Dialectical Materialism for Conceptual Modeling

Cauã Roca Antunes[1]

[1]*Universidade Federal do Rio Grande do Sul, Av. Bento Gonçalves, 9500, 91.501-970 Porto Alegre, Brazil*

Abstract

According to Friedrich Engels, dialectical materialism is the philosophical discipline that studies "the general laws of motion and development of nature, human society and thought". Dialectical materialism has at its core the dialectical contradiction, that is, the interconnection of the opposite tendencies of an entity. The current state of the entity is determined by the relative intensities of those tendencies. The strongest tendency takes the role of dominating aspect of the contradiction, while the weakest takes the role of dominated aspect. The nature of the contradiction allows the entity to be affected by its enviroment through the quantitative increase or decrease of the intensity of one or both aspects. When the dominated aspect has gained enough intensity to change the balance and become the dominating aspect, the entity reaches a new state, qualitatively different from the previous one. In the new qualitative state, distinct aspects and contradictions may emerge, allowing the entity to suffer new kinds of transformation.

Thus, a modeling framework grounded in the concept of dialectical contradiction would enable the construction of better models in at least three manners. First, by focusing on dialectical contradictions, the framework would guide modelers to consider all the relevant influences on any process of change, and account for them in the outcome of the process. Secondly, it would allow models to represent richer accounts on causal relations between events, through the enhancement of the description of transformations to account for the interplays between quantitative and qualitative changes. A model enriched in such manner would be able to not only answer what caused a certain occurence but also how and why. Finally, by taking the properties of entities in the underlying scale as aspects of the dialectical contradiction that is responsible for the behavior of the entities in the scale above, the framework would provide a sound basis for modelers to describe the relations between entities in different scales of analysis.

The resulting models would provide better support for a multitude of tasks, such as causal reasoning, discrete simulation of events, extrapolation of properties from different scales of analysis and investigation of past events from their outcomes. In the petroleum industry, for example, such tasks are of high significance, since it is a domain where past natural processes and their causes are of uttermost importance, as well as the relations between kilometers-long

rock units and the underlying microscopic mineral grains and crystals. Another field that may benefit from such framework is the biomedical domain, with its biological processes and entities ranging from cellular organelles to whole organisms.

Therefore, the goal of our work is to systematize dialectical materialism into a conceptual modeling framework. We believe this framework will guide modelers towards making explicit the causal connections between the dialectical contradictions and the processes that develop from them. In doing so, the modeler also describes the relations between emergent properties in different scales of analysis. Consequently, the framework will promote well-founded, more informative and more effective models.