BOOK REVIEW

Newton C.A. da Costa, *Logiques Classiques et Non Classiques. Essai sur les Fondements de la Logique.* Translated from the Portuguese by Jean-Yves Béziau (with two appendices by the translator) Culture Scientifique, Masson, Paris, 1997, 276p. ISBN 2-225-85247-2

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This book is a translation by J.-Y. Béziau of *Ensaio sobre os fundamentos da Lógica* by Newton C.A. da Costa, (Hucitec/EdUSP, 1979), from which some generations of Brazilian logicians have learned the introduction to the philosophy of mathematics. However, strangely enough, this title is never mentioned in the whole book. An epigraph by Kierkegaard was also banished from the translation. Béziau, however, is not merely a translator: first of all, he is the author of several articles on paraconsistent logic and paraconsistency, and possesses a wide understanding of this theme, specially concerning the work of Brazilian authors. He has added two appendices to this French edition (replacing two small appendices in the original Brazilian version): Appendix 1: Paraconsistent Logic and Appendix 2: Valuation Theory

The volume includes, besides these two appendices and a subject and name index, forewords by the author and by the translator, an introduction by the author, and four chapters Chapter 1: Reason,

Logic, and Language, Chapter 2: Nonelementary and Heterodox Logics, Chapter 3: Hegel's Thesis, and Chapter 4: Intuition and Discourse.

A. BURLESQUE FANTASY

In his opening to the book ("Translator's Foreword") Béziau, while trying to explain the nature and interest of heterodox logics in general, and in particular of paraconsistent logics, sketches a kind of socio-anthropological rationale for the development of paraconsistency in Brazil. According to this section of the book, the reasons why paraconsistent logics so colorfully flourished in Brazil could be found in the essence of the Brazilian nature, "land where contradiction is sovereign". In this way, pragmatical and circumstantial environments would have contributed to the interest in this kind of logic. Moreover, even in the biography of da Costa, being educated in the cultural circles of southern Brazil (specifically, Curitiba) where the positivist views of Auguste Comte presumably had a considerable influence, such factors would have caused a decisive impression.

Taking these spirited explanations with relative weight, and noting that they could as well explain the traditional perplexity concerning the French regard with respect to this "brave new world", the efforts Béziau makes to defend the status of paraconsistent thinking are certainly praiseworthy. He deplores the fact that, among certain circles (and especially among French logicians) non-classical logics have long been discounted, fruit of certain ideology of conservative character with respect to logic, for which Descartes and even Poincaré would have to be blamed. It is a pity, he points out, that even today certain people would see as "burlesque fantasy", in the words of Quine, systems of non-classical logic whose theoretical importance is fundamental, and whose applications are pervasive. But where does this dismissal come from?

B. DOES REASONING IN PRESENCE OF CONTRADICTIONS MAKE ANY SENSE?

In the first chapter, da Costa distinguishes four principles which would intervene in reason, and which would explain the role of the strictly logical laws of excluded middle, identity and non-contradiction. These proto-logical principles are the pragmatic principles of reason, the constructive principle of reason, and the dogmatic and dialethic conceptions of reason. Such principles, even if they do not exclude that a unique logical system could be found, in fact can be used to defend different systems of logic, like intuitionistic logic (rejecting the law of excluded middle), Schrödinger logic (in Chapter 2, rejecting the law of identity) and paraconsistent logics (in Appendix 1, rejecting the law of non-contradiction). None of these systems are capable of offering a definitive solution to the question of paradoxes, but paraconsistent logic is a candidate to master the handling of contradictions by means of introducing a new meaning to negation, not so strong as to yield arbitrary conclusions from a theory which derives a sentence and its negation (that is, preventing trivialization in the presence of contradictions), and not so weak as to be able to represent contradictions in general.

A difficult problem is to find such a negation, strong enough so as to maintain the majority of classical logical principles, and weak enough so as to be logically controllable. A definition of a negation of this sort is attempted in Appendix 1, page 239. There Béziau defines a weak form of the Rule of Reasoning by Absurd, called RA_1, which is used to define the calculus C_1. He subsequently proposes a hierarchy of weaker forms $RA_2,...RA_n$, which should be used to define the calculus $C_2,...,C_n$. It should be noted, however, that these rules are misdefined, because they will not be sufficient to obtain the original C_n hierarchy. This can be remedied without much difficulty, but the question remains: how is it possible to alleviate classical logic from its explosive power triggered by contradictions? This problem can be seen as an ab-

stract form of what has been called the "problem of Jaskowski ", who argued for a "logic of contradictory systems...[which] 1) would be rich enough to enable practical inference, and 2) would have an intuitive justification". There seems to be very clear grounds for such an argument. Suppose that, in the course of an investigation, two different researchers studying a certain problem receive a pair of answers for a given experiment. Researcher 1 receives two false but concordant answers, while Researcher 2 receives two discordant, that is, inconsistent answers. It is clear that Researcher 2 has a clear advantage over his or her colleague, and thus we are forced to face the simple fact that inconsistent situations can work in the direction of sheer rationality. The main problems connected to paraconsistency, then, are of two distinct characters: first, is there an ontology of the inconsistent, that is, a class of entities A such that A and ¬A are simultaneously true? Second, and independent of this question, regardless of whether inconsistencies are merely linguistic facts or whether there may exist inconsistent entities, is it possible to build a well-founded logical system to deal with them?

C. INCONSISTENCY, PARACONSISTENCY AND TRANSCONSISTENCY

Taking a well accepted definition, a logical system, viewed as a pair $(L, \models_L)$ is formally *paraconsistent* when it permits to distinguish between inconsistent theories Σ (in the sense that $\{A, \neg A\} \subseteq \Sigma$, for $\neg A$ negation of A) and trivial theories Δ (in the sense that every $B \in \Delta$). In an equivalent way, defining $(L, \models_L)$ as *explosive* if for all A, $\{A, \neg A\} \models_L B$ for every B, we can say that $\models_L$ is *paraconsistent* if it is not explosive. It is worth noting that explosion is not the only way to produce triviality: we recall here the already well-known "Curry's paradox", which is the objection that in certain self-referential contexts, even in the absence of negation, the Rule of Modus Ponens A, A→B / B and the Rule of Absorption A→(A→B) / A→B can be used to derive absolute triviality.

Supposing that there are inconsistent but non-trivial theories (originated, for example, from the paradoxes in several bodies of formal theories, in some philosophical doctrines, in information systems or even in the dynamics of the hypothetico-deductive method as in the example cited above) the task of finding an adequate (that is, sound and complete) paraconsistent deductive system seems to be of primary relevance. Moreover, this could be done inside any heterodox logics, and not merely inside the realm of classical logic. So the epithet of "burlesque fantasy" either applies to any logic deviant from classical logic, or has no meaning at all.

Regarding the first of the two questions mentioned in the end of the previous paragraph, considerations about the inconsistent can be traced back to Heraclitus of Ephesus, to the Chinese philosophical "School of Names" and even to the ancient Taoists and Buddhists (cf. Jiang (1992)). Chapter 3 is devoted to presenting the author's views on the so-called Hegel's thesis or Hegel-Heraclitus thesis, according to which there are real contradictions in the form of pairs of sentences A and ¬A that are simultaneously true. Although the author concludes in favor of Hegel's thesis for the domain of abstract entities such as paradoxical constructions, he leaves the question open for real objects in the universe, stressing that "knowledge is possible, even if the universe is (or were) inconsistent" (pp. 221). More recently, a radical defense of the *dialetheia* (a neologism to nominate real contradictions) and the existence of the so-called transconsistent was exposed in (Priest (1987)). Whether or not one believes that da Costa or Priest are really convincing about Hegel-Heraclitus thesis or *dialetheia* (this reviewer at least is not convinced), what seems to emerge is that this debate, interesting as it may be for the foundations of the laws of thought, is independent of the second question posed before, namely: is it possible to build a well-founded logic system to deal with contradictions, wherever they come from?

This is the way, I believe, to have a good understanding of the uses of the principle of non-contradiction in human thinking: it is not

difficult to agree that human reasoners do have a method to support contradictions (without slipping into triviality). In everyday thinking, after all, one encounters many contradictions which do not destroy thinking. This is true even in more idealized domains of thinking, as exemplified in the hypothetico-deductive method when contradictory hypothesis are held for an undetermined period of time. What makes paraconsistent logics interesting thus, is not only the investigation of the underlying assumptions, but the possibilities of offering a philosophically acceptable calculus with a satisfactory semantics.

D. THE SEMANTICS

As mentioned before, this French edition adds two appendices (one on paraconsistent calculi and one on its semantics, known as valuation theory), expanding and modifying two smaller appendices present in the Brazilian version. Although valuation semantics can be satisfying from the purely formal viewpoint, it can be criticized for not really explaining what paraconsistent logic really talks about. In recent works (cf. Carnielli (1999)) an alternative kind of semantics has been proposed, which fits especially well for paraconsistent logics. The central idea is that given, on the one hand, a family of logics L_λ having philosophically acceptable (or defensible) semantics, and on the other hand a problematic logic L, written in a language we consider to be foreign, under certain conditions it is possible to interpret the behavior of all connectives and sentences of L in terms of a family of similar connectives and sentences of the basic logics L_λ by means of *translating* these foreign connectives and sentences to the basic logics. In this way, by means of such possible-translations semantics, one can offer a completely new meaning to paraconsistent logics, and in particular for the ones mentioned in the appendices. This approach is a new account of the semantical treatment of paraconsistency and is absent from the book and from the translation (due to the dates of publication) but it

deserves to be mentioned because it can better explain some aspects of paraconsistent logics.

There are some unclear statements in the book. In the main theorem on page 264 (Appendix 2) the notion of "maximal logic "is missing, for example. There are also many misprints in the book (like recurrent misplaced orthographic accents in Portuguese words) but there were many misprints in the original version too. Such misprints, even if they do not cause any major misunderstanding, reveal a certain hastiness from the editor. Nevertheless, the book is so generous in bravely confronting the philosophy of logic from the observational bases of logical principles and general foundations of thought that the reader will be glad to have this book at hand.

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