II Workshop on computational modelling of behavioral data

June 9-10, 2025

CIMCYC
University of Granada

Schedule and people

Monday morning

Drift Diffusion model

----- Lunch ------

Monday afternoon

Reinforcement Learning

----- Free time ------

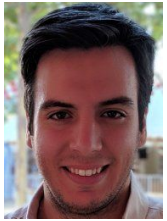
Tuesday morning

Deep neural networks

All slides and materials in our website:
https://wobc.github.io/cmb_website/

Mehdi

Francesco



Juan Eloy

Javier

Carlos

Fran

What is modelling and why do we care?

Making a formal, **mathematical** representation of a theory
(here, about cognitive processes)

(...) modelling is a tool to help construct ***better*** theories of cognition and behavior (...)

(...) it provides a formal language that helps build ***more precise*** theories.

Verguts, T. (2022). *Introduction to modeling cognitive processes*. MIT Press.

Three key reasons:
-They require *explicit* and *precise* definitions.
-They require us to think (speak) in computational terms.
-They enable formal comparison of different models.

} Critical for (good) theory building

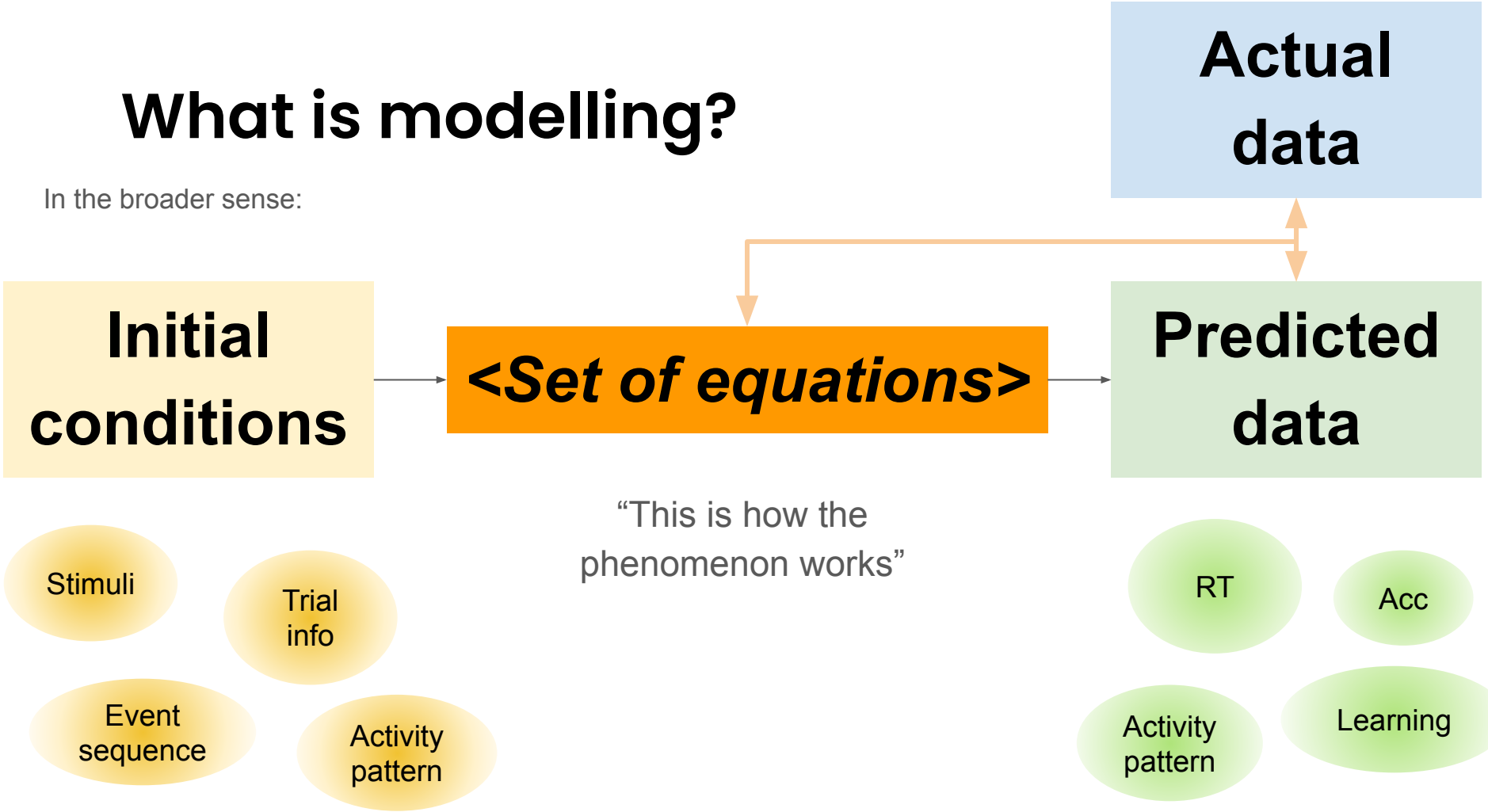
Ortiz-Tudela, J. (a few weeks ago). *Preparing Slides for the CMB workshop*.

“What I cannot create, I do not understand”

– Richard Feynman

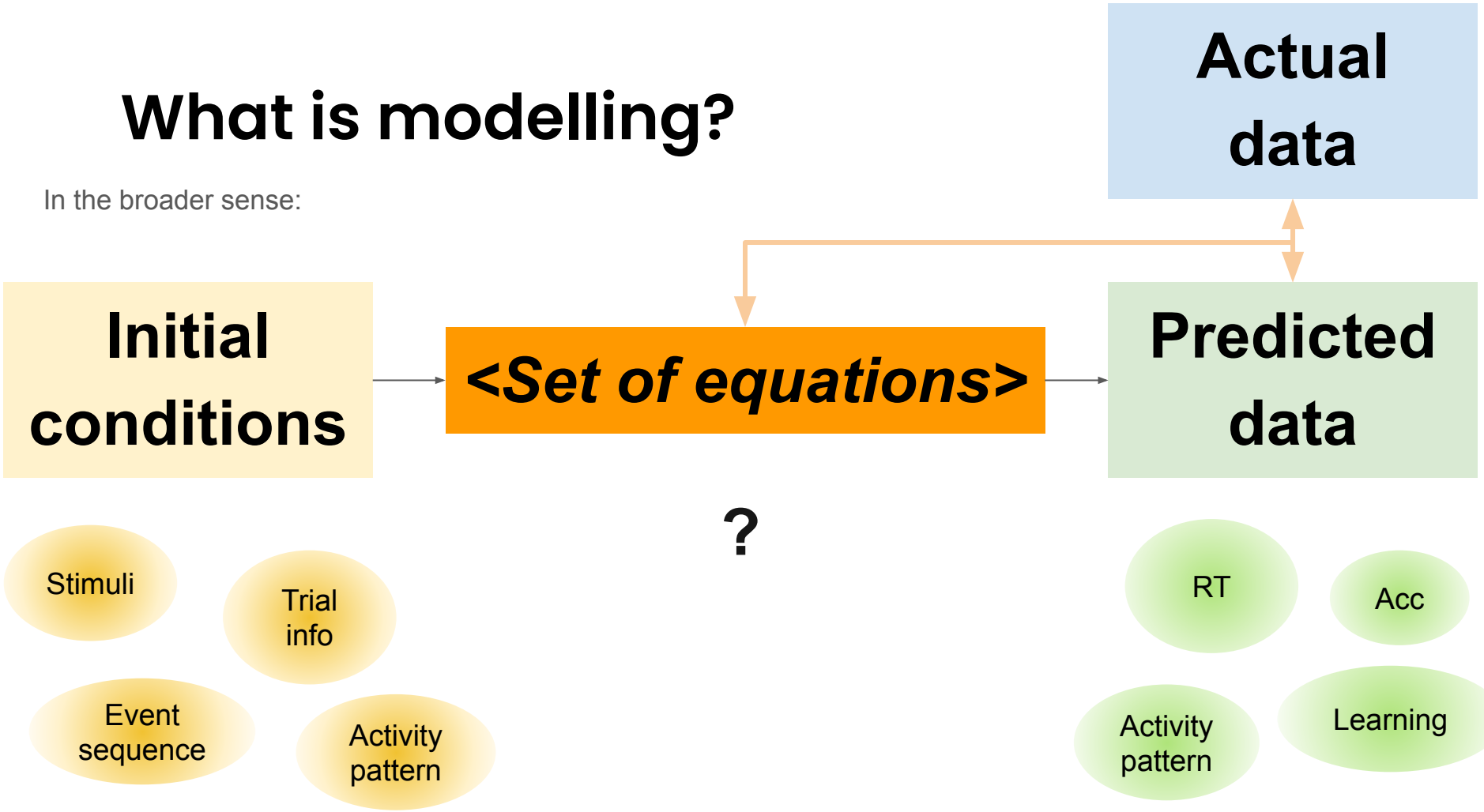
What is modelling?

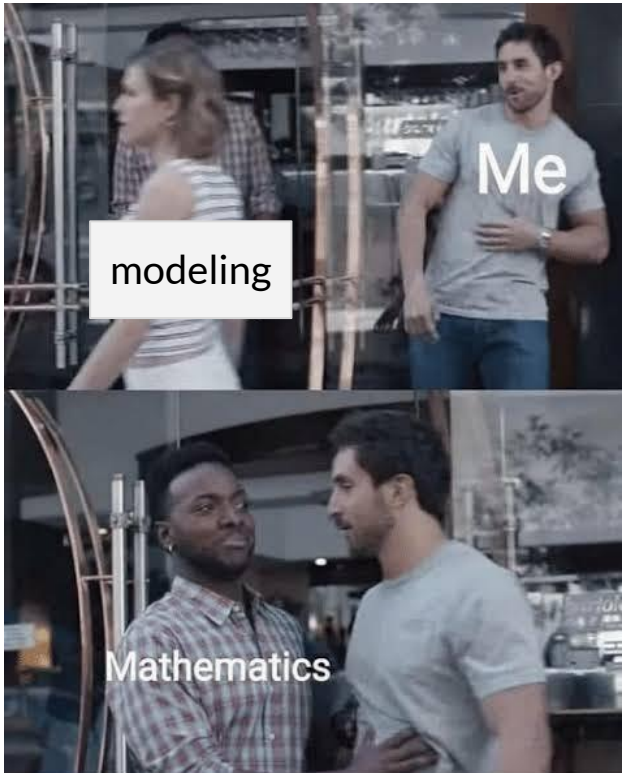
In the broader sense:



What is modelling?

In the broader sense:





Enter:

Mehdi

Francesco

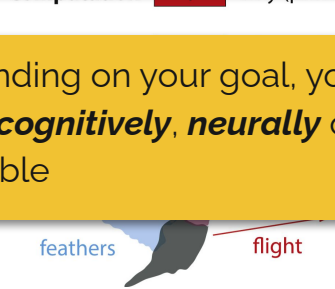
Juan Eloy

...and hopefully all of you after this workshop!

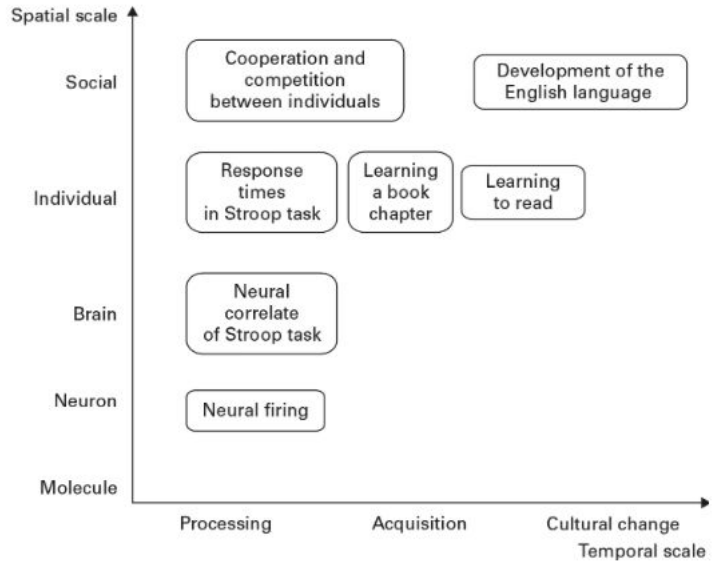
Which models should I use?

Modeling of different natural phenomena takes very different forms

Depending on your goal, your model can aim to be ***cognitively***, ***neurally*** or ***biologically*** plausible



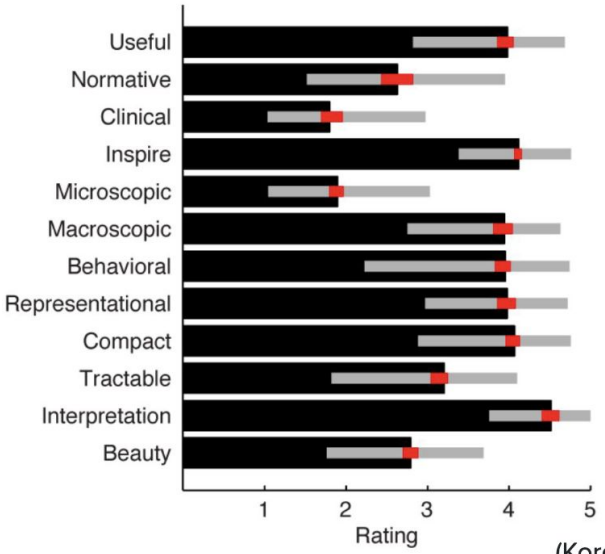
Enter **levels of modelling**



Model diversity

- Different models allow answering different questions
- Everyone has a different idea of what's a "good model"

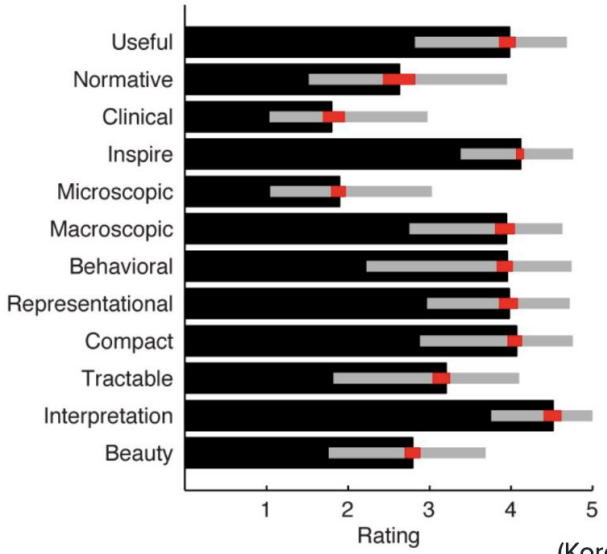
- A "good model" is what best answers the question with minimal assumptions
- Thus **model diversity** is good!



(Kording, Blohm, Shrater, & Kay https://osf.io/3vy69/)

Model diversity

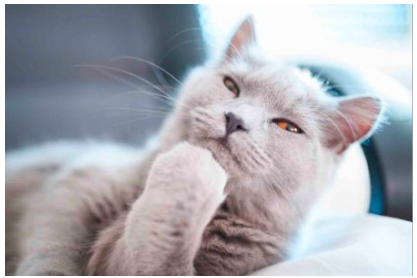
but how do we choose?



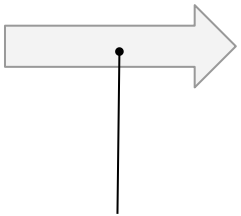
(Kording, Blohm, Shrater, & Kay https://osf.io/3vy69/)

What nobody teaches you

You can read thousands of papers about cool modeling results



vague thoughts about cognition/computation

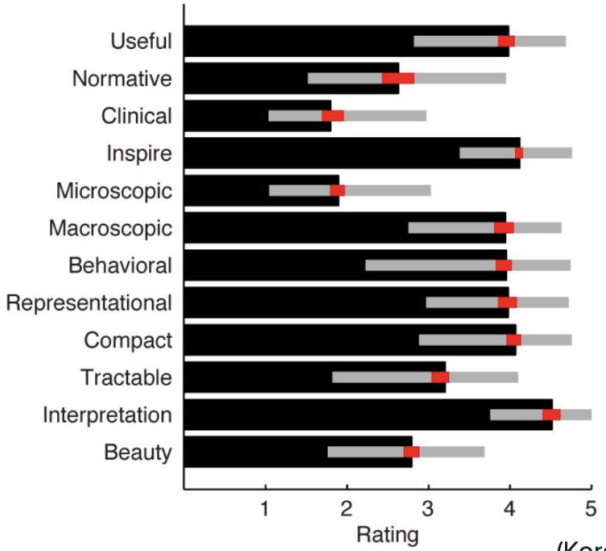


What actually happens here?

sit down to write a model

But nobody ever tells you how to identify the space of models that you should consider in the first place.

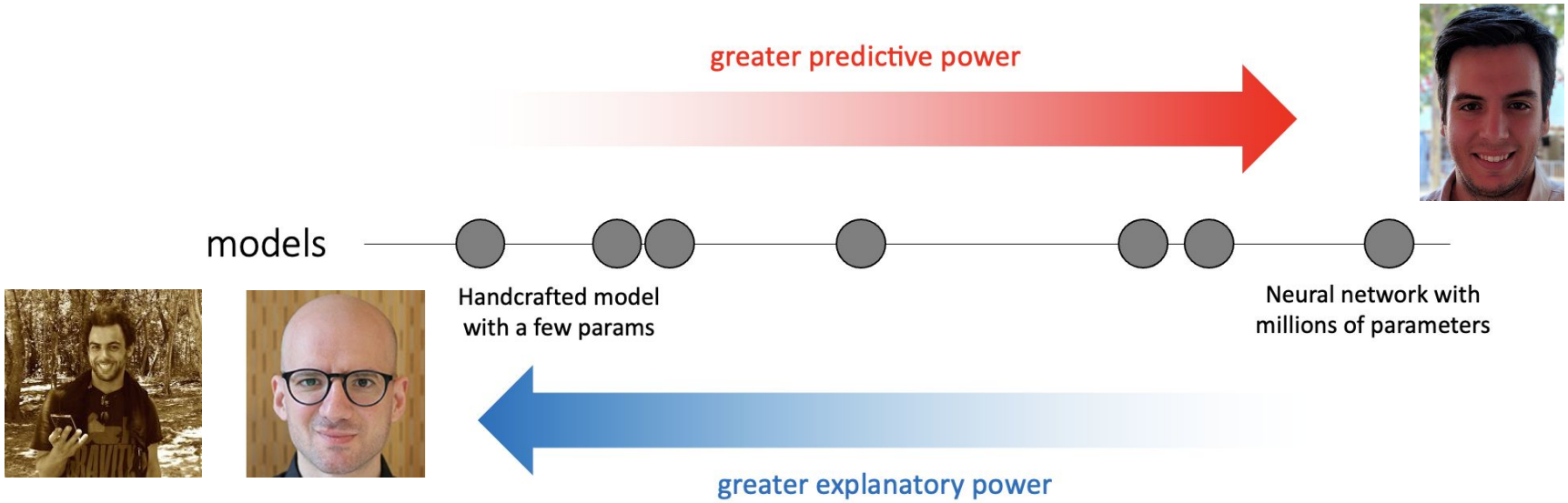
Does X model make sense for my research?



(Kording, Blohm, Shrater, & Kay https://osf.io/3vy69/)

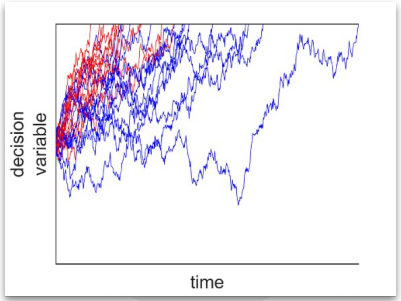
- Reflect on **goal** of the model (what? why? how?)
- Select output variable(s) (think about level of abstraction, detail, etc.)

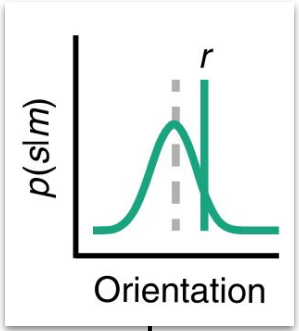
Goal: Explaining vs predicting

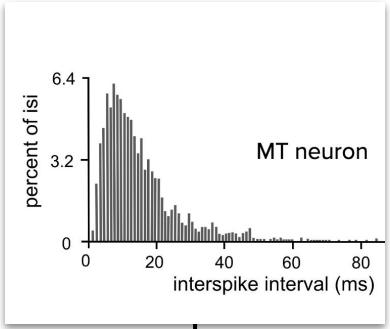


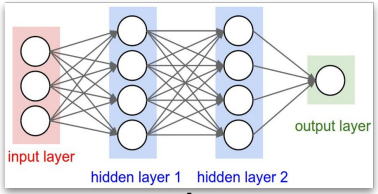
Models are useful for predicting and explaining, and these two virtues typically trade off with complexity

So, how do I know where to start?









1

Use past models as theories

(have you thought about why, though?)

2

Take a normative stance

People must be Bayesian in my task!

3

Get inspired by neurobiology

Biologically plausible but too complex?

4

Rely on the **cost** function

*Forget about hand-designing and focus on ✨**optimisation**✨. But… interpretability!*