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Book Review

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Nimrod Bar-Am

Extensionalism: The Revolution in Logic New York: Springer, 2008. xxii + 172 pp.

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Nimrod Bar-Am has written a salutary book for us. It is written in a delightful and engaging style. It is well researched and original. It is not only a good research tool; it is also thought-provoking. The academic disciplines to which it is of interest are: philosophy, logic, mathematics, computer science, the empirical sciences, as well as anyone interested in the history of argumentation. It would be a good university course text, not to replace an introductory logic course, but as a follow up, to give depth and perspective on logic as it is presented in the modern classroom. It is suitable for a good lay reader, an undergraduate student, a graduate student, or a professional researcher. The reason the book is suitable for such a broad audience is that all technical matters are well explained. Unnecessary details are spared. The style is fresh and engaging. The book is written at several levels, so that a more superficial reading will be rewarding, as will a deeper and more careful reading from a professional researcher. It is a well of interesting and precise history, and a thought-provoking account of the history.

Bar-Am traces the history of logic from before Aristotle to the present day, emphasizing Aristotle and heralding Boole's innovations in logic. For Bar-Am, Boole made a giant step in pulling us out of the conceptual quagmire inherited since Aristotle. Bar-Am's thesis is that the history of logic shows us a general trend, which he calls "extensionalism." Roughly, extensionalism is a desire to rid logic of all trace of intensionality, since intensionality is assumed to be inversely proportional to extensionality; the more intensional a term, the less extensional. The motivation is to make what were hitherto intensional notions clear. The extensionalist believes that we increase clarity through dis-ambiguation. One form of ambiguity the extensionalist deplores is ambiguity of reference; another, concerns

transparency of substitutivity in translation; a third concerns intended (or allowed) interpretations. For example, in Aristotelian syllogistic reasoning, only the verb “to be” may be used (in verb position), as in “all men are mortal.” In Ancient Greek and in English, the verb “to be” (on its own) is ambiguous between: “is identical to,” “is identical to or greater than,” “is a member of,” and so on. Context and judgment must be used in order to avoid silly errors in reasoning, as would happen were we to mistake “are” in “all men are mortal” with identity. We would then reason that “mortal” is not a property of men, but is a species (assuming that we knew that “men” is a species). We don’t make this mistake. This is partly because we know that “men” is a species, and “mortality” a property. But even if we did not quite know this (if we replace “mortal” with an unknown word), we would not make the mistake because of the presence of the quantifier before “men” but not before “mortal.” But to know where it is appropriate to use the quantifier, we have to know what sort of term “men” is and that “mortal” is not a count noun. In other words, without a prior, and quite sophisticated (even if implicit) knowledge of grammar and some basic science, we cannot hope to correctly deploy syllogistic reasoning—as presented in Aristotle and his followers. When we associated “logic” only with syllogistic reasoning, we knew this. This is why “logic” was thought of as an art, and not as a part of mathematical, formal calculation (as “logic” is thought of today).

One way in which logicians have tried to rid logic of ambiguity is to increase the formal, or symbolic, representation of reasoning. Explaining the vocabulary further: a formal system of logic, or reasoning, is extensional if and only if identity is defined in terms of extensions (the objects to which terms in the language refer). That is, two terms are identical if they refer to the same (set of) objects. For example “ $2 + 8 = 10$ ” is an identity statement. In arithmetic, “ $2 + 8$ ” refers to exactly the same object, or extension as “10.” The extension is the number 10. In arithmetic, mathematicians do not care which term one uses, “ $2 + 8$ ” or “10” because they are (to all intents and purposes of arithmetic) identical. Therefore, arithmetic is an extensional formal system of calculation of numbers.

In contrast, intensionality brings with it ambiguities. Intensionality has to do with the mode of presentation, with the particular words used, or the order in which they are used. “ $8 + 2$ ” is intensionally different from “10.” The former term includes an operation (of addition). The other just names a particular number. For most of mathematics, these details are uninteresting, so most mathematical systems are extensional. In fact, they are extensional in the precise sense that models satisfying identical terms are unique up to isomorphism.

The philosophical significance of the movement of extensionalism is to divorce logic from metaphysics (ontology and essentialism) and epistemology. Formal modern extensional logic is presented as a system of mechanical calculation. In contrast, earlier intensional logic required subtlety and common sense in order to be deployed. It was thought that the right use of logic could lead to scientific knowledge—through investigation of what is essential, to a genus, a species or other categorical-type concepts. These lofty ambitions have been abandoned by modern logicians.

Boole made one of the most significant contributions to our enlightened extensionalist attitude in logic, and this was to simply separate formal logical grammar from reference. He did this by allowing both the empty set and the universal set. Nonreferring names or terms, such as “Hamlet,” had been a problem in logic throughout its history. We seem to be able to reason about nonreferring names, but this cannot (or so it would seem) provide us with scientific knowledge of this real and physical world. Even De Morgan, a contemporary of Boole, was categorical about not allowing nonreferring terms in his logic. After all, we have to reason about something. Boole dismissed De Morgan’s restriction, since, for Boole, the reasons for the restriction do not belong to logic, but belong to ontology. The latter is a metaphysical problem, not a logical problem. Statements separating the role of logic from other areas of philosophy or science are so much the received view today, that we find it difficult to read older (pre-Boole) logicians, and for this reason, it is excellent that Bar-Am recognizes, and emphasizes, the depth of Boole’s contribution to our thinking about logic. This contribution of Boole’s is overwhelmingly overlooked in the literature. This is partly because we think of it as obvious. Unfortunately, this obviousness (to us, but not to logicians before Boole) has led to a lot of misinterpretation and misunderstanding of past logicians. Boole’s contribution has hit us quite deep—so much so as to be overlooked! We can thank Bar-Am for showing this to us.

What I regret in Bar-Am’s book is the sketchy index, some lapses in giving references, and some repetition of phrases and themes. Nevertheless, some repetition is useful for the student, and also for someone who dips into the book, rather than reading it cover-to-cover. There are some important typographical errors, which are obvious to the initiated, but might mislead, or confuse, the beginner. For example, on page 141, Bar-Am systematically uses “union” where he should use “intersection.” Thankfully there are few such errors, and they are obvious to the informed reader.

More important, because Bar-Am’s thesis and emphasis is original, his book should not be read as yet another version of “the received view.”

Handle with some care: more in the sense of being aware of the controversy of the position, and therefore paying attention to the arguments used to defend the thesis of the book. There are two aspects of the thesis. One is descriptive: noticing that extensionalism in logic has been a major source of confusion and controversy and has increased over time. The other is evaluative: that this is a positive gain—we have made definite progress in our understanding of “logic.” Since both parts are controversial, the reader should have the ambition to read more widely into the issues and evaluate Bar-Am’s view for himself. Personally, I do not think that Bar-Am is right or wrong. I think that he has identified something very important in the history of logic. I applaud the focus, and have grown richer (conceptually) for having read his book. But I take his thesis in context of wider reading. Succinctly: I prefer the description to the evaluation. But the evaluation is what gives Bar-Am’s writing a certain passion and energy.

The very general lesson of the book is an appreciation of the tortured history of the discipline, or topic, of “logic”. The term “logic” has assumed many different roles: as a guide to perfect reasoning, as a scientific tool, as part and parcel of the study of metaphysics and as included in the organization of the ontology of the world (as something real and outside us). The modern developments have given us a leaner and more precise tool than what we had before, defrocked of epistemology, metaphysics, and science and including a distinction between syntax and semantics. “Logic” is not just one thing, or one category. Once we put the term “logic”, and the careful thought which went into the development of the discipline, into their historical perspective, we can appreciate student disappointment in learning dry formulas which seem to never take us beyond the a priori. The student does not immediately see why “logic” is “useful”. The term “logic” is now relatively precise, but it has a history. We can also appreciate the development of the myriad of formal systems. For, many of these make sense in the light of extensionalism—that is, in terms of giving symbolic expression to hitherto intensional notions. Once we have such a perspective the next step is to question it. Is extensionalism really a good thing? Do we want unbridled extensional logics? Are these possible? What is the relationship between extensionalism and intensionality?

I await a follow-up book with happy anticipation. For, recent developments in logic since Boole have forced us to be much more careful about the relationship between intensionality and extensionality. The relationship can no longer be thought of as an inverse relation. At root, this is because both are now thought of as qualitative notions, not quantitative. The conceptual waters are muddied by our development of intensional formal logics (i.e.,

logics not enjoying transparency of translation—where intentional operators have scope over a well-formed formula rather than a term). The relationship between intensionality and intentionality has also received significant attention. We have also developed formal systems of logic that include, what we call “intensional operators”, but are extensional—at least according to the definition given above. Inversely, we usually look to Frege (to the detriment of Boole) as the great developer of modern logic, but Frege’s contribution is highly problematic. Frege provided us with an axiom of extensionality in his formal logic. This states that identity of terms is to be thought of as isomorphic between extensions. But, despite the axiom, Frege’s formal system is intensional, in the sense of being highly interpreted (by the global universe of everything). Worse, it is a contradictory system, and the contradiction concerns exactly his axiom of extensionality, and the intended interpretation. The diagnosis of the problem in Frege’s formal system has occupied many great philosophers. *Grosso modo*, the treatment of intensionality and extensionality since Boole demands a subtle treatment, which I encourage Bar-Am to give us in the near future.