Critical Analysis of AGM Postulates for Ontology Repair

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Keywords: Belief Revision, AGM model, Ontology Repair

Belief revision [4, 6] is an area of knowledge representation research that aims to understand the rationality of an agent's belief changes in the face of new information and how to reflect these changes in the agent's belief set. Several models have been proposed to formalize and characterize the dynamics of belief changes, but the most prominent model was proposed by Carlos Alchourrón, Peter Gärdenfors and David Makinson in [1], giving rise to the AGM model. In this model, an individual's belief state is represented by a belief set closed under logical consequence [1].

The AGM model is a simple and elegant theory in which all changes result exclusively from inputs, which take the form of a sentence accompanied by a specific instruction on what to do with it [10]. This instruction determines whether a specific sentence should be included or excluded from the resulting belief set, as explained in [4]. One of the pillars of AGM theory is that changes in beliefs should occur with minimal loss with respect to the previous belief state [4].

In the AGM paradigm, there are three fundamental forms of belief revision: expansions, revisions, and contractions. Specifically, expansions consist of adding a sentence to a belief set, which may result in an inconsistency. In contrast, revisions consist of adding a sentence to a belief set but preserving consistency. Some previous beliefs may have to be removed. Finally, contractions consist of the removal of a sentence from a belief set. These are the main forms of belief change in the AGM model, and the symbols $+$, $*$ and $-$, respectively, are used to denote them [4]. The contraction and revision operations are characterized in the AGM model by sets of rationality postulates.

Although considered the standard model of belief revision, the AGM model has become the target of criticism [4]. Firstly, because it is a simplified and idealized theory of rational belief change, there are characteristics of real belief systems that are not captured by the model. The logical closure of belief sets is also seen as problematic, given that the agent must accept all consequences of the beliefs they hold and ensure that their beliefs are consistent [10].The representation of the agent's beliefs as belief sets is also cause for criticism, not only because they are too large, but also because they do not contain information that adds informational value for the agent [4, 10].

According to Fermé and Hansson [4], the main criticisms are associated with the postulates of revision and contraction operations. The recovery postulate has been the subject of intense questioning, as its acceptability may be doubtful under its original interpretation, given that there are counter-examples in which recovery seems to contradict the intuition of preserving the belief set [5, 8, 10].

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Fermé and Hansson [4] point out that although the expansion postulate of revision is less debated than recovery, it is just as problematic as revision. In this way, both postulates have motivated the investigation and development of alternative structures for contraction and revision that do not satisfy these postulates [4, 5].

In this paper, we will discuss the suitability of the AGM postulates for ontology repair and revision applications. Recent work in the literature has explored the connection between belief change and ontology repair (see [2, 3, 7, 11]), especially contraction operations in belief change and ontology repair, since both areas explore how to modify a knowledge base so that an unintended consequence no longer occurs [2, 3].

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