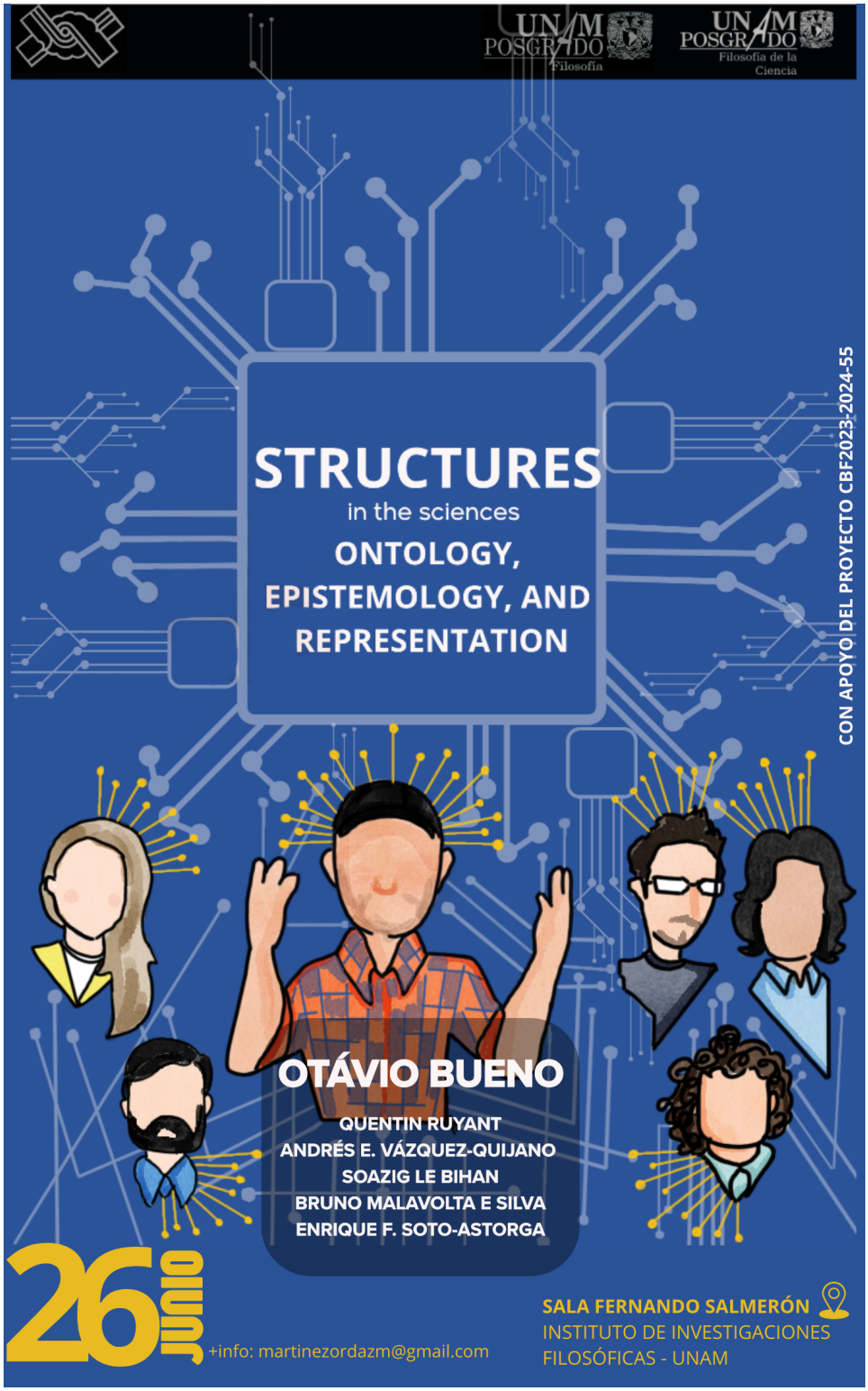
Workshop *Structures (in the sciences): Ontology, epistemology, and representation*

BOOK OF ABSTRACTS


UNAM POSGRADO Filosofía
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STRUCTURES
in the sciences
ONTOLOGY, EPISTEMOLOGY, AND REPRESENTATION
CON APOYO DEL PROYECTO CBF2023-2024-55
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Thursday, June 26, 2025.

[10:00-11:30 MEX] *Keynote Talk: "How Can Models Represent Possibilities?"*
Otávio Bueno (University of Miami)

[11:30 -11:45 MEX] COFFEE BREAK

[11:45-12:45 MEX] *"Moving Past the Semantic Conception of Scientific Theories"*
Quentin Ruyant (Universidade de Lisboa)

[12:45-13:45 MEX] *"Structural Ignorance and Epistemic Criteria in the Historical Sciences: the CMBR's case"*
Andrés Emmanuel Vázquez Quijano (UNAM)

[13:45-16:00 GMT-3] LUNCH BREAK

[16:00-17:00 MEX] *"Deflated Structures: the Pragmatic Turn in Representation"*
Soazig Le Bihan (University of Montana)

[17:00 -17:10 MEX] COFFEE BREAK

[17:10-18:10 MEX] *"Seeing the Structure of Phenomena: Perspectival Realism Meets Active Perception"*
Bruno Malavolta e Silva (UNAM)

[18:10-19:10 MEX] *"Function and entailment: relational science and its take on organization"*
Enrique Soto Astorga (UNAM)

"How Can Models Represent Possibilities?"

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Scientific models are clearly designed to represent what is actual, about which predictions are typically made. On the inferential conception (Bueno and French [2018], and Bueno and Colyvan [2011]), a central component of scientific representation involves establishing suitable mappings between the empirical set up and parts of the relevant models. This seems to privilege representation of the actual. What goes on in the empirical set up clearly has a counterpart in the model—as long as the constraint of empirical adequacy is met. But how can merely possible, but nonactual, phenomena be similarly represented? In this paper, I argue that the surplus structure that is typically offered by mathematics provides a significant avenue to address this issue. Models often have built-in structure that locates the phenomena in a space of possibilities. How can such a structure be known? Isn't this precisely the information that a model is supposed to provide in the first place? I address this challenge by identifying what is a condition for a model to represent—a blind spot, or a hinge, depending on the metaphor one prefers to invoke—and the representational possibilities that the model encodes. Both features are contingent and revisable, but they need to be held properly fixed otherwise representation via models becomes impossible. I conclude by indicating that the result is a form of modalist empiricism about scientific representation.

References

1. Bueno, O., and Colyvan, M. [2011]: "An Inferential Conception of the Application of Mathematics", Noûs 45, pp. 345-374.

2. Bueno, O., and French, S. [2018]: Applying Mathematics: Immersion, Inference, Interpretation. Oxford: Oxford University Press.

"Moving Past the Semantic Conception of Scientific Theories"

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The syntactic conception of scientific theories construes theories as statements about the world, while the semantic conception, today more prominent, construes them as families of mathematical structures, their models. The main challenges that have been mounted against the semantic view are the following:

(i) Language is necessarily involved beyond structure in theoretical representation. Once this is acknowledged, the difference between semantic and syntactic approaches seems superficial (Halvorson 2012; Lutz 2015).

(ii) In practice, scientific models are autonomous from theories and distort their laws. So, theories are not families of models in any practically relevant sense (Cartwright 1999; Morrison 2007).

Although there are responses to both challenges taken separately, I believe that it is impossible to respond to both at the same time, because of a tension, acknowledged by semanticists, between two different understandings of models: as interpretations of statements, or as representations of phenomena. Escaping any one challenge against the semantic conception implies opting for one of these notions of model when characterising theories, which in turn, implies falling prey to the other challenge. A way forward is to move to a pragmatist conception of theories that considers that theories constitute a distinct level of representation from models, and yet accepts that the latter play the role of endowing them with an empirical interpretation. Such a pragmatic conception has been called for, but hasn't really been fleshed out until now. I will sketch a proposal based on a generalised notion of indexicality that formalises Cartwright (1999)'s notion of abstraction and Giere (1999)'s notion of a hierarchy of models.

References

1. Cartwright, Nancy. 1999. The Dappled World. Cambridge University Press.

2. Giere, Ronald. 1999. Science Without Laws. University of Chicago Press.

3. Halvorson, Hans. 2012. “What Scientific Theories Could Not Be.” Philosophy of Science 79 (2): 183–206.

4. Lutz, Sebastian. 2015. “What Was the Syntax-Semantics Debate in the Philosophy of Science About?” Philosophy and Phenomenological Research 91 (2).

5. Morrison, Margaret. 2007. “Where Have All the Theories Gone?” Philosophy of Science 74 (2): 195–228.

"Structural Ignorance and Epistemic Criteria in the Historical Sciences: the CMBR's case"

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Here, I introduce *the argument from ignorance*, that aims to reject the ability to produce predictions of novel phenomena —termed *the prediction criterion*—, as *the* central epistemic criterion for the evaluation of theoretical products (theories, hypotheses, narratives, etc.) in archetypal research situations of historical sciences. Specifically, I focus on its role in theory choice schemes. The argument stresses the ignorance of theoretical structure that historians have to cope with when finding (or not) novel relict objects, and that impedes a legitimate use of the prediction criterion to provide positive (or negative) evaluations.

To illustrate this, I analyze the role of the *Cosmic Microwave Background Radiation* (CMBR) in the rivalry between big bang and steady-state theories. This is a case where prediction is traditionally appealed to when justifying cosmologists' rational solution in adopting big bang theories and rejecting steady-state theory. However, I show that cosmologists were aware of their ignorance, and that it impeded a clear-cut usage of the prediction criterion.

“Deflated Structures: the Pragmatic Turn in Representation”

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"Seeing the Structure of Phenomena: Perspectival Realism Meets Active Perception"

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Perspectival Realism reinterprets the notion of phenomena, putting it at the center of scientific ontology. Once phenomena are distinguished from data, the Evidential Inference Problem arises: when do a state of affairs provide conclusive evidence for phenomena? Massimi argues that traditional empiricist and realist approaches fail to address the problem by requiring vicious epistemic circularity. Alternatively, she invokes cross-perspectival justification as a way of assuring the reliability of particular sets of evidence. Consequently, perspectival realism treats phenomena as stable events indexed to a particular domain of inquiry, and modally robust across a variety of perspectival data-to-phenomena inferences. The stability of phenomena emerges from a structure of nomological dependencies between features of it. This account treats the identification of phenomema as fully based on data-to-phenomena inferences. Thus it makes the relationship between phenomena and experience to be somewhat mysterious. Can modal phenomena be seen? I argue that action-based accounts of perception allow us to treat phenomena as perceptible regardless of (and precisely because of) its modal features. I focus specifically on the ecological approach to perception. It stresses that perception is focused on affordances, that is, the opportunities of interaction that an environment offers for a particular being. The acquisition of practical knowledge implies learning new forms of perception, as new forms of interaction enable the grasp of new affordances. When practice allows scientists to identify a dynamical structure of ecological information, scientists are able to see the nomological dependencies that constitute the realist dimension of affordances.

“Function and entailment: relational science and its take on organization”

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https://sites.google.com/ciencias.unam.mx/xaltentli/home?authuser=0 Drawing on the work of Robert Rosen and Nicolas Rashevsky, I present relational

science as a project that rejects the ontological primacy of parts and matter and instead foregrounds functional relations as defining features of complex systems. In contrast to mechanistic models grounded in state transitions operating on concrete objects, relational systems are expressed through formalisms that emphasize transformations over classes of objects. This shift suggests a science where structure is understood not as a configuration of material components but as a network of functional entailments, a conception of structure that aligns with Category Theory and its capacity to model systems without presupposing substance. As an example, I reproduce Rosen’s relational theory of machines and organisms, and then conclude by outlining how such a perspective invites a reformulation of the role structures play in science, particularly in biology.

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