

How computational modeling can force theory building in psychological science

[10.31234/osf.io/rybh9](https://doi.org/10.31234/osf.io/rybh9)

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Overview

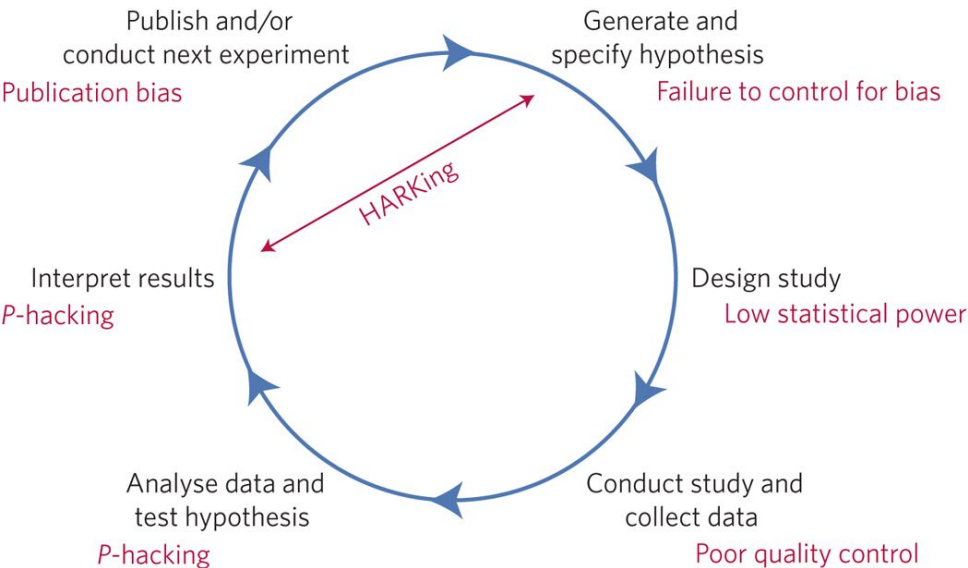
Why

Pizza problems

Path model of science

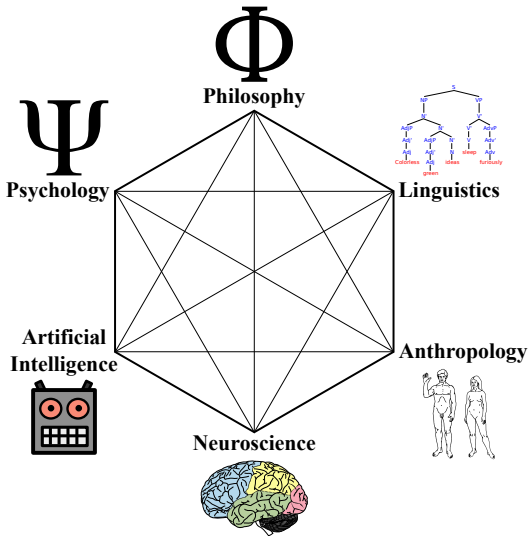
Future

Why?



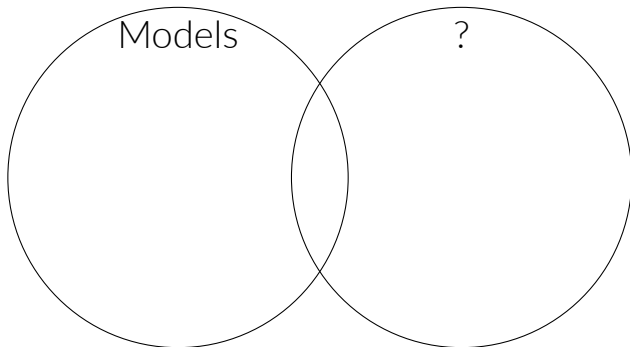
Munafò, M. R. et al. (2017). A manifesto for reproducible science. *Nature human behaviour*.

Cognitive Science



https://commons.wikimedia.org/wiki/File:Cognitive_Science_Hexagon.svg

Non-overlapping magisteria?



Olivia Guest is on the job market! | Ολίβια Γκεστ
@o_guest



Why we need computational modelling: even if everybody agrees what the area of a circle is defined as there are apparently people unwilling to execute the formal model itself and not only that but the results are counterintuitive. 😂



$$\text{Area} = \pi(18/2)^2 = 254 \text{ in}^2$$



$$\text{Area} = 2\pi(12/2)^2 = 226 \text{ in}^2$$

An 18-inch pizza has more pizza than two 12-inch pizzas, and people are losi...

Math is important, people!

mashable.com

7:47 AM · Oct 21, 2019 · [Twitter Web App](#)

Specification

a

Two 12" pizzas



$$\text{Area} = 2 \times \pi 6^2 = 226 \text{ in}^2$$

b

One 18" pizza



$$\text{Area} = \pi 9^2 = 254 \text{ in}^2$$

Implementation

```
import numpy as np
import math

def food(ds):
    return (math.pi * (ds/2)**2).sum()

two_pizzas = np.array([12, 12])

one_pizza = np.array([18])

print(food(two_pizzas) > food(one_pizza))
```

Specification

$$\phi_i = \sum_{j=1}^N \pi R_j^2 \quad (1)$$

Specification

$$\phi_i = \sum_{j=1}^N \pi R_j^2 \quad (1)$$

$$\omega(\phi_i, \phi_j) = \begin{cases} i, & \text{if } \phi_i > \phi_j \\ j, & \text{otherwise} \end{cases} \quad (2)$$

data



data



hypothesis



data



hypothesis



implementation



data



hypothesis

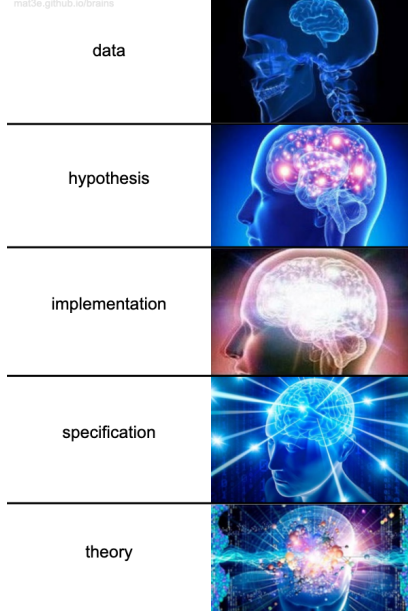


implementation



specification





data



hypothesis



implementation



specification



theory



framework



framework



framework



theory



framework



theory



specification



framework



theory



specification



implementation



framework



theory



specification



implementation



hypothesis



specification



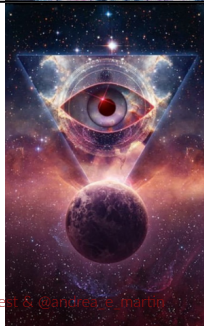
implementation

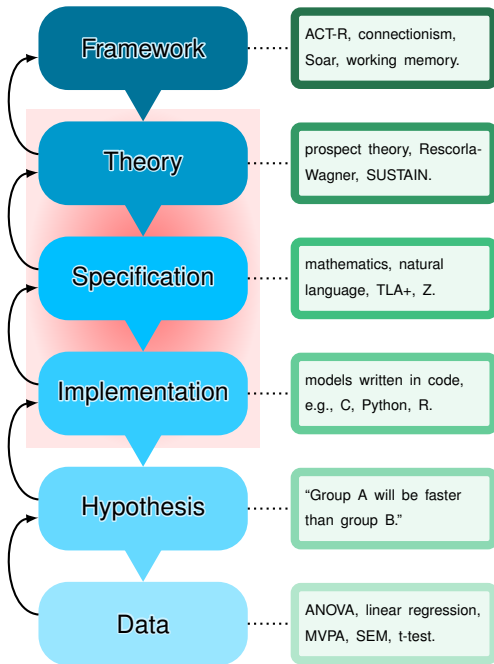


hypothesis



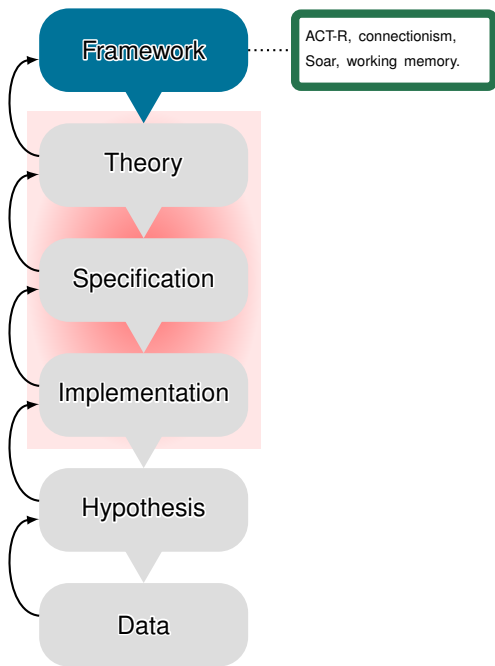
data

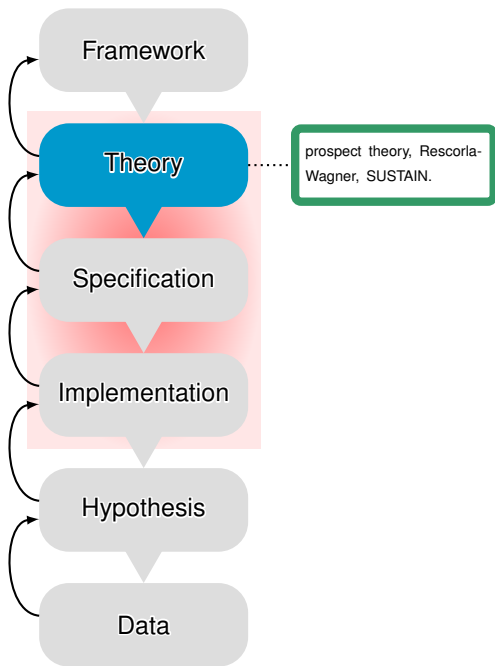


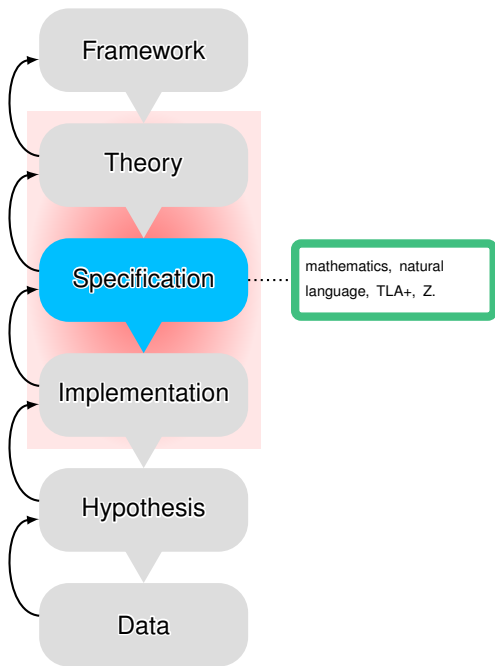


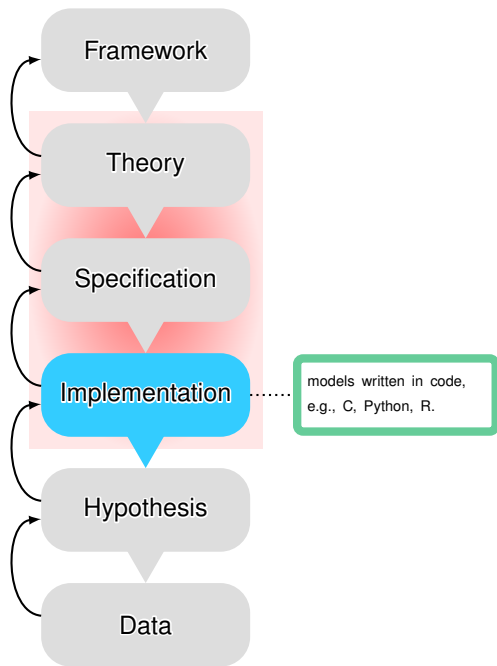
a) any point,
move up

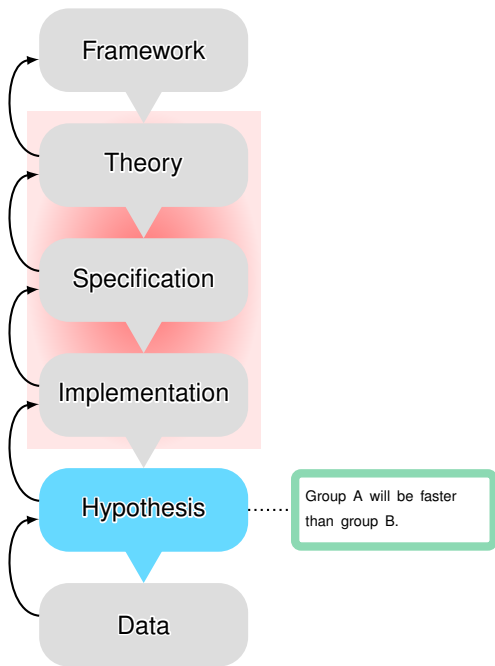
b) resolve
violation,
move down

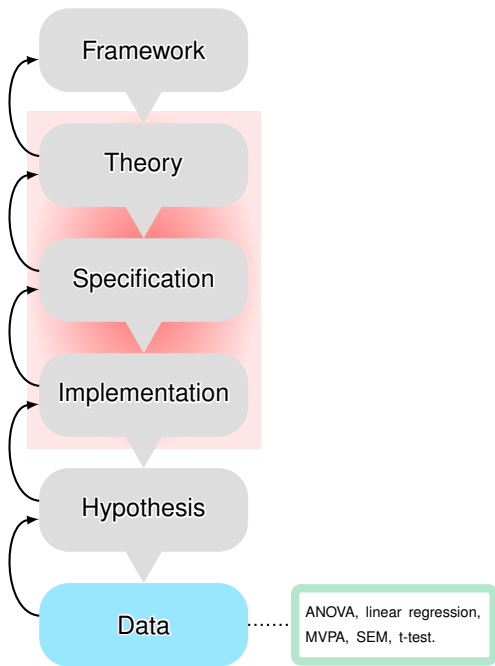




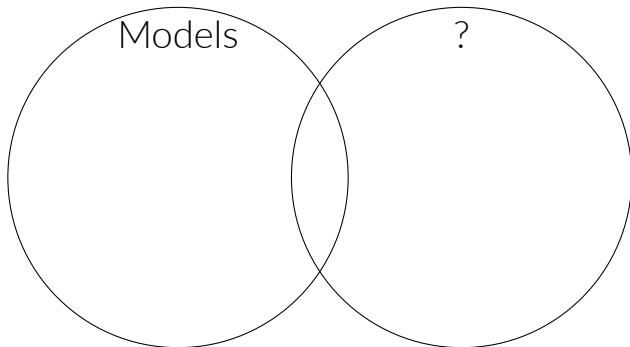


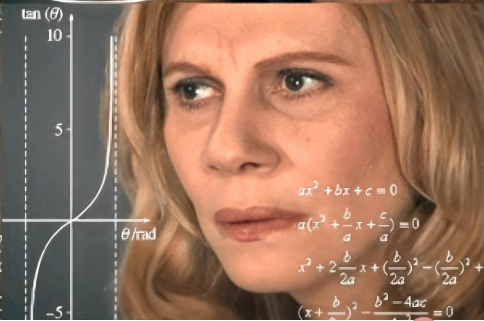
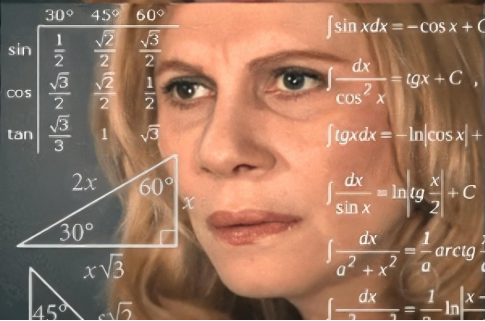
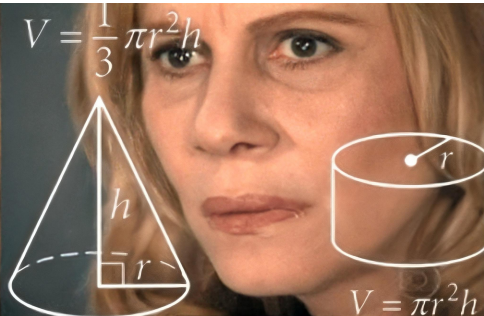






Non-overlapping magisteria?





Radically recentre modelling



Radically recentre modelling



Radically recentre modelling

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Thank you!

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