Conceptual Revision in Revolutionary Times: Taking up Thagard's challenge.

Abstract

In his monograph on conceptual change in science, Thagard (Thagard, 1992) developed a fine-grained cognitivist model of scientific theory change centered around transformations in conceptual systems. The basic units of these systems are concepts, understood as complex structures akin to frames (Schurz and Votsis, 2014), interconnected via different kinds of links such as kind-links, instance-links, rule-links, property-links, and part-links. Changes in science then correspond to different modifications of these links. Specifically, scientific revolutions involve transformations in part-links and in kind-links inside a conceptual system. Thagard defends his concept-based model arguing that these revolutionary changes cannot be modeled by belief-revision theories, because these theories lack the required structure and they are constrained by a too narrow focus on the cumulative changes. This supposed impossibility of modeing radical conceptual change within a belief-revision framework is known in the literature as *Thagard's challenge* (Park, 2010).

Despite the enormous expansion of the belief-revision literature in the last thirty years (Hansson, 1999) and recent work connecting it with philosophy of science (Olson and Enqvist, 2010), Thagard's challenge has not received so much attention. The main aim of this talk is to suggest a way of taking up Thagard's challenge by developing a belief-revision framework which is able to model all kinds of conceptual changes described by Thagard.

Our framework breaks with the traditional background of belief-revision theories in the following way. Traditional belief-revision theories are built upon data sets which may lack the expressive power to capture the fine-grained transformations of part and kind hierarchies pivotal in Thagard's model. Our framework on the other hand involves at its core a more fine-grained structure which we call *conceptual structure*. This conceptual architecture is taken from data semantics (Veltman, 1984). Specifically, we interpret sets of facts as concepts and the filters defined on these sets as part-hierarchies, kind-hierarchies, and instance relations. From this basis, together with an adequate inference operator, we will show how to define sets of rules and sets of statements as the remaining two elements of the models, completing the static part of our framework. Our revision operators allows not only the cumulative addition of sentences, but also the merging of conceptual structures. We will show how these operators satisfy common desiderata for scientific change operators such as locality and the possibility of indeterministic change (Hansson, 2010).

We will show how all the nine degrees of conceptual change of which Thagard's model is made of can be represented in our framework as different kinds of revisions. In order to show the adequacy of our proposal, we will rationally reconstruct one of Thagard's main case studies, i.e. the chemical revolution (Thagard, 1990), as a succession of rational revisions. Finally, we will discuss the relationships between our framework and other related models of scientific conceptual change such as frame-based models (Schurz and Votsis, 2014), conceptual spaces (Masterton, Zenker, and Gärdenfors, 2017), and structuralist philosophy of science (Stegmüller and Wohlhueter, 1976; Enqvist, 2010).

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