

Consistency, Paraconsistency and Truth (Logic, the Whole Logic and Nothing but 'the' Logic)

NEWTON da COSTA (e-mail: ncacosta@usp.br)
OTÁVIO BUENO (e-mail: oasbueno@usp.br)
Department of Philosophy, *University of São Paulo*

ABSTRACT

After examining some components of a framework articulated in terms of general remarks on logic (in which two inadequate views of it are critically investigated), we present some arguments to the effect that a fallibilist, pluralist, though certainly not relativist, proposal might be interestingly pursued. Based on this proposal, we argue for a comprehensive agnosticism in connection to some issues raised by paraconsistency (in particular with regard to the existence of true contradictions). Such an agnosticism, not being philosophically committed to any particular "interpretative" claims surrounding paraconsistency, seems to be at the moment more adequate than the alternative proposals.

(Introduction; 1. Logic: old-fashioned and radical views; 2. A true logic?; 3. True contradictions?; 4. Concluding remarks)

Indeed, even at this stage, I predict a time when there will be mathematical investigations of calculi containing contradictions, and people will actually be proud of having emancipated themselves from consistency.

L. Wittgenstein

INTRODUCTION

The aim of this paper consists in putting forward some arguments in order to claim that one of the expressions in our title «does not denote». Indeed, the very idea of a unique, global, all-embracing logic («the whole logic», mentioned above) seems to be, for several reasons, fairly inadequate. We shall thus be talking in detail and for some time about a «non-existent» topic, and just as Popper has once remarked with regard to scientific method, there is frequently considerable things to be said on such issues.

In a less playful mode, we intend to present and to review here some arguments in favor of a pluralist stance with regard to logic in general and an agnostic view concerning some questions in connection to paraconsistency in particular. Several theses to be here argued for seem to us quite straightforward (not to say simply obvious), being thus, at least for us, rather surprising to note how they can be so at odds with the literature. But anyway, this might be due to a general feature of philosophical issues (though perhaps not only of them): the obvious being so theory-laden and relative...

In order to proceed towards our task, we shall first outline a comprehensive framework within which the mentioned arguments will be later examined. This framework, to be suggested in sections 1 and 2, consists roughly of (rather) general points related to logic and some remarks concerning its nature. Afterwards, in sections 2 and 3, the arguments are to be put forward, and their relative strength shall be evaluated. We conclude the piece gathering together some of its threads.

Before closing this introduction, we wish to point out that the following discussion, in several respects, is quite preliminary and incomplete, being in need of further developments, which shall be opportunely pursued.

1. LOGIC: OLD-FASHIONED AND RADICAL VIEWS

As a certain «received view» of logic claims, for ages and indeed until recently (excepting mainly our century), logic has been thought of as a rather «uniform» discipline, as far as its basic conceptual setting is concerned. Its main problems, function, concepts and theoretical strategies, this view goes on, remained nearly «constant» throughout a considerable part of its development. Of course, during the years there have been changes, in fact several of them, but they can be viewed mostly as adjustments within a well established framework, rather than revisions of the setting under consideration. From this point of view (except again for our century), logic seems not to be the most «revolutionary» field.¹ A natural problem that one shall face at present (given this interpretation of logic) consists then in supplying an explanation of such an obstinate feature.

¹ For an interesting and illustrative discussion of this issue with regard to mathematics, see Gillies (ed.) [1992a]. Of course, things are quite distinct if one considers the changes that logic has undergone from the last part of the nineteenth century onward; but we shall examine this in a moment. For a defense of a revolutionary view of this subject (considering specifically Frege's role), cf. Gillies [1992b].

Despite its strangeness (in several respects), this particularly monolithic view of logic and its development might still be extended to our own century, and then one would simply have one unique logic, the «whole» logic as viewed from a Fregean perspective, and which might include centuries of the Aristotelian approach as a special case. If this were not so, how to understand such a stability of logic, so strikingly distinct from other branches (even formal ones) of knowledge?

One can think of old-fashioned explanations. ‘Well’, the nice fellow approaches us, ‘logic has been so «stable» because it is from its very nature to be so. After all, it is concerned with the (most general) ways we use some «logical» words, such as, connectives, quantifiers, etc. (for a discussion, see Quine [1963]). And as far as this usage remains the same (or nearly the same), which means not changing our basic conceptual framework, it is natural to expect that our «logic» has not been modified as well.’

There is indeed a serious sense in which this putative explanation is old-fashioned, and this is concerned with the very conception of logic adopted by its proponent in this context. Logic seems here to be taken basically as a tool employed in the evaluation of particular linguistic phenomena, for instance, and perhaps specially, in reasoning. To this extent, it is thought of as consisting fundamentally of propositional and first-order quantificational logic. Though, of course, besides this, it might also be employed for the construction of mathematics. In order to do so, one needs set theory - but set theory, our fellow goes on, is not logic...

It seems to us that there are several delicate issues entangled here. Just as other fields of knowledge, logic by no means could be described in such simplistic terms. Similarly to mathematics, it can be viewed from a pure or from an applied perspective. From a *pure* one, it is basically concerned with the formulation and study of certain abstract structures, such as, for instance, models, formal languages, Turing machines, etc. At this level, it is basically an *a priori* discipline, developed, like pure mathematics, with the same freedom that Cantor had once identified as the very nature of mathematics. That is, no unrevisable constraints are to be laid down beforehand here; indeed, as the development of paraconsistent logic has shown quite clearly, not even consistency ones. In conformity to the celebrated Hilbertian motto to the effect that the mathematicians should examine all logically possible theories, the logicians while devising and analyzing their structures shall proceed in a similar way. (Of course, the bounds of «logicality», and in particular, of what to deem

as «logically possible», with the inception of non-classical logics, have changed drastically within the present century.)

Conversely, from an *applied* perspective, logic is fundamentally concerned with the use of abstract structures, which have been devised at the pure level, to model some aspects of particular domains of investigation. In fact, just as any particular field of an empirical science, applied logics have also their proper domains. The delimitation of these domains depends of course, analogously to what happens within science proper, on several grounds, ranging from particular features of the abstract structures adopted to specific traits of the domain of application, as well as to the expected degree of precision to be met by the problems being considered. At the applied level, however, as opposed to the pure one, *empirical constraints* (taken in a broad sense) have clearly a relevant function, in particular in the determination of the acceptable solutions to the problems under examination, and to this extent logic is not quite so *a priori* but presents remarkable *a posteriori* traits. Moreover, pragmatic considerations (such as theoretical simplicity, capacity of systematization etc.) enter as well. As a result of the interplay between pragmatic and empirical features (not to mention of course the obvious function of abstract structures), the heuristic resources at disposal of the applied logician are considerable. On this regard, we should note that the evaluation of particular samples of reasoning, usually taken as the very aim of logic, seems to us as nothing more than one of its applied roles, and by no means shall be mixed with its pure ones. (For further details on and developments of these views, see da Costa and Bueno [1996].)

With these remarks, we wish to point out the fact that, in our view, restricting a consideration of logic just to (1) first-order logic and (2) to the sheer evaluation of arguments constitutes, beyond any doubts, an extreme oversimplification. Too much is left behind with such a move. In particular, the picture that emerges both of logic and its development seems to be, in several respects, quite unsuitable. There is no room, for instance, to several important applications of logic both to mathematics and to the empirical sciences, nor to an *understanding* of whole branches of theoretical research in pure logic, not to mention of course the emergence of non-classical systems. Moreover, the problem that this oversimplified proposal has been set out to solve (namely, the stability of logic) was left thoroughly unsettled, for this proposal has just shifted the analysis of the issue concerning the presumed stability of logic to the fairly more doubtful stability of our use of some «logical» words. To this extent, the «solution» (if there is any here) would be blatantly circular, given that the very meaning (and thus the proper stability) of such words depends upon the logic being employed!

So much for old-fashioned explanations. These, however, by no means are the only ones at our disposal. One should also examine (and these are particularly important in the present context) «radical» views. Logic, or so the latter goes, has been so stable because *it is true!* And if we have reached the truth with it, why should we ever change it?

This is a perplexing and undeniably bold proposal. In fact, in what sense is a particular logic *true*? Of course, in order to answer such a question one has first to spell out the meaning of «logic» in this context, and then to ponder on the notion of truth that might be here employed. With regard to the former, the same considerations that we have just made (in connection to pure and applied logics) naturally hold. Indeed, logic can be viewed from several perspectives; think, just to take an example, about the connections between the so called linguistic and structural approaches to logic (for a discussion, in the context of algebraization issues, see Béziau [1996]). Of course, such a multifarious way of analyzing it, makes the whole issue surrounding its characterization much more delicate. It is natural then that what to deem as logic by no means be an undisputed issue, being subject in particular to several methodological considerations. From our perspective, given that logic is basically concerned with the study and systematization of certain conceptual structures, and that in order to formulate them we need, for instance, set theory, it seems reasonable to demand that a logic, to be taken as such, be developed at least up to this point.

Anyway, trying not to take too many sides on this issue and considering logic in as abstract and general a way as possible within the present framework (be it concerned with the study of «logical» structures, with the application of them to particular mathematical or empirical issues or whatever), the problem - in fact the second one mentioned above - of considering (a particular) logic as *true* is undeniably subtle. Indeed, how to examine and to conceive the truth of such field? Of course, one has here to distinguish, on the one hand, between mathematical and logical truths (as certain statements considered as true within particular domains of mathematics and logic) and, on the other hand, the thesis that mathematics and logic *are true* (which depends not only on their domains as pure disciplines, but presumably on those considered in their applications as well).² In both cases, the conception of truth to be adopted - truth as correspondence, as coherence, a pragmatic view or a deflationary proposal - is by no means a trifling matter, and when our «radical» philosopher presents his/her case, one is supposed to have in mind which conception is being employed.

² There are several discussions of and proposals on both issues scattered through the literature (see, for instance, Benacerraf and Putnam (eds.) [1983], part III).

Depending on the chosen view, distinct philosophical consequences (with regard, for instance, to ontological commitments) are obtained, and have to be clearly sorted out.

However, instead of pursuing here such a rather abstract and idealized line of inquiry, in what follows we intend to examine this issue in a special, «more concrete» fashion, trying afterwards to draw some conclusions for this general discussion. We shall thus briefly consider how the introduction of paraconsistency to the philosophical scene has brought new perspectives to some of these issues, also presenting, along the way, critical remarks to some versions of the «radical» view.

2. A TRUE LOGIC?

When claiming that logic *is true*, the radical philosopher intends to highlight an aspect of logic that may help to understand its stability. The first rather unclear point with this view, however, consists exactly in this assumption: is logic really stable in the intended sense? Indeed, specially in the present century, with the comprehensive development of non-classical logics, dramatic changes have been brought into the logical scenario, and hardly anyone, at least in our view, would seriously claim that we don't have here a striking example of a revolution. Consider, in particular, the drastic revolution, somehow already predicted by Wittgenstein (as his words in our motto indicate), represented by the inception of paraconsistent logic *vis-à-vis* the standard conceptions of the role of consistency within our conceptual frameworks. So, one finally wonders, is there really *stability* in such a context?

This is more than a rhetorical question. In fact, some recent writers, particularly from the non-classical «front», notwithstanding the emergence of alternative logical proposals, surprisingly seem to defend the thesis that certain logics *are true*. As opposed perhaps to their fellows physicists, for centuries acquainted with the phenomenon of theory change, which might have eventually induced them to fallibilistic views, these writers seem to have simply changed the pole of their discussion. Instead of claiming, with the older «radical» proposals, that *classical* logic is a tool to apprehend the most general structure of the world (it is supposed to be true after all!), their new «radical» version claims the same as far as certain *non-classical* logics are concerned. One wonders, in such a case, about the meaning of learning from experience - that is, from the recent history of logic. Indeed, what is the import, the relevance of this history, with the changes and moves that it has yielded, to our

philosophical understanding of logic? Given these circumstances, how not to be fallibilistic after all? (And *this* definitely is a rhetorical question!)

Accepting such a fallibilism, nonetheless, by no means leads one necessarily to a relativist view. In order to note this, the pure/applied «dichotomy» might be quite useful. As we have previously remarked, from our point of view, each particular logic has its specific *domain of application* (classical logic, for instance, as opposed to intuitionistic ones, is not appropriate to study the constructive features of mathematical thought). To this extent and in contrast to the «radical» views, an all-embracing logic, appropriate to all domains is hard to find. We are thus in general left with (several) alternative logics that describe only some aspects of them, and there are many heuristic and pragmatic reasons to choose between such logics, depending in particular, of course, on the specific traits found in such domains. Thus the relativist threat, based on the claim that there are no criteria of choice between rival logics, can be at least in part circumvented. A fallibilist view of logic (indeed, a rather natural outcome of the conspicuous proliferation of logical systems in the present century) does not seem then to imply relativism inescapably.

It seems accordingly that the view that is here presented can naturally match some «lessons» of our recent history of logic, pointing out as they do to the proliferation of logical frameworks (which in turn spontaneously leads to fallibilism), with a refusal of a relativist stance, based on heuristic and pragmatic grounds. As a matter of fact, the underlying motivation for the introduction of various non-classical logics³ consists exactly in specific inadequacies of the classical framework to deal with certain issues (which of course is not to claim, much on the contrary, that classical logic is worthless!). From our standpoint, this feature produces evidence in support of a «domain-oriented» view of logic. To some extent, or so we claim, each logic (at least with regard to its application level) has its proper domain, it «models» some aspects of it, establishing what is and what is not acceptable within it. The natural move from

³ For some motivations for the devising of paraconsistent logic, see da Costa and Bueno [1996], section 2; da Costa, Béziau and Bueno [1996], introduction; da Costa, Béziau and Bueno [1995], sections 2 and 5, and the references therein. We just wish to note here that among these motivations the interplay between semantic and set theoretic issues was of paramount importance. One should note that, at least on philosophical grounds, it is needed to have a paraconsistent set theory already articulated if one intends to develop a reasonable semantics for paraconsistent logic (given that semantics shall be constructed within set theory). That is the reason why the first author, when first presented his paraconsistent systems, not having developed yet a paraconsistent set theory, formulated them in a syntactic, not in a semantic, way (for a discussion of some questions related to semantics, see da Costa, Bueno and Béziau [1995]; for a recent treatment of some paraconsistent systems, cf. da Costa, Béziau and Bueno [1995]).

here consists in advocating then a *pluralist* stance. However, for the same heuristic and pragmatic grounds, such a pluralism shall not commit us to a relativist view; after all one has some criteria of choice between rival logics. Of course, and we insist on this, such criteria, besides not being conclusive (we are all fallibilist), are not epistemic as well (for we are not planning to inflate our ontology). This is an important point, and with it we return to the issue of truth.

In not being interested in inflating our ontology, we intend to suggest that it is possible to present an account of some philosophical problems concerning logic independent from the notion of truth (or at least a strong notion of truth), and in particular, from the concept of a true logic. We wonder, in fact, in what respects these notions might be relevant to the comprehension of the main elements of logic. Our only guess concerns applied logics. If they are to be minimally successful, perhaps our «radical» might claim, they have to be true, at least as far as their domains are concerned. This is an interesting remark. The problem underlying it, as in general with any radical view, consists in supplying evidence to the claim that such logics are in fact true. No means though seem to be available to offer such an evidence (there seems to be a considerable underdetermination at this level). As far as we see, applied logics can be at most pragmatically acceptable (given certain methodological considerations), but hardly true *simpliciter*, and thus why should we be committed to this notion? We shall then propose an agnostic view with regard to truth. After all, from certain aspects, we don't need this notion in order to understand, develop and apply logic; indeed, in order to do most of the usual things we intend to with it! (This point though is quite controversial, and shall be developed in future papers.)

All these general remarks concerning logic apply of course, specifically, to paraconsistency. In particular, as we shall now examine, we have here a quite comprehensive agnosticism: not only to truth, but to true contradictions as well.

3. TRUE CONTRADICTIONS?

Based on the previous considerations, we wish to furnish in this section some remarks on the nature of the paraconsistent undertaking as it has been articulated (at least from our perspective) thus far. From our point of view, paraconsistent logic can be presented as a formal construction, similar in several respects to many others found within mathematics. Just as an algebraist (*qua* algebraist) examines, for instance, properties of finite groups, indepen-

dent from any specific philosophical commitments regarding them, it is possible to investigate, as it has been done, some features of Russell's set (or of any other «inconsistent object»), with no triviality, employing in order to do so a paraconsistent set theory, independent from philosophical commitments with regard to the nature of the contradictions involved (see, for instance, da Costa and Bueno [1996], and da Costa, Béziau and Bueno [1996]). From this point of view, as a research domain, paraconsistency has a conceptual status similar to other mathematical fields.

Is this, however, an undisputed thesis, or even a simple one to defend? After all, when one replaces deeply entrenched components from the classical paradigm - within which consistency has played and still plays a prominent role, bounding the extension of what could be legitimately investigated -, moving and stretching its limits, from the inconsistent to the non-trivial, wouldn't, to some extent, the very *meaning* of the researches developed *ipso facto* be changed? Remarkable debates concerning for instance the notion of existence in mathematics and its relationship with the concept of consistency would undoubtedly lose much of their strength, and probably would have to be completely rewritten. Traditional epistemological questions related to the nature of knowledge, in particular of that supplied by mathematics, will have to be reviewed. Indeed, what is paraconsistent knowledge? What does it mean to «apprehend» an «inconsistent» object? Is such an ontology (based on this kind of objects) necessarily presupposed in the formulation, or in the employment, of a paraconsistent logic?

These are just a few questions, among several others that might have been formulated, placed at an *entirely distinct level* from that in which we find ourselves when making the comparison between the conceptual status of paraconsistency with other domains of mathematics. One is here concerned with a methodological distinction. Just as it is usual to operate a demarcation between foundations and philosophy of mathematics, the former being, to some extent, entangled in mathematics, *mutatis mutandis*, it is possible to introduce, in this context, a similar distinction between foundations and philosophy of paraconsistency. It is clear that each of the above questions involves conspicuous philosophical components that are not to be found in the research developed at the foundations level. It is one thing to operate with a paraconsistent logic, examine distinct formulations of it, extend its result to new domains (for instance, elaborating a paraconsistent model theory); another one, of a completely distinct nature, consists in investigating the nature of the assumptions involved in such an inquiry. As far as we understand, it is perfectly legitimate to develop the first activities in an almost independent way from the second

ones. Indeed, it is for this very reason that we have matched the status of paraconsistency with that of mathematics.

Such a demarcation, between foundations and philosophy of paraconsistency, represents of course just a «division of labor» within the various researches in this area, by no means indicating any kind of negative evaluation with regard to the parts involved. This is, nevertheless, an important delimitation, whose neglect may add up to severe distortions, despite being quite simple. For instance, G. Priest and R. Routley, based on the presentation of a certain kind of paraconsistent logic, seem to argue for the existence of «true contradictions» (a proposal that they call «dialethism»; see Priest and Routley [1989], and Priest [1987]). Independent from the acceptance or not of the existence of such contradictions, it seems to us that the very strategy of argumentation adopted by them is considerably fragile. Just as, in general, one does not settle metaphysical issues, nor choose between rival conceptions of this kind, by appealing to current physics (given that the latter, in most cases, underdetermines the former), one does not establish questions concerning the interpretation and nature of logic based on the sheer examination of the content of the logical theories involved (indeed, factors of several orders have to be taken into account in such a context). From our point of view, it seems that the sheer formulation of a logic does not in general supply the very defense of a «speculative» thesis regarding it: the fact that there are paraconsistent logics does not necessarily commit one to the existence of «true contradictions». These are traits clearly situated at distinct levels.

For this reason, as opposed to Restall (see Restall [1995]), in our opinion, there is no problem with the adoption of an *agnosticism* with regard to the existence of this kind of contradiction. According to Restall, «this does not seem to be an interesting position to hold. After all, each theorist in this particular debate thinks that *if paraconsistency is true, then either dialethic or non-dialethic paraconsistency is true too*» ([1995], p. 2, note 1; the italics are ours). On the contrary, it seems to us that even the antecedent of this conditional is fairly tendentious. The question concerning the *truth* of paraconsistency will inevitably carry us beyond the limits of paraconsistent logic, at least as far as its foundations are concerned - the level in which we intend to be. Thus, if from Restall's viewpoint, «it is unclear whether Brazilian school of paraconsistency adheres to a non-dialethic or a dialethic paraconsistency, as their writings do not indicate whether they think of inconsistencies as possibly true or not» ([1995], p. 3), this is just a sign of the agnostic view that we hold. A commitment to the *truth* of paraconsistency, as we have already remarked, by no means seems to be, from our perspective, necessary neither for the de-

velopment of theoretical research with regard to paraconsistent logic nor for the various applications that such research has opened up. In connection with the former, heuristic and pragmatic commitments (independent from the notion of truth) are enough to motivate and sustain the most diverse inquiries in the field; concerning the latter, a commitment to the «pragmatic truth» (or to the sheer «empirical adequacy») of such a logic seems to suffice to «legitimate» its applications. Hence, one finds here a double-headed agnosticism: on the one hand, with regard to the *truth* of paraconsistency; on the other, though closely linked to this, concerning the *existence* of true contradictions.

However, although this seems to be, to some extent, a quite simple thesis, *at the abstract level of formal sciences*, just as the research related to paraconsistent set theory suggests (this is, for instance, the case of Russell's set and Russell's relations), there is, *in a certain sense*, the possibility of the «existence» of «true» contradictions. Nonetheless, such notions, both of existence and of reality, have in this context of course quite distinct a meaning (and independent from the postulation of any Platonic world!) from the one employed when one claims that reality is actually contradictory - not jeopardizing thus, in any way, our agnosticism.

Anyway, independent of «speculative» issues such as these, and once again in conformity to the agnosticism here proposed, perhaps one of the most striking features supplied by paraconsistency consists in its considerable «heuristic power»: new conceptual perspectives are brought, leading thus to new questions and new problems to be examined. To illustrate this remark, we can mention (among others) two examples, one of them from logic, the other from mathematics, which have been developed in detail elsewhere (see da Costa, Béziau and Bueno [1996], Chapter 3, and Mortensen [1990]).

(1) Based on the development of a paraconsistent set theory, it is possible to advance a *paraconsistent model theory*, which generalizes several classical results. Moreover, (2) still based on such a development, the devising of a *paraconsistent theory of infinitesimals*, which reformulates, under new grounds, one of the most celebrated (though no less controversial) concepts of mathematical analysis is made possible. In particular, in this theory of infinitesimals, the well known inconsistencies detected in the foundations of the calculus, since its very inception, can be taken at face value. Consider, for instance, the following remarks made, in 1696, by the Marquis de l'Hospital, a pupil of Leibniz and John Bernoulli, in the beginning of his *Analyse des Infiniment Petits pour l'Intelligence des Lignes Courbes*:

First requirement or supposition. One requires that one may substitute for one another two quantities which differ only by an infinitely small quantity: or (which is the same) that *a quantity which is increased or decreased only by a quantity which is infinitely smaller than itself may be considered to have remained the same [...]*. (de l'Hospital [1696]; quoted in Robinson [1967]; the italics are ours.)

As the italicized expression makes plain, de l'Hospital's first requirement is clearly inconsistent! However, at least from de l'Hospital's viewpoint, his proposals were not trivial. It seems fairly natural then to suggest a paraconsistent approach to reconstruct his views.

So, as these two brief examples suggest, paraconsistency may supply interesting perspectives to the examination of conceptual issues involving inconsistencies, though, as we have been arguing for, in an independent way from any specific philosophical commitments with regard both to truth and to true contradictions.

4. CONCLUDING REMARKS

We wish to conclude this paper concisely gathering together some of its threads. After examining some components of a framework consisting of some general remarks on logic (in which two inadequate views of it were critically investigated), we have presented some arguments to the effect that a fallibilist, pluralist, though certainly not relativist, proposal might be interestingly pursued. Based on this proposal, we have argued for a comprehensive agnosticism in connection to some issues raised by paraconsistency.

We should note that such an agnosticism, not being philosophically committed to any particular «interpretative» claims surrounding paraconsistency, seems to be more adequate than the alternative proposals. In particular, for that matter, it may reflect a more appropriate attitude for the researcher in the paraconsistency domain, who may simply «put into brackets» his/her possible commitments with regard to them, while investigating the relevant issues.

References

- Benacerraf, P., and Putnam, H. (eds.) [1983]:** *Philosophy of Mathematics: Selected Readings*. (Second edition.) Cambridge: Cambridge University Press.
- Béziau, J.-Y. [1996]:** "Logic May Be Simple (Logic, Congruence and Algebra)". Unpublished manuscript, University of São Paulo, to appear.
- da Costa, N.C.A., Béziau, J.-Y., and Bueno, O. [1995]:** "Aspects of Paraconsistent Logic", *Bulletin of the Interest Group in Pure and Applied Logics* 3, pp. 597-614.

- da Costa, N.C.A., Béziau, J.-Y., and Bueno, O. [1996]:** *Paraconsistent Set Theory*. (In Portuguese.) To appear in Coleção CLE, Campinas.
- da Costa, N.C.A., and Bueno, O. [1996]:** "Paraconsistency: Towards a Tentative Interpretation". Unpublished manuscript, University of São Paulo, to appear.
- da Costa, N.C.A., Bueno, O., and Béziau, J.-Y. [1995]:** "What is Semantics? A Brief Note on a Huge Question", *Sorites - Electronic Quarterly of Analytical Philosophy* 3, pp. 43-47.
- de l'Hospital, G.F.A. [1696]:** *Analyse des Infiniment Petits pour l'Intelligence des Lignes Courbes*. (Second edition 1715.) Paris.
- Gillies, D. (ed.) [1992a]:** *Revolutions in Mathematics*. Oxford: Clarendon Press.
- Gillies, D. [1992b]:** "The Fregean Revolution in Logic", in Gillies [1992a], pp. 265-305.
- Lakatos, I. (ed.) [1967]:** *Problems in the Philosophy of Mathematics*. Amsterdam: North-Holland.
- Mortensen, C. [1990]:** "Models for Inconsistent and Incomplete Differential Calculus", *Notre Dame Journal of Formal Logic* 31, pp. 274-285.
- Priest, G. [1987]:** *In Contradiction: A Study of the Transconsistent*. Dordrecht: Nijhoff.
- Priest, G., and Routley, R. [1989]:** "The Philosophical Significance and Inevitability of Paraconsistency", in Priest, Routley and Norman (eds.) [1989], pp. 483-539.
- Priest, G., Routley, R., and Norman, J. (eds.) [1989]:** *Paraconsistent Logic: Essays on the Inconsistent*. München: Philosophia.
- Quine, W.V. [1963]:** "Carnap and Logical Truth", in Schilpp (ed.) [1963], pp. 385-406.
- Restall, G. [1995]:** "Paraconsistent logics!". Unpublished manuscript, Australian National University, to appear.
- Robinson, A. [1967]:** "The Metaphysics of the Calculus", in Lakatos (ed.) [1967], pp. 28-40.
- Schilpp, P.A. (ed.) [1963]:** *The Philosophy of Rudolf Carnap*. La Salle, Ill.: Open Court.