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Jelle Bruineberg, Krzysztof Dołega, Joe Dewhurst, Manuel Baltieri

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Making Reification Concrete: A Response to Bruineberg et al.

FULL NAME

Mel Andrews

INSTITUTION

The University of Cincinnati

FULL INSTITUTIONAL MAILING ADDRESS

2700 Campus Way, Cincinnati, Ohio 45221 USA

INSTITUTIONAL TELEPHONE NUMBER

+1 (781)-547-1556

EMAIL ADDRESS

mel.andrews@tufts.edu

HOME PAGE URL

www.mel-andrews.com

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Making Reification Concrete: A Response to Bruineberg et al.

Mel Andrews

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Abstract

The principal target of this article is the reification Bruineberg et al. perceive of formalism within the literature on the variational free energy minimisation (VFEM) framework. The authors do not provide a definition of reification, as none yet exists. Here I offer one. On this definition, the objects of the authors' critiques fall short of full-blown reification—as do the authors themselves.

Scientific modelling can often look a bit like playing a game of pretend. We play soldiers and pretend our sticks to be guns; we play explorers and pretend the sand to be lava. Misrepresentations, distortions, nonlinearities, untruths, and oddities run rampant in scientific models. Such idealisations are harmless, so long as we do not forget that we have made them; so long as we do not forget that the sand is really sand and our friends really our friends, and not lava or enemy soldiers after all.

Imagining the developing organism to be a generative model of its milieu, or the brain an engine for inferring the distal causes of incoming sense data is a beautiful exercise, and scientifically fecund. It requires, however, a bit of suspension of disbelief. It requires the scientist to dream up a mapping between two things which are fundamentally unalike; to envision the world as though it really were a directed acyclic graph, a phase space, Shannon information measures defined over a Riemannian manifold. We come to talk as though they were one and the same.

Formal modelling, as with science in general, aims at uncovering causal patterns (Potochnik, 2017). Philosophers of science hold scientific models to consist in interpreted structure (Weisberg, 2013). The structure of a formal model is a mathematical system. An interpretation or construal thereof relates this formal structure to a target phenomenon of interest (ibid). Model structures bear no intrinsic representation relations to targets (Nguyen & Frigg, 2017). We stipulate a relation of partial representation between model structure and target in order to put the model to work. The crucial implication here is that there will be features of any model structure that do not emulate any feature of the

systems we are utilising them to investigate. This makes modelling prone to undergo reification.

The mere employment of an idealisation or the application of an idealised model is not yet a reification, however; nor is the mixing of math and metaphorical language. Reification is the mismapping of formal structure onto target phenomena—or theoretical representation thereof—in a manner that leads us to misapprehend the causal structure of nature. Reification is an epistemic error. It involves, by definition, a fallacious inference.

I have argued (2021) that the variational free energy minimisation (VFEM) framework is a mathematical model structure and can do no conceptual or philosophical work on its own. The interpreted formal structure of *VFEM models*, however, can. Such models typically operate in an intuition-pumping capacity; they function to shape our conceptual grasp on the causal structure of target systems of interest, ranging from microphage to macrocosm (Kirchhoff et al., 2018; Kuchling et al., 2019; Rubin et al., 2020). What Bruineberg et al. take to be assertions about nature are, in fact, interpretations and conceptual manipulations of formal models.

There is a crucial distinction to be drawn between claims made about the causal structure of nature that result from a modelling exercise and idealisations or gambits involved in the modelling procedure which may be literally untrue in reference to the model's target—and which, indeed, hold no pretence to truth (Potochnik, 2017). Not all scientific modelling efforts aim to furnish such assertions, however. Some modelling work furthers our epistemic aims of latching onto causal patterns in the world by by enabling us to reenvision the form that such causal architectures could take. All modelling aims at facilitating human understanding, but not all modelling aims at truth. This entails that we will have different degrees of commitment—ranging from absolute certitude to total noncommitment—to the posits involved in our modelling efforts.

I take it that Bruineberg et al. understand VFEM models to be after claims about the causal structure of certain systems in nature because they implicitly take the epistemic utility of modelling to reside solely in offering truth-evaluable assertions about nature. The loose, analogical reasoning of the literature surrounding the VFEM formalism strikes them as would-be statements of fact. Were this the case, it would indeed be a reification, and an egregious one, at that. I want us to resist, however, the temptation to read the literature in this light.

Indeed, if reification were merely talk of the world as though it had formal properties, or talk of formal structure as though it had empirical or conceptual content, Bruineberg et al. would themselves be guilty of the reification fallacy, for they speak of Pearl's (1988) Markov boundary as being "substantiated by

the empirical literature," and address its "scientific credibility." The existence and use of a formal tool, however, cannot receive empirical substantiation.

The central move in Bruineberg et al. is to distinguish between a strictly formal reading of the Markov blanket construct, as developed in Pearl (1988), and a conceptually—even metaphysically—laden notion, as wielded under the VFEM framework. It is this "reification of the Markov blanket construct" in the research programme centred around this second notion that they denounce.

"[M]any authors in the field," they write, "are seemingly not aware of this process of reification, leading to the conflation of several different kinds of boundaries in the literature: Markov blankets are characterized alternatively as statistical boundaries, spatial boundaries, ontological boundaries, or autopoietic boundaries."

One way to view this is as a multifold reification. But I think that there is a much more natural reading available, namely that the Markov blanket is simply a mathematical fixture of the VFEM framework—held as contentless formal modelling framework. It is utilised to build many different models which differ with respect to their conceptual content.

Interpreted model structure does not yet consist in knowledge about the natural world. The interpretation of a formal model merely maps it onto our conceptual representations of things which we hold to exist in nature. Facts, or hopeful, would-be facts, are only generated when a model is put into the appropriate coordination with an empirical measurement procedure. Not all scientific modelling is in dialogue with data in this manner or aspires to generating knowledge in this way. We run into trouble when we treat modelling practices that are not aimed at knowledge—conceived as sufficiently true causal patterns—as generating knowledge. This is when reification occurs.

Game-theoretic modelling in economics and the social sciences or optimality modelling in evolutionary biology do not, in their own right, generate knowledge of natural systems, because they are not coordinated with the results of empirical measurement procedures in the right way. The use of VFEM models occupies a similar epistemic position. So long as we keep this context in view, the conceptual exploration facilitated by such models is harmless.

Thus the takeaway of this exposition is not that the VFEM framework is unscientific or bad science, or that it does not deliver what its proponents and architects want of it, but rather that its ambitions were (like most science, I am afraid) far less ambitious to begin with than philosophers had hoped. The other key lesson is to caution VFEM modellers against use of overly suggestive language, lest they send the philosophers into an even deeper state of befuddlement. Such conceptual promiscuity, especially in the treatment of heavily idealised models, opens the door to reification.

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