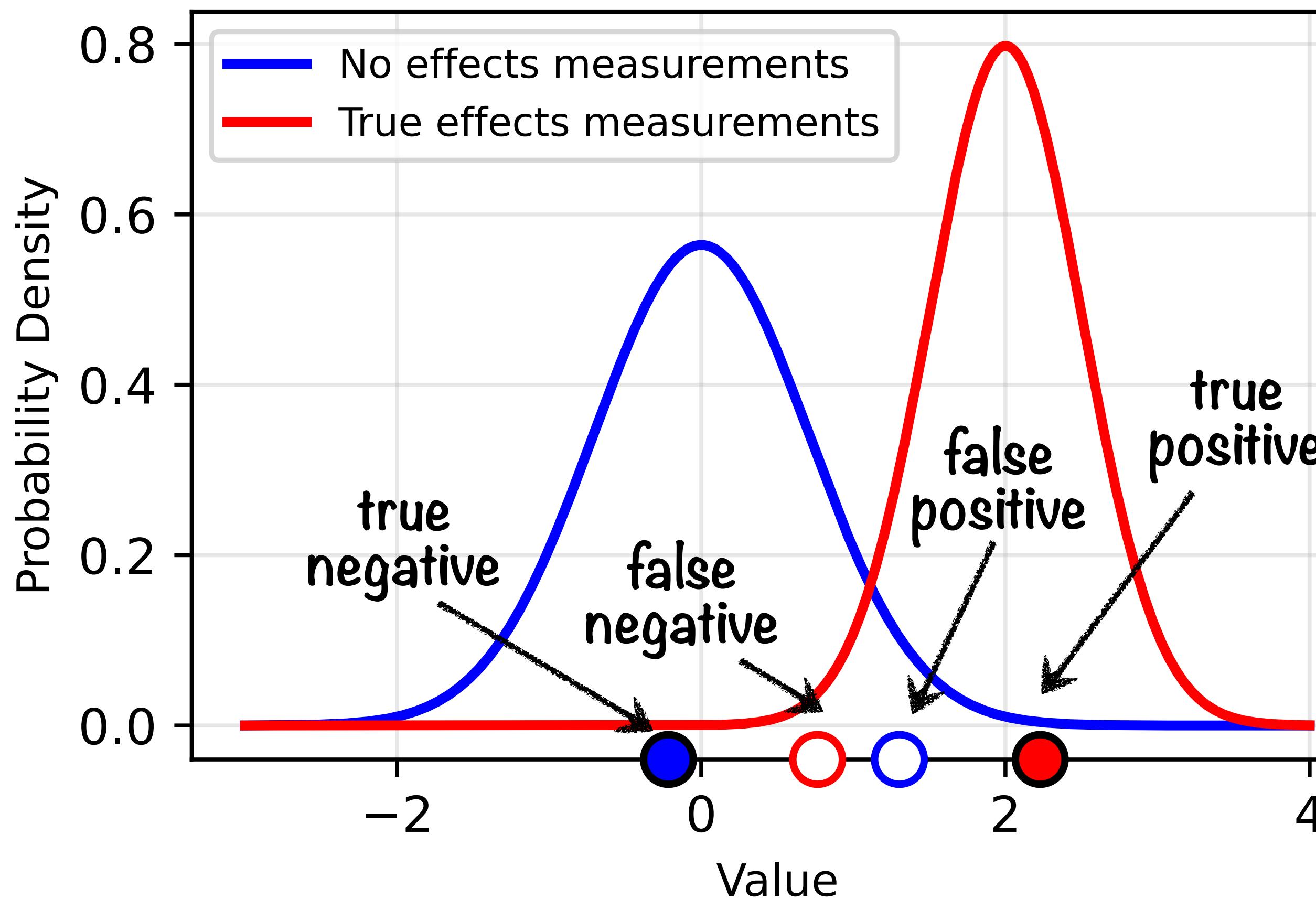
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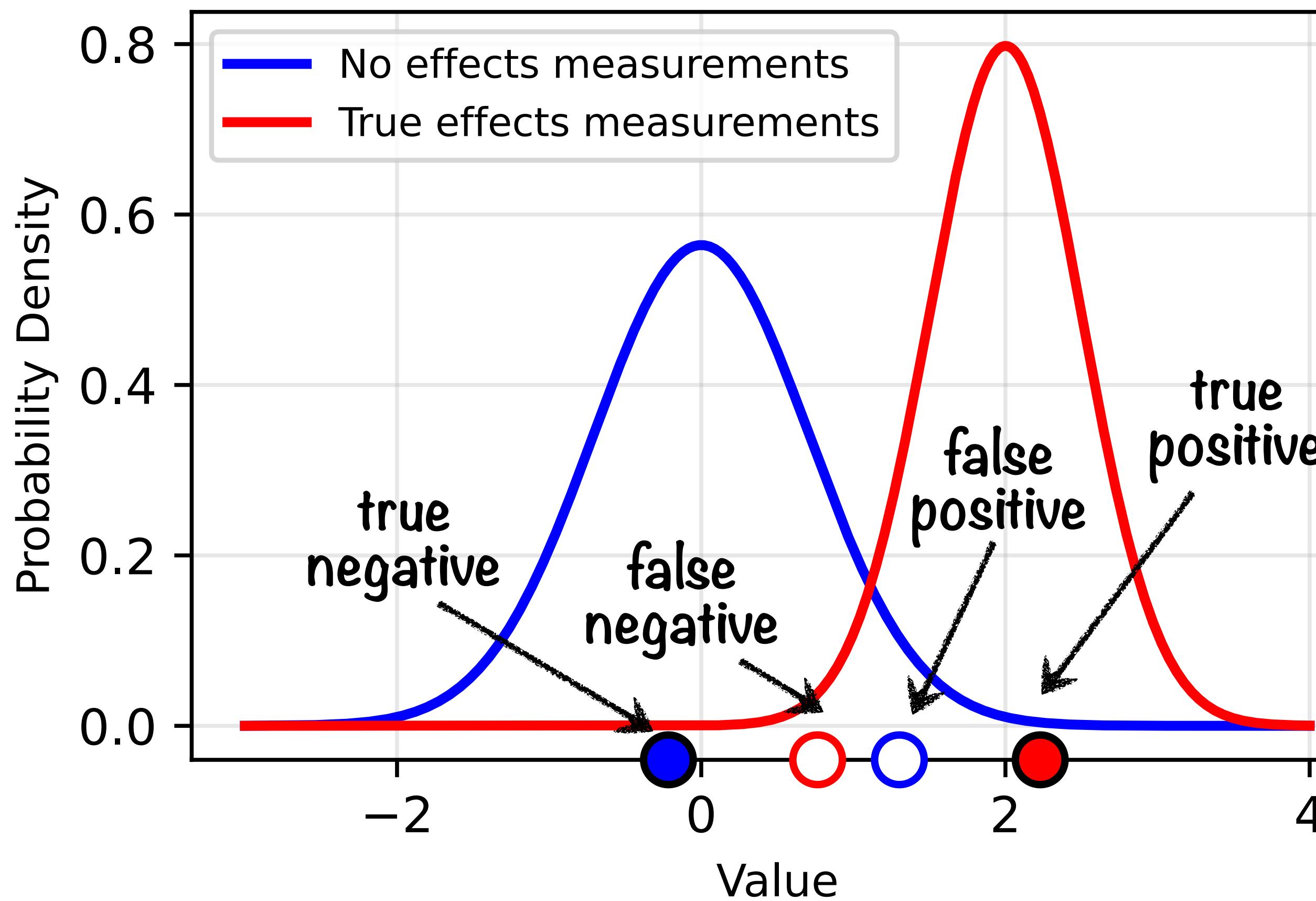
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Accidental p hacking

Some researchers p hack in bad faith



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- Not much we can do about that
(with the tools we have in this room)



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- How can we evaluate the risk of us p hacking our results?



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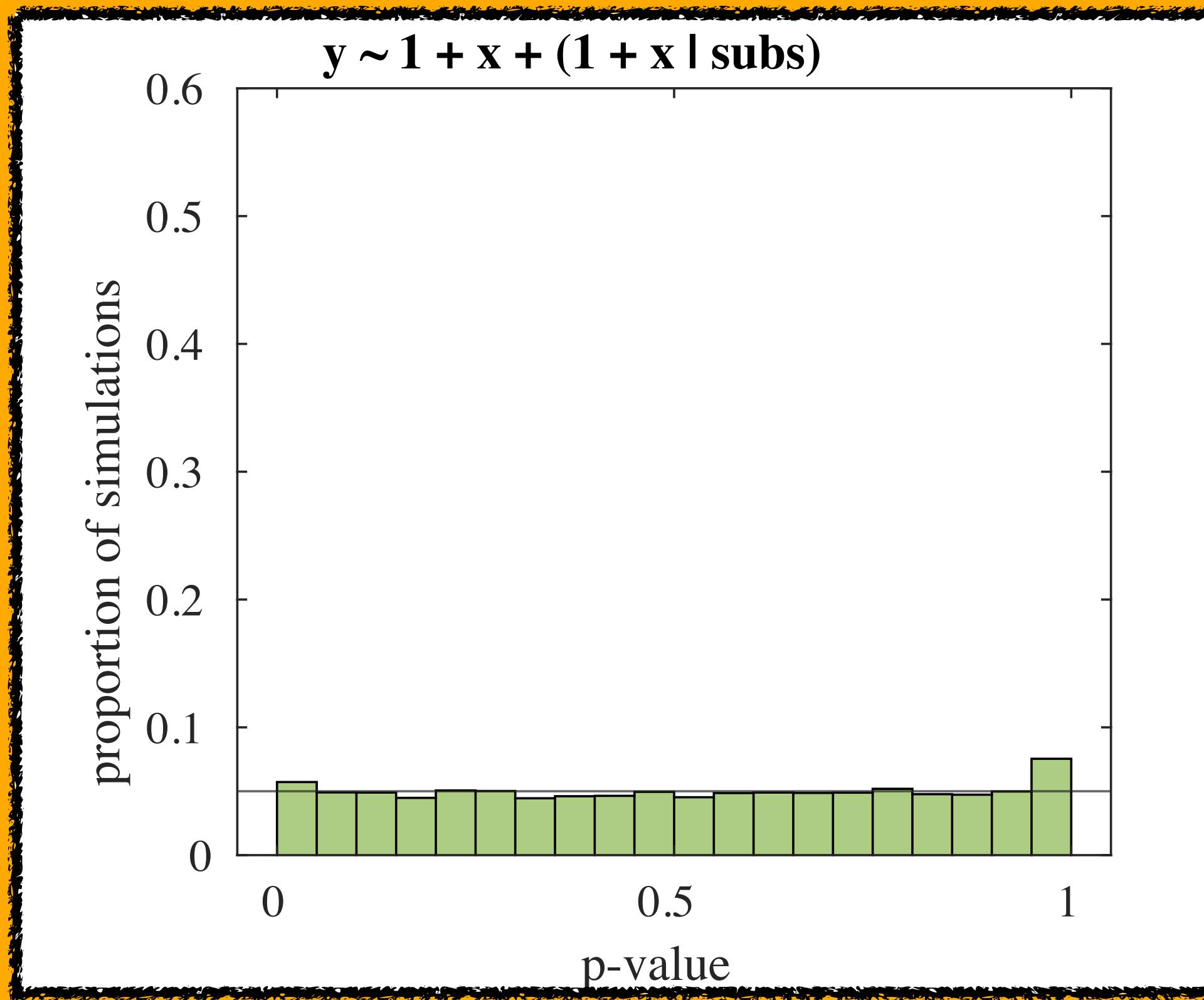
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Simulation shows the way



$$k_s \sim \mathcal{N}(k_0, \sigma_k^2)$$

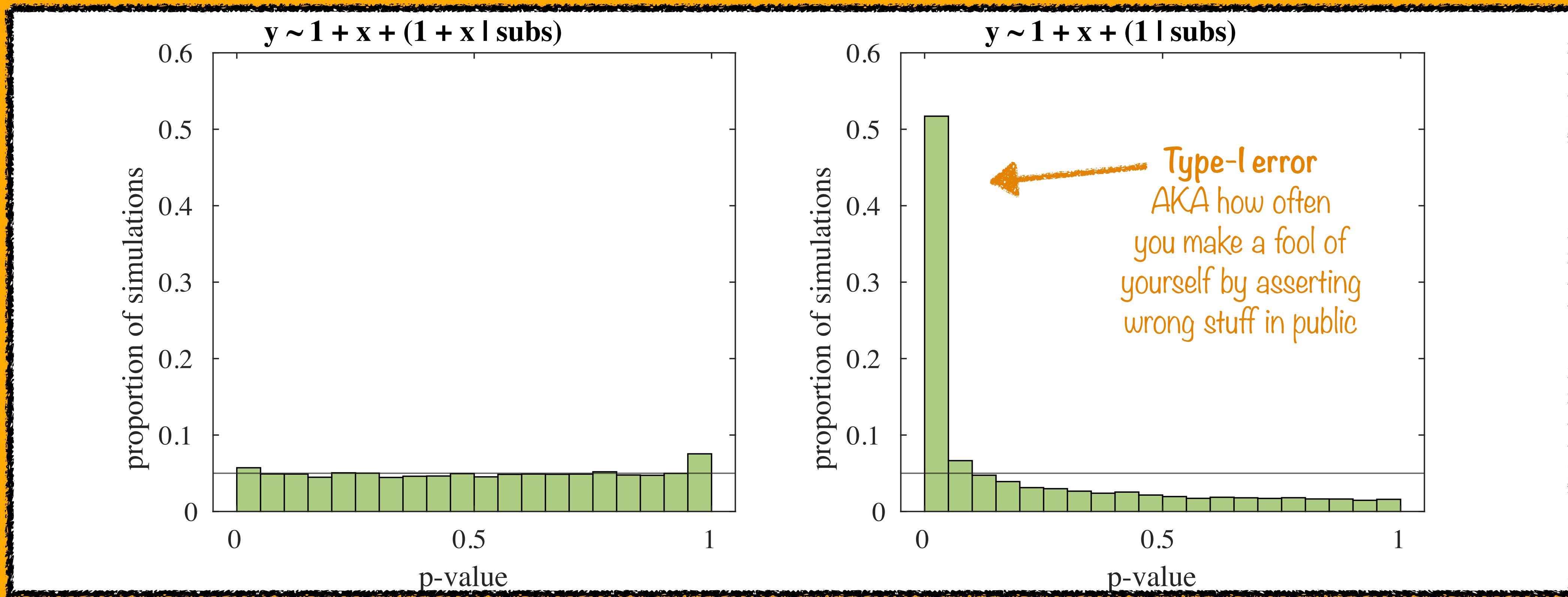
$$\beta_s \sim \mathcal{N}(\beta_0, \sigma_\beta^2)$$

$$\text{height}_s \sim \mathcal{N}(\beta_s \times \text{age} + k_s, \sigma_h^2)$$

Simulation with 50 subjects, standard deviation of beta 0.001

Simulation shows the way

Continuous case with 10 samples per subject: inflated type-I error rates



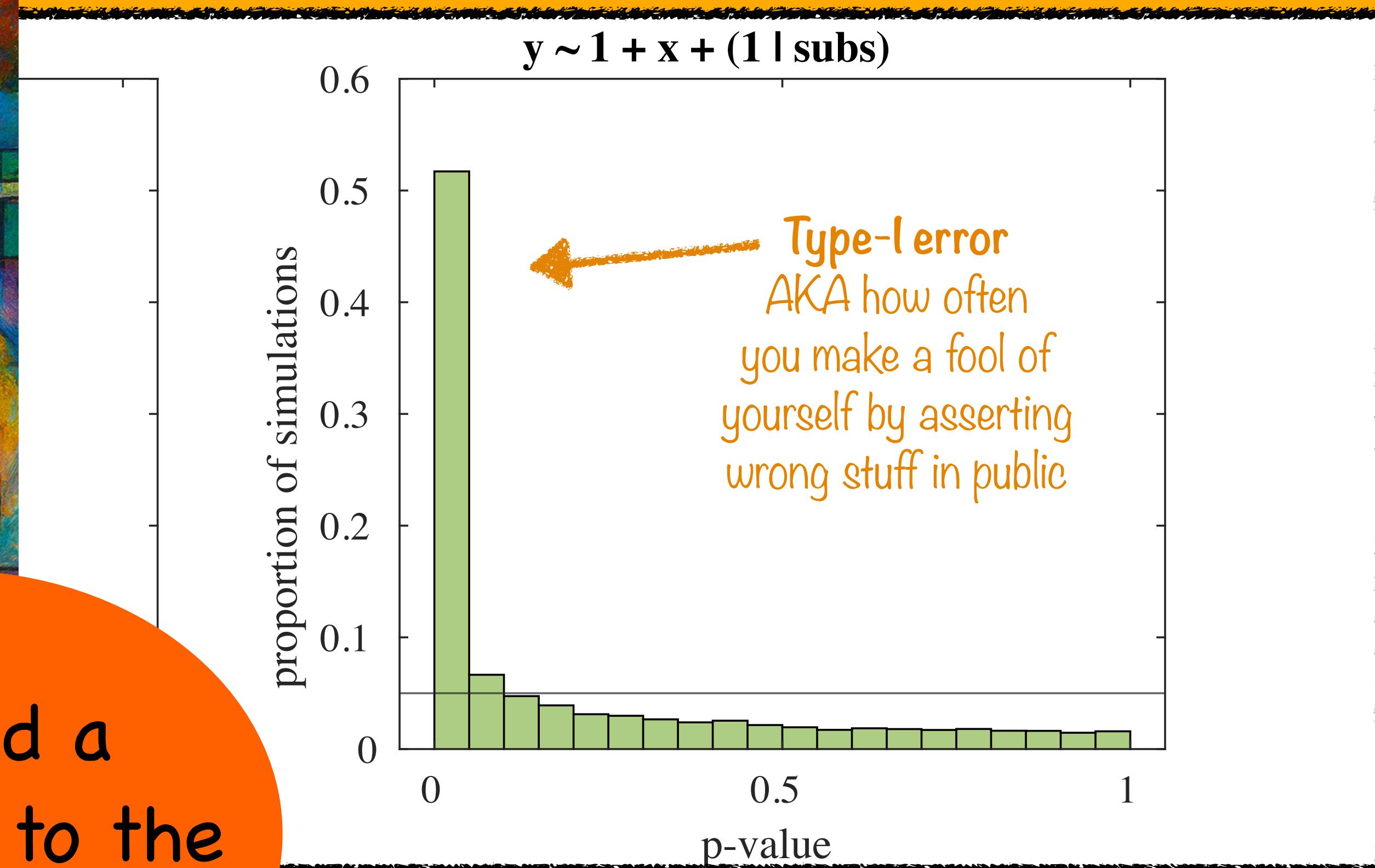
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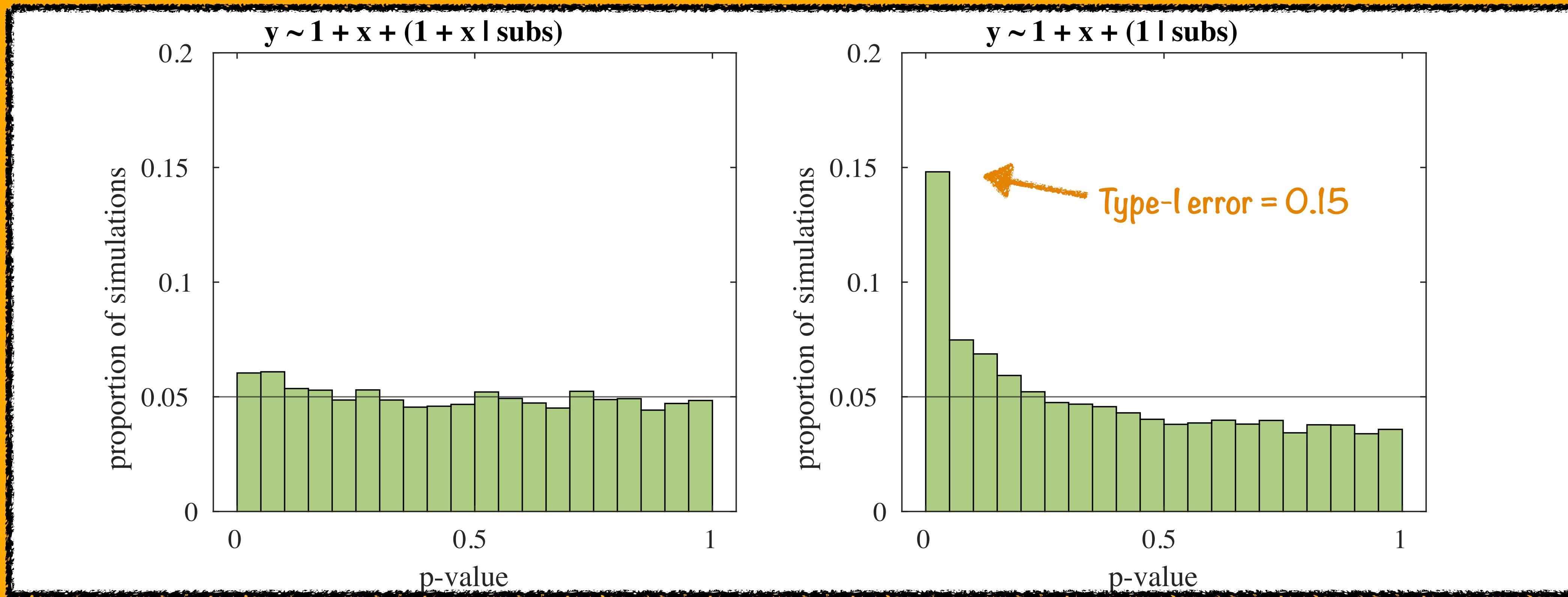


I found a
backdoor to the
backdoor!



But there are so many ways to do things!

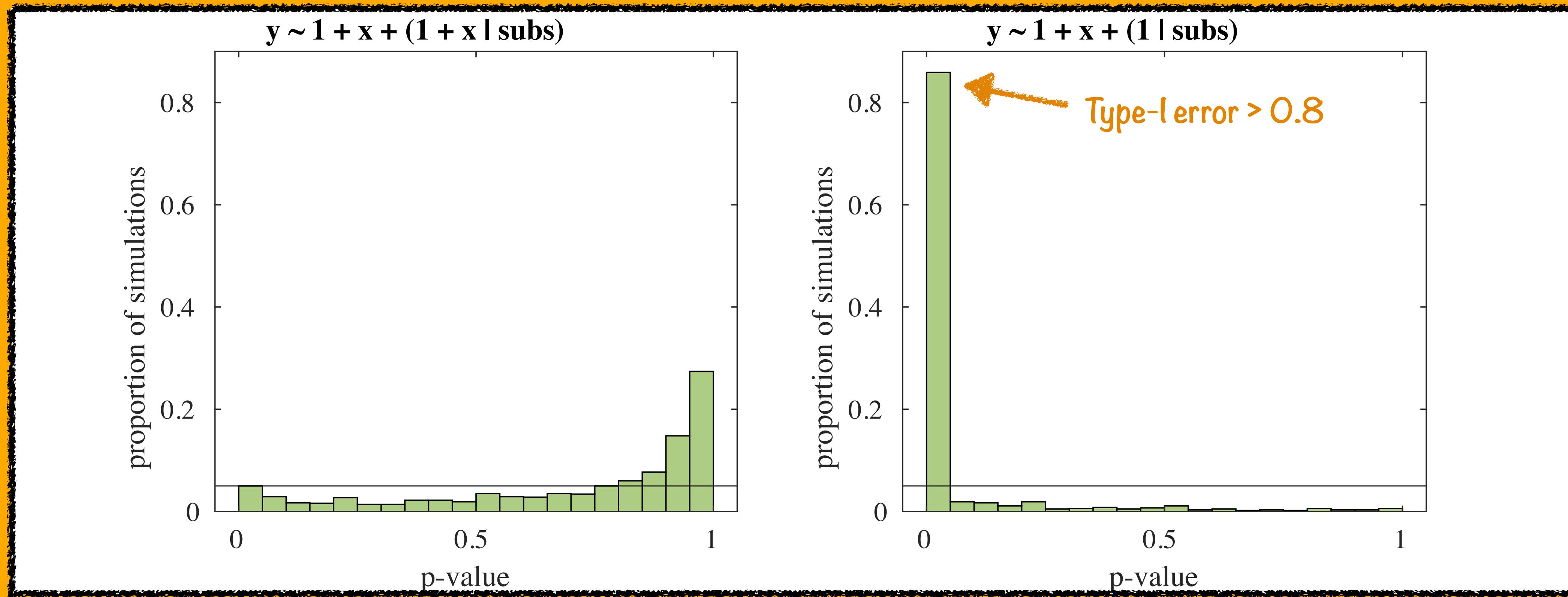
What if I only have one sample per participant?



Simulation with 50 subjects (2 with $d = 0.5$, 98 with $d = 0$), 1000 samples per subject

But there are so many ways to do things!

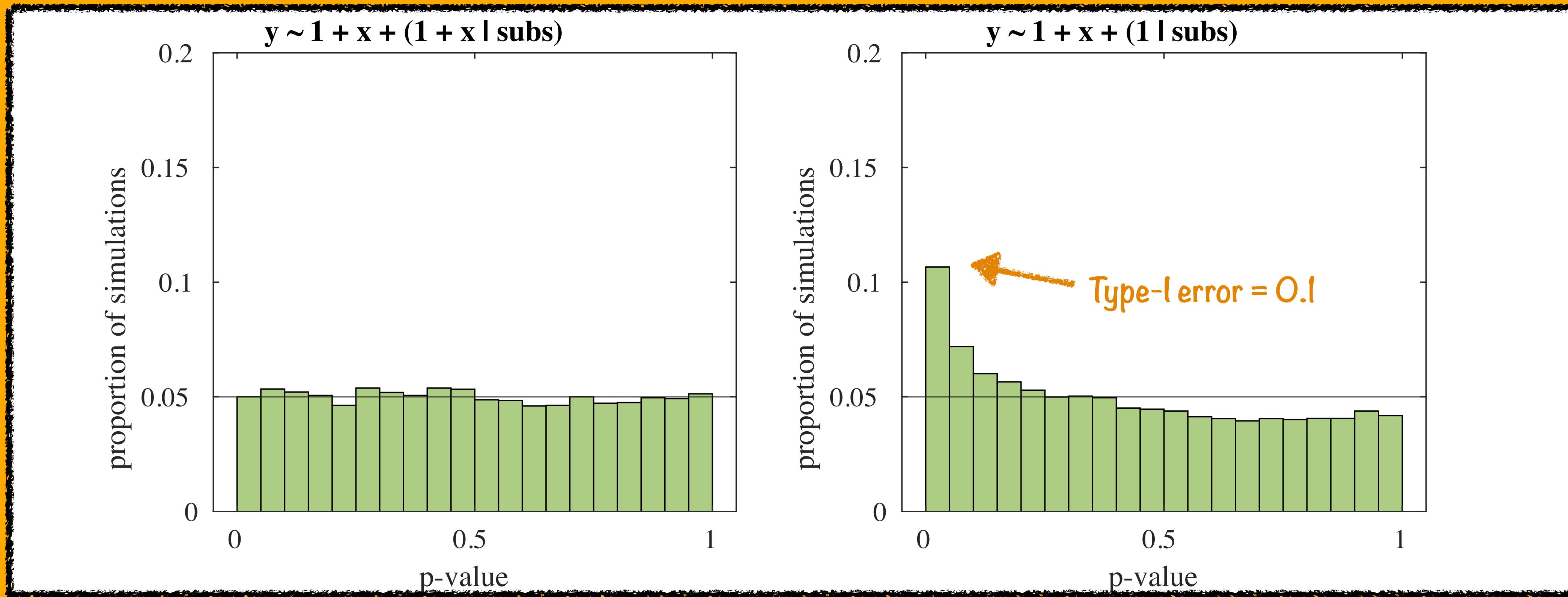
What if I have like a lot of subjects and a lot of samples?!



Simulation with 5000 subjects, 100 samples per subject

But there are so many ways to do things!

What if my data is discrete!?



Simulation with 100 subjects, 1000 samples per subject, 5 subjects present a positive effect



I can't pre-hack
every damn edge case!
My buffers aren't
infinite!

Well: lets embrace the diversity!

One paper = one pipeline

- We can use simulations to study how difficult results would have been to p hack

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Two shiny results:

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- A study of robustness of the most cited papers in the field
(because who needs friends anyway?)

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(extremely useful for both, the bad-faithed p hackers and the rest of us!)

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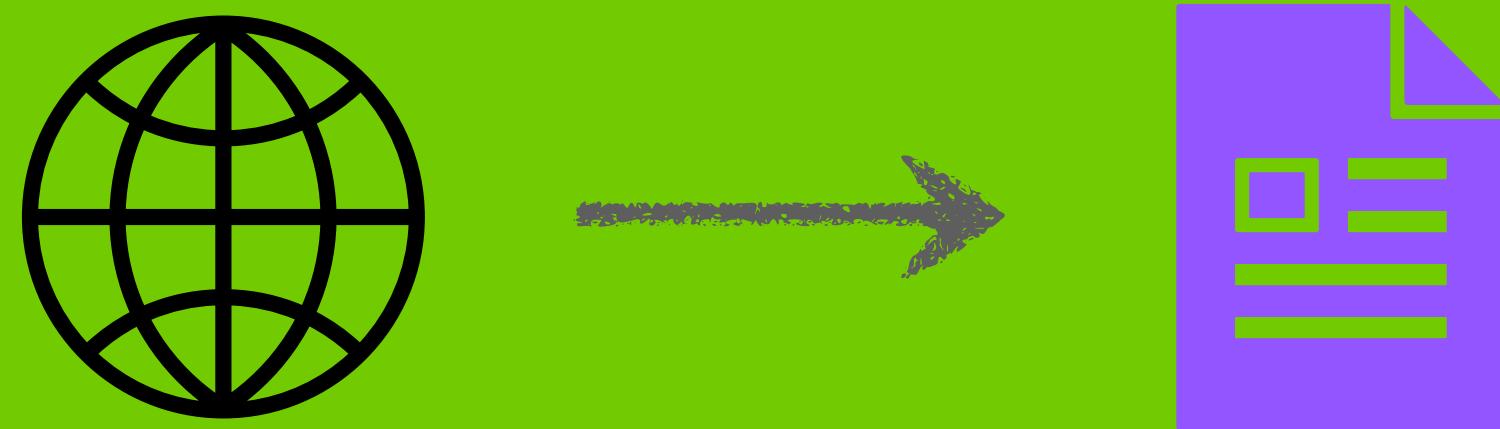
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- I say: linear mixed-effects models!
(gaining popularity, super-easy to p hack, lets stop this madness with a methods paper!)

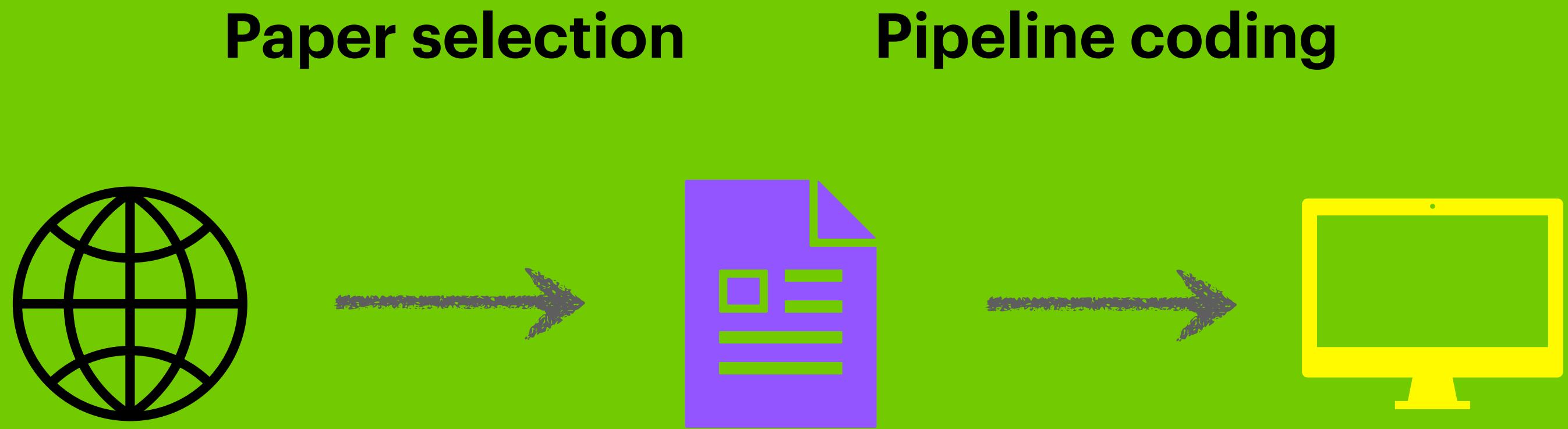
A work force of legendary heterogeneity

Paper selection



- Select papers
(we won't tell them it was you)
- Extract methods
- Streamline data

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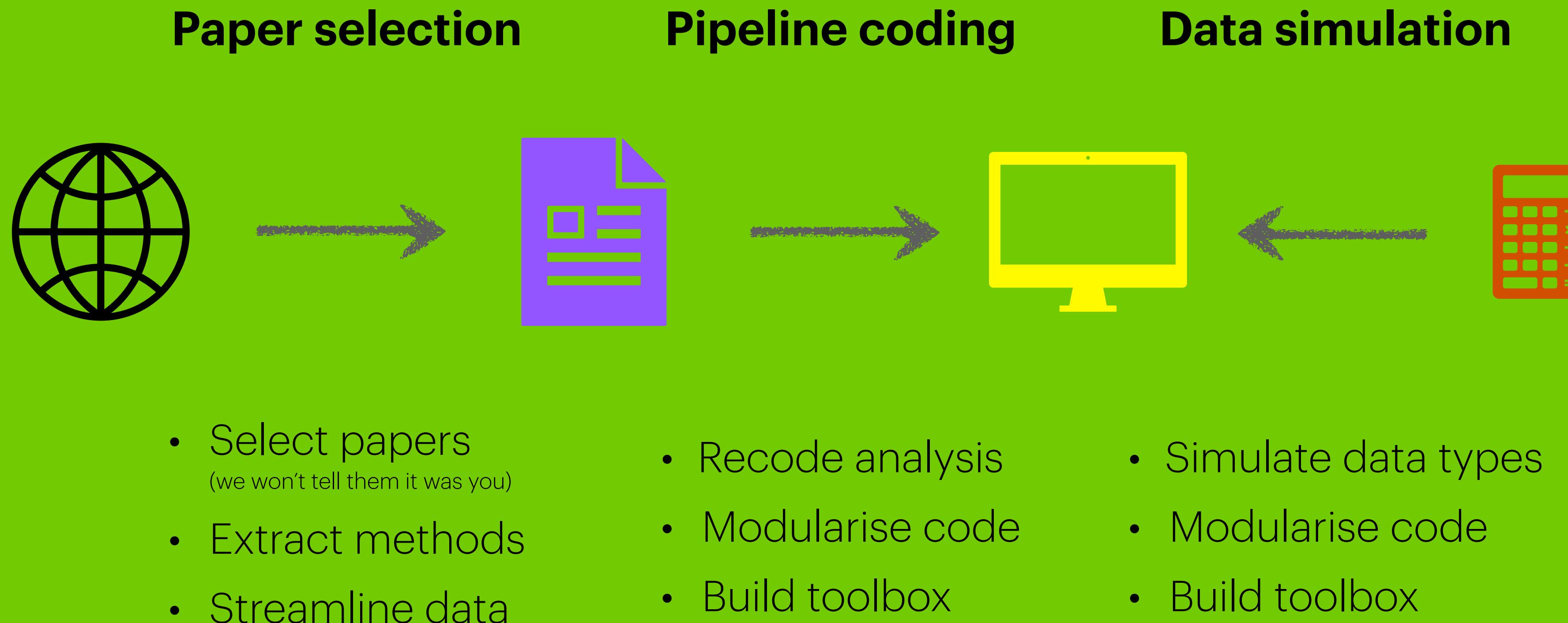


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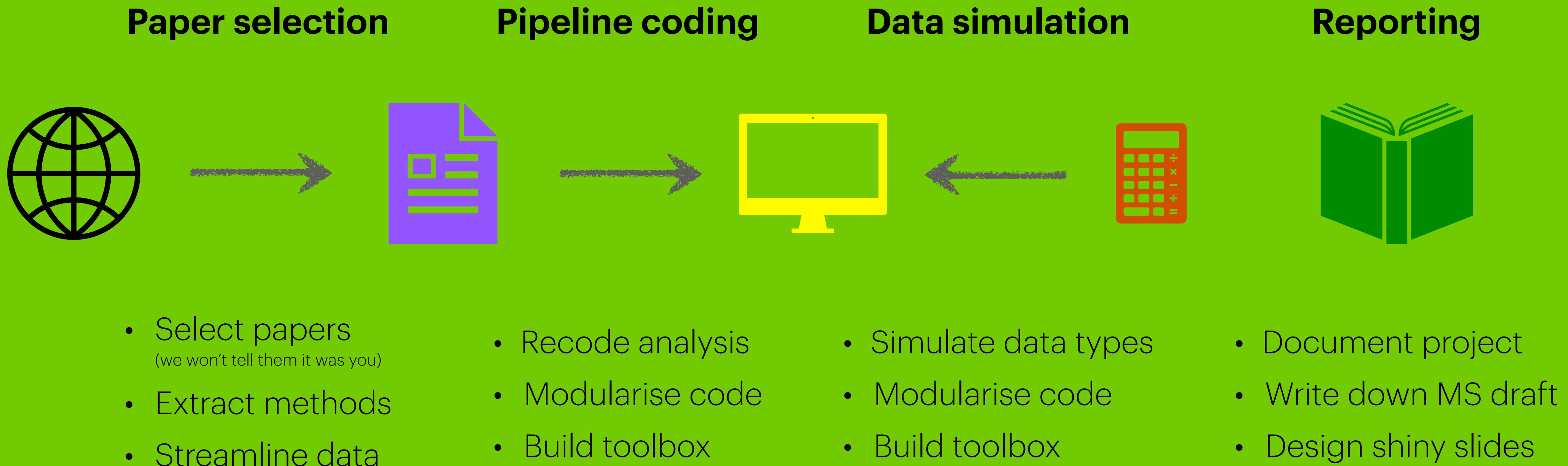
Pipeline coding

- Recode analysis
- Modularise code
- Build toolbox

A work force of legendary heterogeneity



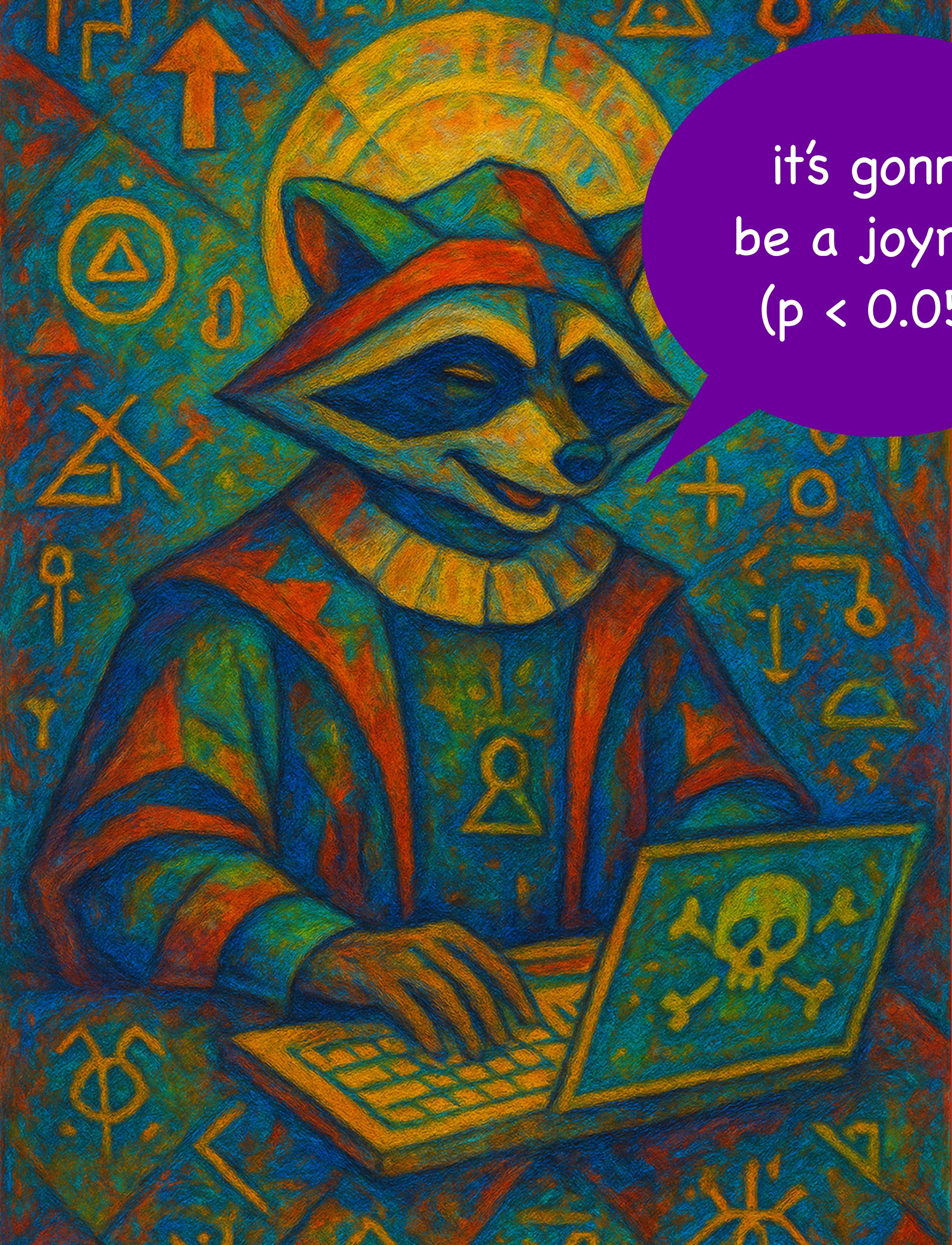
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In conclusion:

- Promoting good science at its best
- Learning to simulate null data
- Dwelling into (classical) stats theory
- Building a toolbox useful to others
- Non-coders welcome (needed!) <3
- Hacker jargon and racoons everywhere
- What other ops you got running?!

DETAILED INFO:
github.com/qtabs/abrainpackproject



Work teams, this time for real

The Intellectuals

- Handpick papers for testing
(we won't tell anyone it was you)
- Maintain paper repository
- Summarise data properties
- Summarise analysis pipeline
- Write down a draft for a MS
- Prepare the presentation slides

Skills: Basic CogNeuro

Learn: Analysis methods, LMEs,
scientific writing

The Simulators

- Develop null-hypotheses models of different data types
- Implement simulators
- Evaluate models
- Interface with phacking module
- Maintain codebase

Skills: basic stats, beginner python

Learn: statistical modelling,
codebase creation

The Phackers

- Code automatic analysis pipelines
- Refactor code into a toolbox
- Create a user interface
- Consider dreamy platforms
(web app anyone?)

Skills: intermediate python

Learn: Interfacing with MATLAB,
codebase creation

Overoptimistic (yet achievable) timeline

