

B1: The impact of computer simulation and machine learning on the epistemic status of LHC data

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Output – part 1

■ Clever Hans project:

- ⇒ F. Boge, M. Krämer, C. Zeitnitz (*in preparation*). Anomaly detection, Model-independance, and the limits of deep unsupervised learning for scientific discovery
- ⇒ F. Boge (2021). Two Dimensions of Opacity and the Deep Learning Predicament. *Minds and Machines*. <https://doi.org/10.1007/s11023-021-09569-4>
- ⇒ F. Boge (*submitted manuscript*) Functional concept-proxies and the Actually Smart Hans Problem: What's special about deep neural networks in science?

■ Models: measuring or cognitive instruments?

- ⇒ F. Boge (2021). Why trust a simulation? Models, parameters, and robustness in simulation-infected experiments. *The British Journal for the Philosophy of Science*. <https://doi.org/10.1086/716542>

Output – part 2

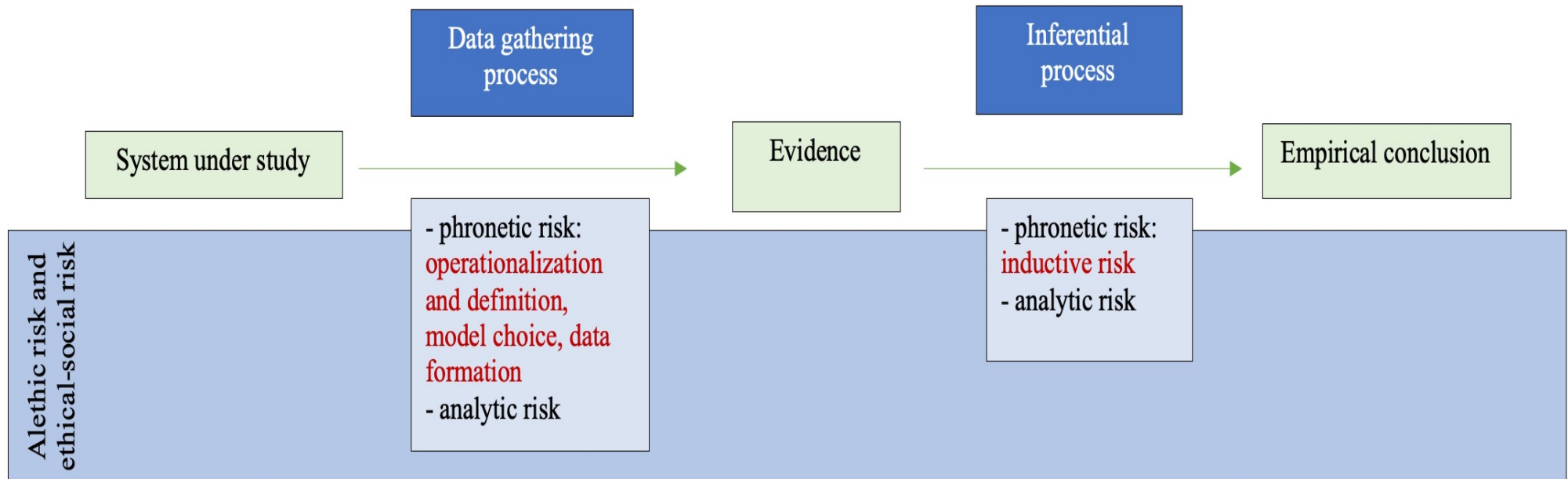
- ⇒ M. van Panhuys & R. Hillerbrand (*in preparation*). Extending the Geography of Risks. Computer simulations and epistemic risks in particle physics
- ⇒ M. van Panhuys & R. Hillerbrand (*in preparation for the SAS-21 Proceedings*)
Epistemic Risks and Computer Simulation:
 - **Salzburg Conference for Young Analytic Philosophy (SOPhiA)**, 9th-11th September 2021, Salzburg, Austria, online
 - **Science and Art of Simulation Conference: Trust in Science (SAS-21)**, 27th-29th November 2021, High Performance Computing Center, Stuttgart, Germany, online
 - **Fourth International Conference of the German Society for Philosophy of Science (GWP)**, 15th-17th August 2022 (*forthcoming*), Technical University of Berlin, Germany
- ⇒ M. van Panhuys (*early stage*). Discovery at Deadlock? Path dependence and Epistemic Risk in particle physics experiment
- ⇒ Research Visit, “Epistemic Risk from a Perspectival view point”, School of Philosophy, Psychology and Language Sciences, University of Edinburg. Host: Michela Massimi (duration 3 months, early 2023)

Extending the Geography of Risks.

Computer simulations and epistemic risks in particle physics

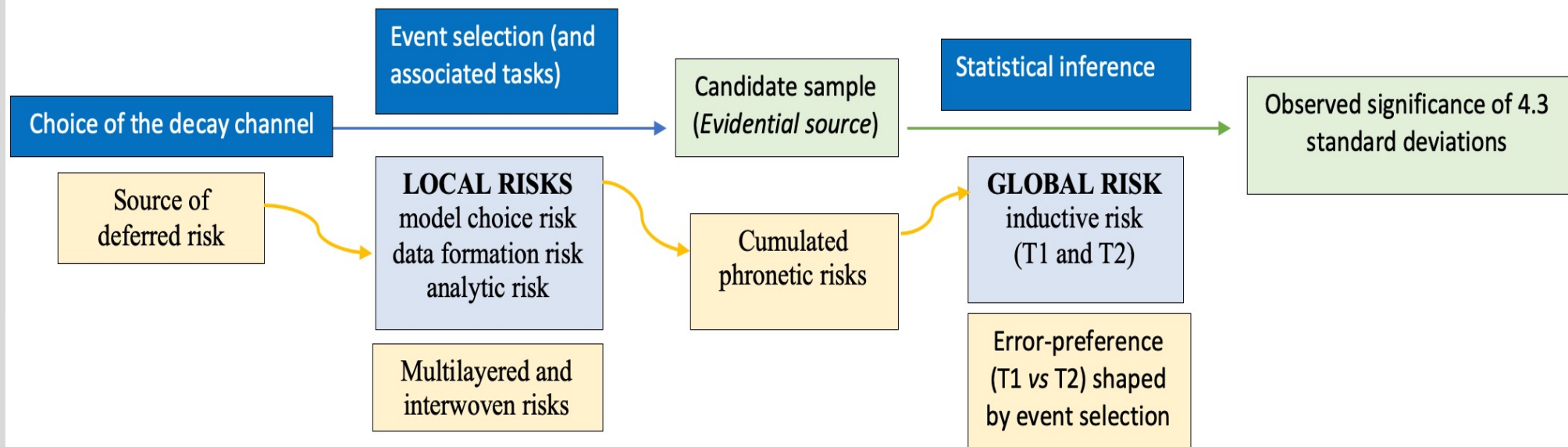
- Identify and explicate CS-related risks and uncertainties (W.P.1)
- An extended epistemic risk framework: varieties of risk besides inductive risk (Biddle & Kukla, 2017)
- CS are centrally involved in data-generation and analysis: looking for risks *ahead of* evidence

Figure 1. Location-based typology of Epistemic Risks in experimentation



- Experimental tasks prior to hypothesis testing: distinguish between local aims (e.g., prediction) and the global aim of the experiment (e.g., discovery) and associated risks of epistemic failure
- Epistemic risk as the risk to not achieve one's epistemic goal
- Uncover modalities of risk: dynamic, multilayered, interwoven

Figure 2. Epistemic Risks in ATLAS searches for four top-quarks



Discovery at Deadlock?

Path Dependence and Epistemic Risk in particle physics experiment

- Impact of simulation & ML on the discovery potential of ATLAS? (W.P.1)
- Epistemic risk as risk to not achieve one's epistemic goal > *discovery*

Path dependent feature of LHC experiments:

- Organizational and material structure (structural path-dependency)
- Modelling and simulation practices (theoretical or methodological path-dependency)



Epistemic principle of conservation in decision-making:

- Solve underdetermination problems
 - Discourage alternatives



Lock-in effects > detrimental for discovery > epistemic risk

Risk of lock-in

=> Contribute to expand the typology of epistemic risks

Work plan

- Discuss Peacock's (2009) general account of *path dependence* in the light of further insights from the philosophy of computer simulation and collaborative research
(Lenhard&Winsberg, 2010; Ruphy, 2011; Winsberg et al., 2014)
- Explore the philosophical literature on the epistemic consequences of the principle of conservation in decision-making
(Bedessem, 2021; Dellsén, 2019; Sklar, 1975; Stanford, 2019)
- Build on a case-study from ATLAS : focus on decision-making dealing with case-specific uncertainties (i.e., in the absence of standardized assessment procedures)

Objectives:

- argue that in path-dependent contexts some decision-making patterns can be harmful for discovery
- attract philosophical attention on the *risk of lock-in*

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