



# Why we need protocols in science

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## About me

- MSc Psychology in Methods, Cognition & Perception at Unibe
- MSc in Statistics at ETHZ





## Current work

- At Roche working in a blended role as
  - Statistical programmer
  - Biostatistician
  - R package developer, e.g. {admiral}



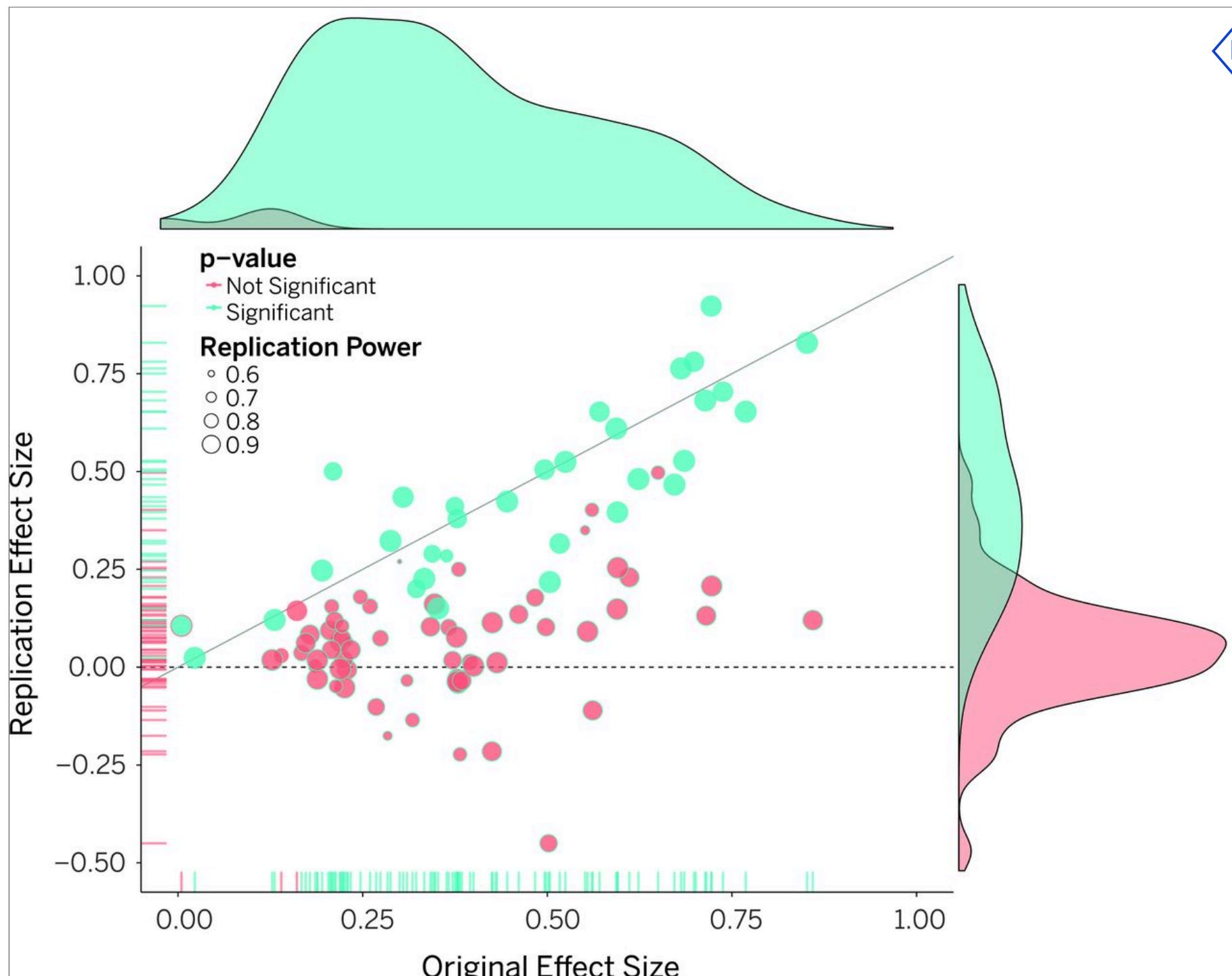


## Replication crisis in Psychology

- Researchers are unable to replicate many findings from psychological experiments.
  - Klein et al. (**2018**) managed to replicate only 15 / 28 studies
  - Open Science Collaboration (**2015**) replicated only 36 / 100 studies, with on average half of the original effect size
- Yarkoni (**2022**): How generalisable are findings from psychological experiments?



## Many labs result



## Results of Open Science Collaboration (2015)

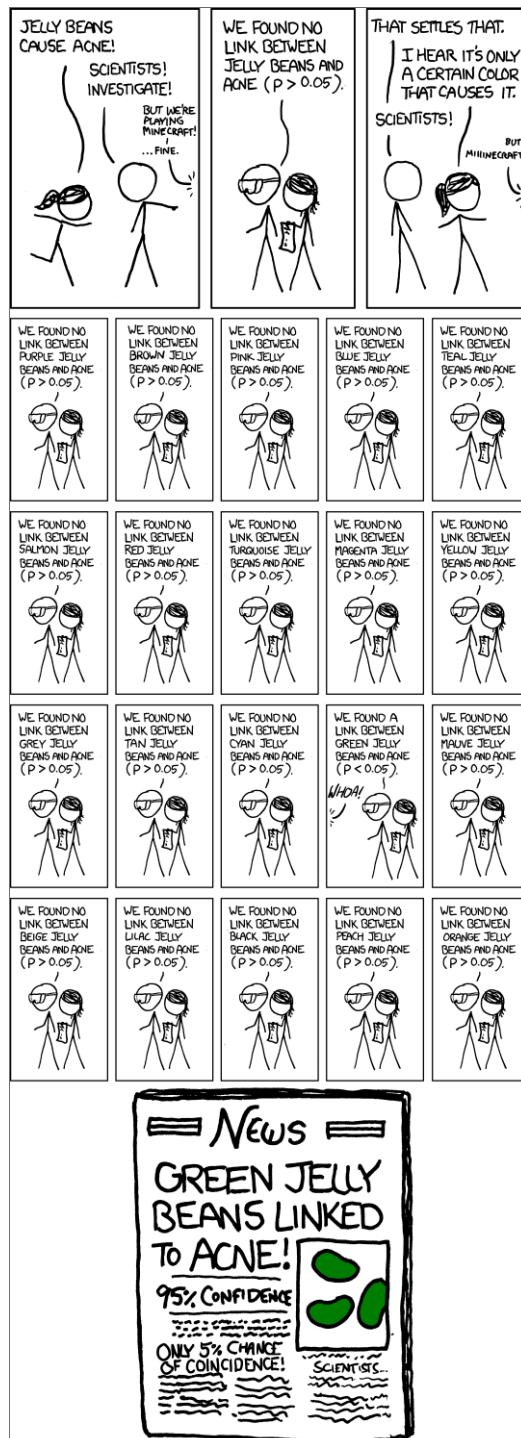




## Misaligned incentives for researchers

- Publication bias
  - Harder and less likely to publish null-results
  - More likely to continue looking for something
- Questionable research practices undermine trial integrity
  - Hypothesising After Results are Known (HARK-ing)
  - P-Hacking, e.g. adding covariates until p-value is significant
- Fraud, for an example see Data Colada posts by Simonsohn, Nelson, and Simmons ([2023](#))
  - Hard to spot, as open data was not very common
- Doing replications is not “novel research”, less prestigious



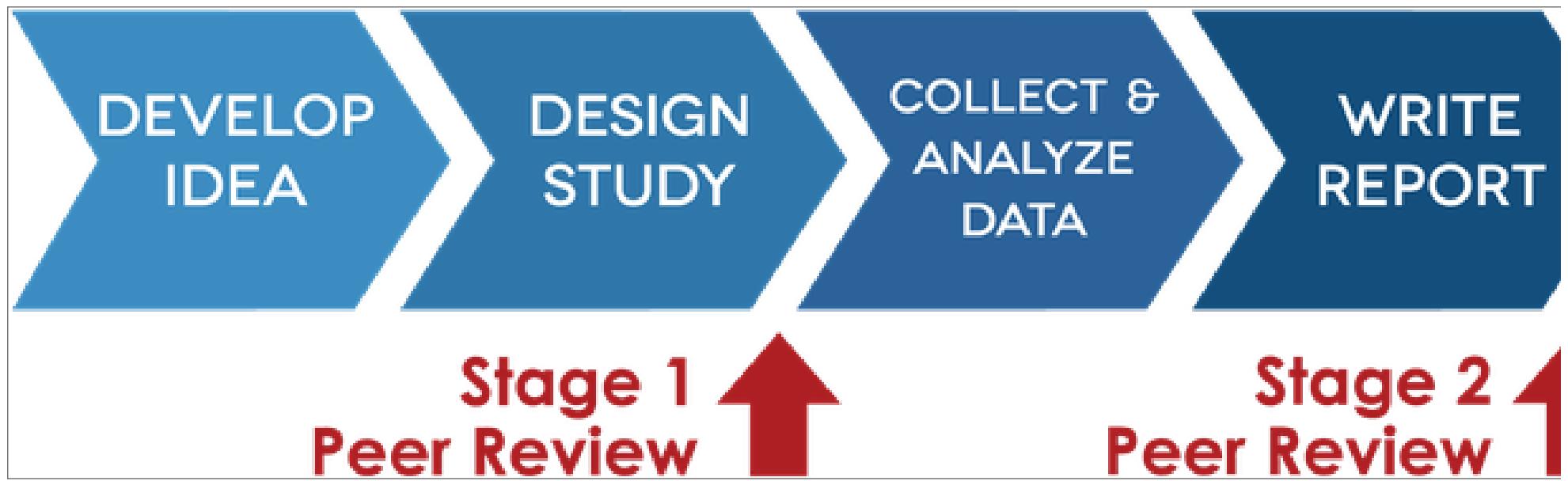




## Realign researcher incentives

Move away from rewarding the most attention-grabbing findings

- Preregistration, see [OSF](#)
  - Support trial integrity / validity
  - Registered reports almost guarantee publication before data collection Chambers ([2019](#))
  - Published based on the merits of the hypothesis and methods, independent of results



From Science ([n.d.](#))



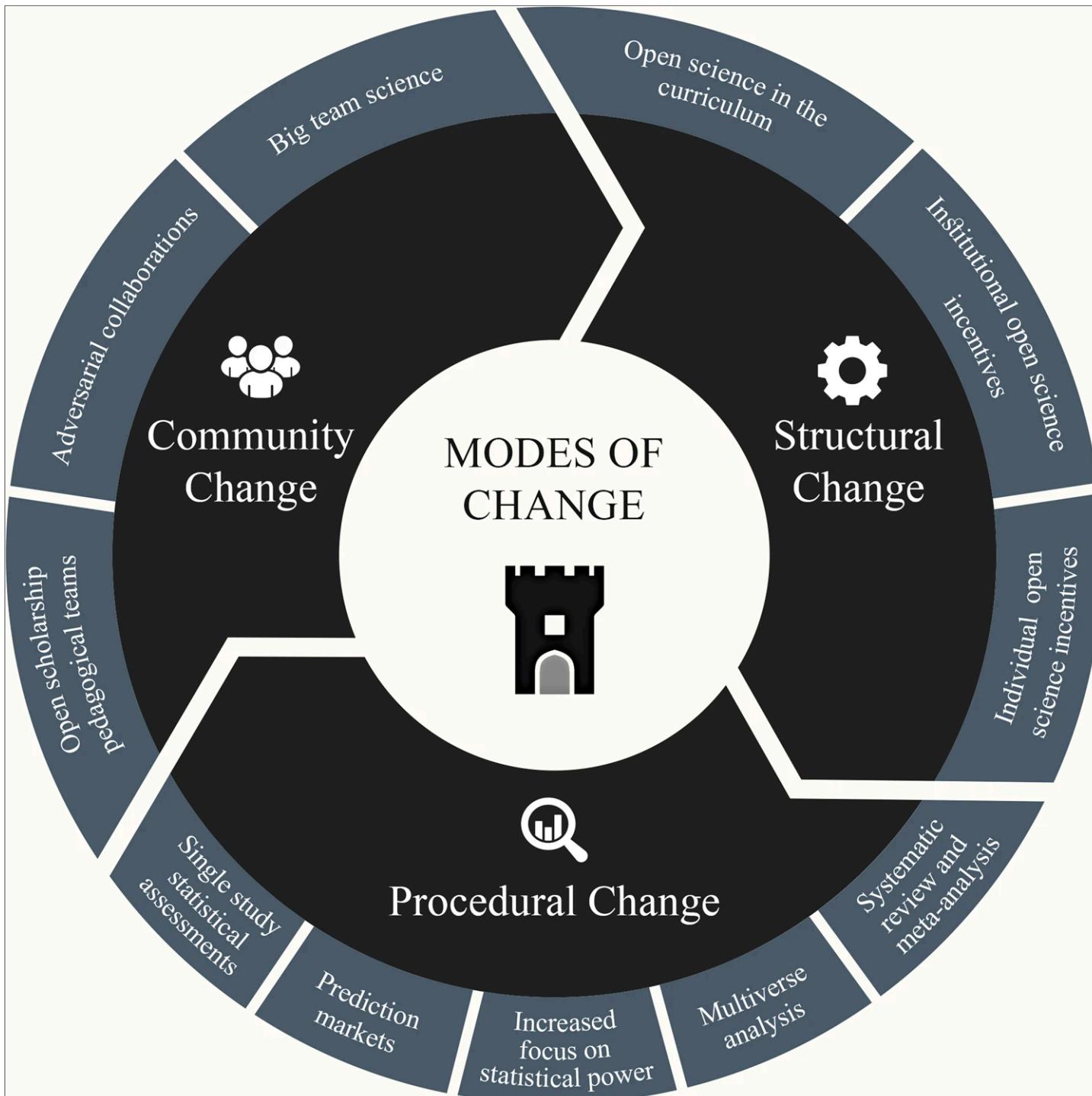
## Open research practices

- Openly available data and methods
- Encourage collaboration
- Reduce ease of fraud
- Openly available publications
- Data as publication rewards data collection
  - Increases data quality
  - Treated as legitimate research



## Things are changing

Structural changes are happening!



From Korbmacher et al. (2023)





## Protocol - Study blueprint

- Includes:
  - Motivation and objectives
  - Primary and key secondary endpoints, as estimands
  - Methodology
  - Organisation
  - Some statistical considerations, e.g. sample size & power, etc.
- Details should allow recreation of the study



## Estimands

An **estimand** (Pohl et al. (2021)) is a precise description of the treatment effect to be estimated in **a clinical trial**. - “What exactly do we want to learn from the trial?”

- **Key Attributes:**

- **Population:** The specific group of patients of interest.
- **Treatment:** The intervention or comparison of interest.
- **Outcome:** The specific outcome variable being measured.
- **Intercurrent Events:** Events that occur after treatment initiation that affect the interpretation of the outcome (e.g., use of rescue medication, treatment discontinuation).
- **Population-level Summary:** The summary measure that will be used to quantify the treatment effect (e.g., difference in means, hazard ratio).



## Statistical analysis plan

- Describes the precise statistical analysis for each estimand.
- Written before looking at the data
- Confirmatory analysis with less researchers degree of freedom
- Exploratory analysis still encouraged, but must be declared as such



## Regulation

- Encourages good scientific practice
- Ensures transparency and reproducibility
- Encourages good scientific practice
- Sets standards in data quality and documentation
- Hurdle that every project needs to pass



## Summary

- Protocols or Preregistrations ensure study integrity
  - Your shield!
- Estimands define the question to be answered
  - Take a closer look at Estimands for your own project
- Statistical Analysis Plans ensure validity of confirmatory results
- Regulators ensure good scientific practice
  - Same objective - to ensure the safety and efficacy of the drug



## Resources

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