Book Review

Johan van Benthem

Exploring Logical Dynamics. CSLI Publications. Center for the Study of Language and Information, Stanford, CA. 1996. ISBN 1-57586-058-9. $22.95. xi+329pp. Softbound.

Johan van Benthem's book is somehow reminiscent of a Seurat painting. You can view it from close distance, which allows you to appreciate single brushstrokes, single results in the philosophy of logic, language and computation that have been contributed by the author or by his colleagues, either in the form of new logical calculi or of new perspectives on old ones. Or you can view it from a longer distance, maybe squinting your eyes a bit, and from this distance the brushstrokes lose their individual character, thereby revealing the overall, fascinating picture of the dynamic perspective on logic.

But, what is this perspective in the first place? what is "logical dynamics"? The book makes clear that there is no completely organic, thoroughly developed theory of logical dynamics yet, as the opposition 'dynamic' vs. 'static', "like the opposition 'procedural' vs. 'declarative' in computer science, has immediate appeal but very elusive content" [p. 285]. What van Benthem manages to convey, though, is that at the current stage logical dynamics (not to be confounded with dynamic logic *á la* Pratt, although there is a strong commonality in spirit between the two) is, more than anything, a way of looking at logical and linguistic phenomena which is somehow orthogonal to the received wisdom. Although dynamic concerns also feature within previous research in logic and language, the present paradigm is different in its clear debt to theoretical computer science.

The bottom line of logical dynamics is that there is a dual character to many entities we commonly deal with in logic and language. A sentence of natural language, or a formula of logic, should be studied not only for their "static" properties, which is the point of view privileged by standard logic, but also in their "dynamic" aspects. For instance, a sentence of natural language may be "statically" seen as having truth conditions, but once uttered by a speaker may also be "dynamically" seen as causing an information flow to the hearer, thus engendering a transition from her previous information state to a new one, much like the internal state of a machine changes after the execution of a programming language statement. Under this new light, natural language is *de facto* to be viewed as "the programming language of cognition", and this leads in turn to the investigation of linguistic devices as operators of an imperative programming language.

This book is a powerful statement that this metaphor is far-reaching, and that the study of many phenomena in natural language and logic (anaphoric reference, belief revision, quantification, to name but a few) may benefit from this analysis. Various influences are recognisable within logical dynamics, ranging from Ramsey's test for implication, to the dynamic logic of programs, to the Alchourron-Gärdenfors-Makinson theory of belief revision, and to speech act theory. The heterogeneity of the predecessors naturally makes a vision of logical dynamics as a possible unifying paradigm in the study of logic, language and computation, linger in the distance.

The author argues that the "dynamic stance", to which he has arguably been the major contributor since its inception, does not aim to substitute the static one, but to supplement it. This is just a reflection of the equal importance attributed within natural language to human activities

and their effects: natural language terms like "judgment", or "move", evoke both aspects at the same time. The dual character of reality that dynamicists advocate has various surprising consequences. For instance, the analytic tools provided by the dynamic stance even allow to shed new light on old pillars of logical analysis, e.g., revealing assumptions (Chapter 9) hidden under first order logic that, once substituted with their "dynamically justified" equivalents, yield decidability!

The book is beautifully written. Going through it is not an easy task, as in his walk through the repercussions of the dynamic viewpoint the author touches upon a wide range of tools and techniques, ranging from modal correspondence theory to cylindric algebras, and from dynamic logic to game theory; only a reader with a strong background in logic, mathematics and theoretical computer science may hope to understand the book in depth. However, the book will be enjoyed also by mathematically less sophisticated (or more philosophically inclined) readers, also thanks to the valiant, if concise, introduction to a number of advanced logical and mathematical tools (Chapter 3) with which the reader needs familiarity in order to understand the main points of the book.

This is an important book, and one which is bound to raise interest around logical dynamics among people that had not been previously exposed to the specialised literature of the field. Like a true Seurat painting, the contours of the picture which van Benthem gives are still fuzzy, as in a hazy morning: the agenda of dynamicists is still rich with unsolved problems, and the rich notes at the end of each chapter are there to remind researchers about this.

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