

MODELS AND MODELING IN THE SCIENCES PREFACE TO THE SPECIAL ISSUE OF THE 12TH PRINCIPIA INTERNATIONAL SYMPOSIUM

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The 12th *Principia International Symposium* was perhaps the most different in its series, that started in 1999. It happened between August 2nd and August 5th, 2021 — a moment in which many countries in the world were already dismissing some of the restrictions to contain the CoViD-19 pandemic, but Brazil was still struggling with a slow vaccination rate and with a fragile health system. Even though saddened by the tragedy that fell upon our country, the members of the Epistemology and Logic Group (NEL) of the Federal University of Santa Catarina (UFSC) felt that the 12th *Principia* shouldn't be postponed indefinitely: the symposium community, which overlaps significantly with this journal's community, needed the interaction. Hence the symposium was held in online platforms, in particular Zoom for the talks (the main conferences were broadcast live through YouTube) and GatherTown for the coffee breaks and other informal get-togethers. It was a success: we had about the same number of presentations and participants as in recent in-person symposia. It was an intense week of philosophical debate and reflection. But, let's be honest: it was not as productive and not as fun as the in-person experience. Nevertheless, having the symposium at that moment was very important and we had many remarkable moments, some of which are recorded in the symposium's YouTube channel.¹

The main theme of the 12th *Principia International Symposium* was “Models and Modeling in the Sciences”. As our call for papers announced, since the mid-twentieth century, scientific activity counts on the use of tools named models, which become ever more present in areas as diverse as quantum physics, psychology, mathematics, the social sciences, such as economics, sociology and anthropology, meteorology,



and that which has become the center of our recent attentions, epidemiology, among many others. Models are used not only in the pure sciences, but also, and quite extensively, in the applied sciences and in technological research, indicating the ubiquity of these tools. Philosophy of science has noticed this increase in usage and has been seeking an understanding of models, in regard to their ontology, their epistemology, their methodology, their logic, their ethical, political, and social aspects. This philosophical debate gains intensity since the 1980s and generates some controversies. However, in the last ten years, philosophical and scientific communities have been reaching some important conclusions, systematizing our knowledge of models and modeling. Our 12th symposium aimed at presenting a plural overview of these conclusions and at highlighting the open discussions, offering our community a broad perspective on the activity of modeling in the sciences.

Our call for papers also remarked that this is a topic that crosses scientific and technological areas. For that reason, it is clear that the topic of models and modeling constitutes an eminent theme of philosophical research; it is not an exaggeration to claim that only philosophy is fully able to contemplate scientific activity and its history so as to systematize knowledge of models and modeling. As a consequence, it is possible to state that only philosophy can offer a foundation for the theme of modeling to be approached in education without limiting the discussion to specific areas and, therefore, without limiting the view that students might develop on the subject. Hence, if we understand that science should be taught to our youth and, more than that, that it should be taught as a way of thinking and solving problems, then we will realize that it is of the greatest importance to understand the role of models and of the modeling methodology and to transmit that in education. We hope that the 12th *Principia* offered a further step towards such understanding, as well as that it stirred the discussion in our South-American and Brazilian contexts.

The choice of this topic to be the main theme of the 12th *Principia* allowed us to offer a tribute to some of our professors. Their names are in the history of *Principia* and the excellence of their keynote addresses makes it easy to understand why. They are:

- Décio Krause, who is now retiring from UFSC after more than two decades. His guest talk at the symposium gave origin to the article “**Models and Modeling in Science: The Role of Metamathematics**” in this issue. The paper argues that there are relevant logical questions which are not always acknowledged by the most common approaches to models in philosophy of science. May this also be a tribute to our professor, colleague and friend. *Cheers, Décio! Congratulations and all the best in this new phase!*
- Gustavo Caponi, our colleague at UFSC. His guest talk became the article “**El Arquetipo Vertebrado de Richard Owen: Razón de Ser y Destino de unos**

de los Modelos Más Influyentes en la Historia de la Biología". The article presents the uses and rationale of an influential model in biology, offering a historical example to discuss the main philosophical features of scientific models.

- Luiz Henrique Dutra, our colleague at UFSC, could not present his guest talk "**O poder normativo dos modelos**" at the symposium, but his students and former students recorded a reading of his text (it is available at the *Principia* YouTube channel). His talk became a chapter of the new edition of his book *Pragmática de Modelos* (Ribeirão Preto: Agrya, 2021), which has been reviewed by Renato Cani in this issue.

The 12th *Principia International Symposium* also had five international guest keynote speakers:

- Catherine Elgin (Harvard University), whose opening talk to the symposium became the article "**Models as Felicitous Falsehoods**" in this issue. The paper argues that models *ought* to neglect some features of reality in order to enable us to understand it.
- Bas van Fraassen (Princeton University and San Francisco State University) who showed us "**A Landscape of Logics Beyond the Deduction Theorem (and Moore's Paradox)**" in the closing talk of the symposium and in this issue. The paper crosses the threshold of pragmatics to discuss Moore's Paradox from a certain point of view in epistemic logic, offering some interesting insight on the matter.
- Anjan Chakravartty (University of Miami), who presented "**Models of Knowledge Transfer: Science in Society**".
- Nancy Nersessian (Harvard University), for the first time in *Principia*, brought us "**Building Analogies: In Vitro Simulation Modeling in Biomedical Engineering Sciences**" — *welcome, Nancy!*
- Otávio Bueno (University of Miami), who gave us the talk "**Two Kinds of Fictionalism about Scientific Models**".

We also had the opportunity to offer another tribute to our professors Alberto Cupani (UFSC) and Hugh Lacey (Swarthmore College), who made a roundtable discussion in the Science & Values Workshop, mediated by Débora Aymoré (Federal University of Paraná and State University of Amapá) and by Ivan F. da Cunha (UFSC). The workshop was itself a result of a collaboration between our NEL/UFSC team and

our friends and colleagues at the NECTEC/UFPR, the Center for Studies on Scientific and Technic Culture of the Federal University of Paraná. Another product of this collaboration was *Principia's* Special Issue on Science and Values last year (see vol. 25, no. 2, 2021).

Furthermore, in the 12th *Principia International Symposium*, we had the — already traditional — Philosophy of Quantum Mechanics Workshop, mediated by Jonas R. Becker Arenhart (UFSC) and Raoni Wohnrath Arroyo (UFSC and Unicamp). As we are now also used to, the 12th symposium had the participation of the ANPOF Workgroups on Analytical Epistemology, Ethics, Philosophy of Science, and Theories of Justice. The interaction of these other groups enriches the *Principia International Symposium*, as well as the experience of our community.

The call for papers to this Special Issue on Models and Modeling in the Sciences has been answered with more than 20 submissions, all of which were great contributions to the symposium. Through our usual process of double-blind peer-review, we were able to select nine articles and one book-review. A few papers needed further rounds of peer-review and hence are still under evaluation. If approved, they are going to appear in the next issues of *Principia*, along with the regular submissions. Besides the already-mentioned keynote papers (by Gustavo Caponi, Catherine Elgin, Décio Krause, and Bas van Fraassen), this Special Issue brings the following:

- **“Taking Models Seriously and Being a Linguistic Realist”**, in which Raoni Wohnrath Arroyo and Gilson Olegário da Silva seek to locate Rudolf Carnap’s stance within the contemporary debate between realism and anti-realism. Carnap’s linguistic frameworks can play the role of models in the contemporary debate — and thus the logical empiricist is back.
- In **“Compatibilizando Autopoiese e Atribuições Funcionais”**, João Willian Stakonski sustains that the theory of autopoiesis, originally proposed by Maturana and Varela, can be extended by Gustavo Caponi’s proposal for biological functions. To do that, the author shows that Caponi’s ideas are fit to survive criticisms inspired by the Chilean authors.
- **“Ignorância Proposicional e Proposições Falsas”**, in which Lucas Jairo Cervantes Bispo sketches a new perspective in the epistemological analysis of propositional ignorance. This new view seeks inspiration in recent developments to argue that the standard view on the matter does not comprehend all the subtleties of ‘S is ignorant that P’.
- With the title-question **“What is the Aim of Models in Formal Epistemology?”**, Matheus de Lima Rui undertakes an investigation on rationality and normativity that leads us to realize that formal models can be an useful tool

in epistemological analysis. Important as they are in scientific inquiry, models can, according to the author, be also relevant in philosophy.

- In “**Representando Fenômenos Emergentes**”, William Ananias Vallerio Dias approaches the lively problem of representation in models by exploring the DEKI account by Frigg and Nguyen, in particular the use of cellular automata to represent emergent properties. The author discusses thoroughly a variety of examples in complex systems.
- As briefly mentioned above, “**Abstração e Ação**”, by Renato Cani, is a review of the third edition of Luiz Henrique Dutra’s book *Pragmática de Modelos* (2021), which adds a new chapter to the work originally published in 2013. Cani presents the whole book and addresses how the new chapter complements the work.

This special issue is also an important milestone for us: it is the first number of *Principia*’s 26th volume. This means that in 2021 the journal completed 25 volumes — i.e., **25 years!!!** We, old and new members of the editorial board, are proud to be part of this history and we’d like to thank *you* — our reader, collaborator, author, reviewer — for being with us and constituting our community.

As these lines are written the Federal University of Santa Catarina resumes in-person activities and our campus is once again busy with people, students, researchers, professors — *with knowledge in the making*. The success of this reopening gives us reason to believe that the 13th *Principia International Symposium* will be held once again in person next year. Of course, if conditions are not favorable, for whatever motives, we’ll do it again online — we have the model ready and set from our 2021 experience. *But we do hope to see you in person in Florianópolis in 2023!*