



Observations, simulations and models: different ways to study Nature

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Motivations:

-  Is “micro-simulation” a good definition? (I will show is a much better one)
-  Are models and simulations access similar?

📌 Definitions I heard:

📌 Model = formulae

📌 Simulation = solution the formulae using a computer (i.e. any non-analytical result, or any computer-made table of an analytical result)... but then no sense the distinction simulation and microsimulation!



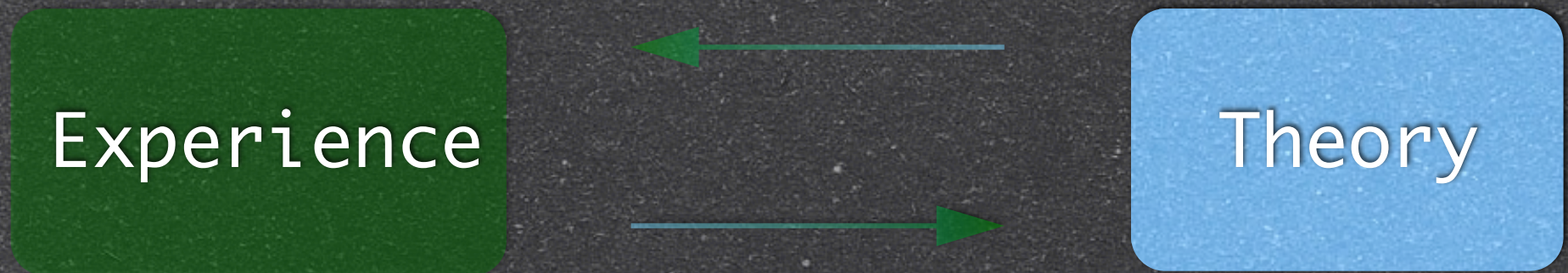
• Definitions (Dictionary):

• Model = a simplified description, especially a mathematical one, of a system or process, to assist calculations and predictions;
prototype/archetype

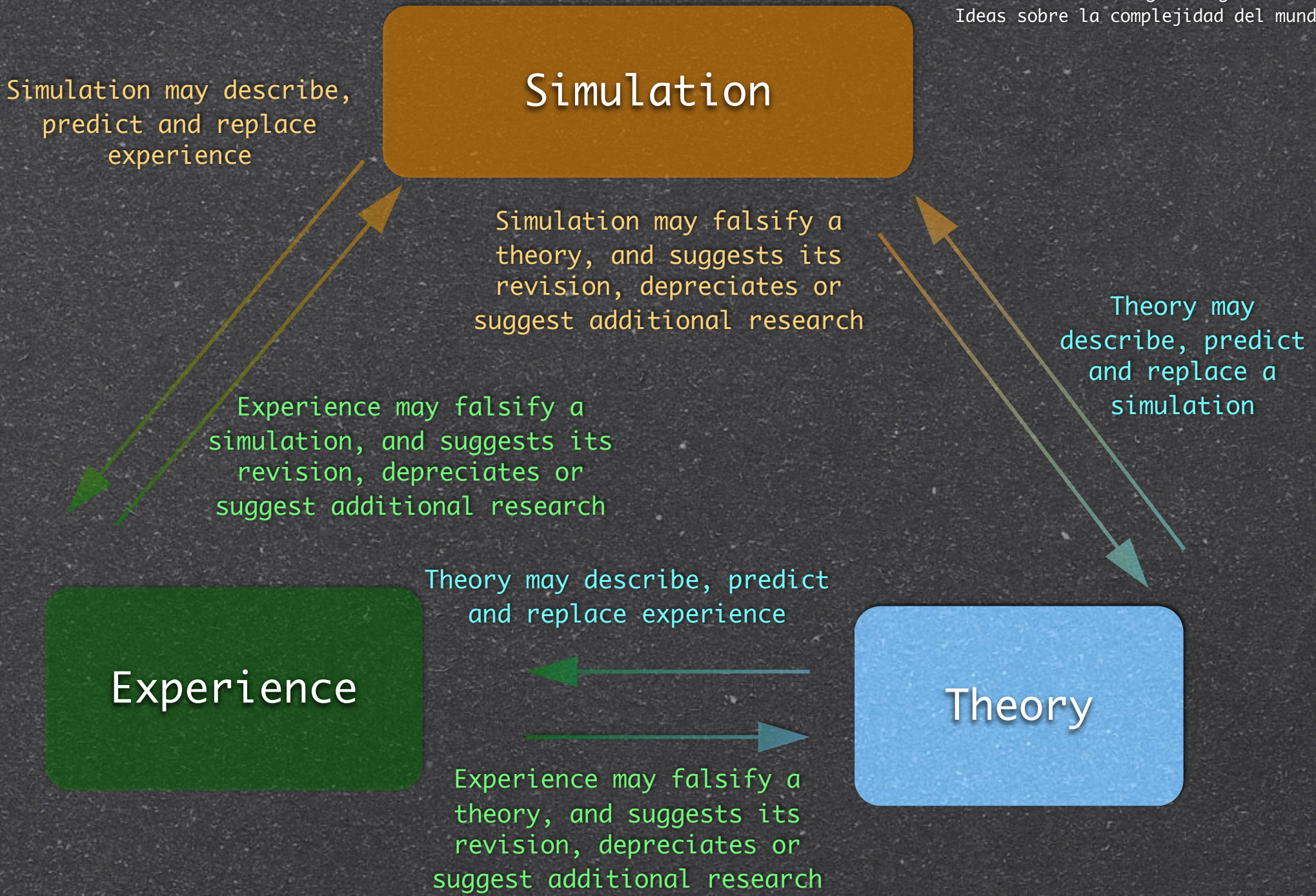
• Simulation

- 1. imitate the appearance or character of something
- 2. produce a computer model of

Theory may describe, predict and replace
experience



Experience may falsify a theory, and suggests its
revision, depreciates or suggest additional
research



- Theory: Allows to classify experience in terms of few (physical) parameters -> produce models
- Simulation: Allows to combine models including inter-relations and explore looking for hidden correlations/laws (and if a correlation of a law is found it is included in a models, it is not needed to be “simulated” again)
- Both can be compared with experience.



Conclusions; theory includes:

Models:

1. describe experience according a parameter space (so, main search is just in the **parameter space**) -> **success of TSAP and S3 protocol**
2. Can be compared with observation for data analysis (so, a search in results is also needed in a model grid, but not always!)

Simulations

1. Look for hidden correlations not previously known, or emergent properties (from de combination of models). So main searches are in both **parameter and results space**-> **SIM* approaches**
2. Can be compared with observations (but not necessarily for data analysis)



Final Conclusion

- Model is a better definition for most of microsimulations
 - Simulation is an misunderstanding work if just refer to “the use of a computer”, (everything is a simulation, so why a distinction of simulation - microsim.?),
 - “Micro” as a physical description process is misleading (a galaxy result from stellar population is a “microsimulation” and galaxy result from a cosmological sim. is “simulation”!)
 - Models and simulations have not exactly the same access requirements (although both can be described in the same DM) neither they cover the same use cases.
 - Not all micro-physics produce a model (e.j. Montecarlo “simulations” of stellar clusters, galaxies) neither micro
 - In the present situation it is not clear where “model” can be included (now it is mixed-up as microsim).
 - Finally, just count how many times the word model instead microsim has been used in this interop... model is more natural of all of us (and also scientist!).



Final conclusion after discussion

- Do not make distinction between micro-simulation and simulations: **Everything is “simulation”** in the sense of computer usage to obtain theoretical data
- Any standarization effort must take into account all different requirements for all possible theoretical cases (modeling and simulations as explained here)

