Carlos Alchourrón's Contribution to Logic

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It took many years for Argentine universities to emerge from the torpor imposed by military dictatorship in 1966. In particular, in the Faculty of Philosophy and Literature of the University of Buenos Aires, the investigation of logic and its philosophy all but disappeared when Gregorio Klimovsky left its lecture halls.

However, work in formal logic continued elsewhere in certain universities outside Buenos Aires. Even within the capital, logic and its philosophy were vigorously pursued in the *Sociedad de Análisis Filosófico* (Society of Philosophical Analysis), with contributions by people like Raúl Orayen and Carlos Alchourrón.

Until his departure from the University of Buenos Aires in 1966, Klimovsky had taught, with great success, concepts and results of the 1930s 'golden decade' of classical logic. In the following period, in the *Sociedad*, Orayen carried out exquisite analyses of fundamental philosophical problems using logical tools; Andrés Raggio in Cordoba continued his investigations of calculi of sequents; Antonio Monteiro maintained a precarious group working on algebraic logic in the Mathematics Department of Bahía Blanca; and Alchourrón brought to the Argentine philosophical scene, in both the *Sociedad* and the UBA, new and quite different kinds of logical problem.

These problems formed part of various research projects that he directed in the Faculty of Philosophy and Literature of the University of Buenos Aires. The projects made it possible to train professionals in philosophical logic and attract researchers from other areas, notably computer science; but they were interrupted by Carlos' untimely death in 1996.

Alchourrón's openness of spirit may have owed something to the fact that he was not himself a professional philosopher. He had graduated in 1957 as a lawyer, but never actually practiced the profession. Inspired by his readings from works of Kelsen, Carnap, Tarski and Von Wright, he chose as subject for his 1969 Doctoral Thesis in Law and Social Sciences the logical clarification of some normative concepts. From that point onwards, his intellectual activities centred on the study of problems in the philosophy of law and, most of all, the relation between logic and law.

Notwithstanding the quantity and variety of his work, one may present it, at least roughly, under three distinct but closely related headings: (1) The logic of norms and normative systems, (2) the logic of belief change, and (3) the logic of what are known

as defeasible conditionals.

Carlos began work on the first of these themes during the 1960s. Almost all his publications dealing with it were written in collaboration with Eugenio Bulygin. Although they first appeared in English, Spanish translations were published in 1991 in the collection *Análisis Lógico y Derecho*, with a preface by Georg H. von Wright. In the present author's opinion, Alchourrón's first fully original contribution was in the 1969 paper "Logic of norms and normative propositions", for it is there that he articulates three ideas that permeate all his subsequent work in the area, namely: (i) The logic of norms is distinct from the logic of normative propositions, and they need to be formalized in different ways; (ii) the system that had been proposed by von Wright in his 1951 paper "Deontic logic" is more suitable for formalizing the logic of norms than that of normative propositions; and (iii) the lack of clarity over this distinction is the source of a number of confusions affecting both logic and the philosophy of law.

These three ideas were applied to the juridical sciences in the book Normative Systems that Alchourrón wrote with Eugenio Bulygin. It was first published in English in 1971, then translated into Spanish in 1975 under the title *Introducción a la Metodología de las Ciencias Jurídicas y Sociales*, and later translated into German. Today it is accepted, without exception, that this work is one of the first systematic attempts to apply deontic logic to the analysis of juridical problems. It presents a rigorous analysis of the notion of a normative system and its structural properties and relates certain specific kinds of formal incompleteness to different kinds of juridical gap, thus breaking with the then received view in the philosophy of law that normative systems must always be complete. The volume had a great impact in America and Europe, and was the subject of many commentaries.

However, there were certain logical problems about normative systems that already deeply interested Alchourrón, but were not pursued in the book. One of these is the problem of the indeterminacy of elimination. It arises when some of the consequences of a normative system are derogated or otherwise eliminated, for such an action gives rise to a family of alternative subsystems without providing a criterion for choosing between them. The investigation of this problem led Carlos to write several papers, some in collaboration with other authors. The first of these, co-authored with David Makinson, was "Hierarchies of regulations and their logics" in 1981, followed in 1982 by the single-authored "Normative order and derogation". These two papers proposed tackling the problem by introducing a relation of order between norms of the system. They were the first of a series on rational belief change, of which the following are the most important: "On the logic of theory change: contraction functions and their associated revision functions" (1982), "On the logic of theory of change: partial meet contraction and revision functions" (1985) and "On the logic of theory change: safe contraction" (1985).

The first of these, written in collaboration with Makinson, sets out from the idea

that the difficulty arising from the derogation of norms is a particular case of a more general problem of choice between propositions, which presents itself in various ways according to the context in which it arises. The challenge is thus to characterize in a general manner functions of contraction of bodies of propositions, with derogation seen as a particular kind of contraction that arises in the context of a normative system.

The second of the three mentioned papers, written in collaboration with David Makinson and Peter Gärdenfors, takes this perspective further, passing from the 'maximal' and 'full meet' contraction operations developed in the first text, to more general 'partial meet contractions', which are characterized semantically using selection functions on families of maximal subsystems of the initial normative system. This quasi-semantic mechanism was characterized by postulates expressing regularity conditions on the associated contraction and revision functions themselves - conditions that had been articulated independently by Gärdenfors from a quite different perspective, namely that of revising a system of beliefs in the face of new evidence. The resulting general theory of rational change in a normative or epistemic context came to be known by the name AGM, an acronym formed by the initials of the author's names. AGM had great resonance in a number of domains, notably the logic of normative systems, the logic of artificial intelligence and, rather later, the area that came to be known as formal epistemology. Application to the first domain was initiated by Alchourrón himself: in a paper "Conflicts of norms and the revision of normative systems" (1991), he analyses the problems of change in normative systems in terms of the general AGM theory of partial meet contraction and revision.

The third of the papers mentioned above, also written in collaboration with David Makinson, examines an alternative approach to contraction and revision operations which, while quite different from the partial meet account in its conception and formulation, turns out to be essentially equivalent to it.

Following the work so far described, in the logic of norms, normative systems and belief change, Alchourrón's investigations culminated in a theory of defeasibility that covers, with minor adjustments to its parameters, defeasible conditional assertions of ordinary language as well as prima facie obligations in legal discourse. The most important publications developing this theory are "Philosophical foundations of deontic logic and the logic of defeasible conditionals" (1993), "Defeasible logic: demarcation and affinities" (1994), and "Detachment and defeasibility in deontic logic" (1996). While these papers made use of various ideas that were current at the time, it should be emphasized that those ingredients were knit into a unified perspective, providing a general logical frame within which it is possible to formalize both defeasible conditionals of natural language and various kinds of obligations, whether conditional or unconditional, in a manner that satisfies the intuitive condition known as the Ramsey Test.

We end by remarking that any non-monotonic account of defeasible conditionals similar to that of Alchourrón will exhibit behaviour that might be considered as un-

desirable. For example, as noted by Makinson, the consequence relations that are generated will not satisfy uniform substitution - a property that is possessed by classical logic and often regarded as necessary for a formal system to count as really being a logic. This in turn raises the more general question of what conditions a formalism should satisfy in order to be regarded as a genuine logic, which is in turn part of the philosophical issue of how the very notion of logic should be understood.

Discussion of these matters goes beyond the goal of this article, but we will make one further comment. Logic as a science appeared with Aristotle, and had the aim of investigating which among the forms of human reasoning may be considered valid. The Stagirite essentially resolved this problem for the particular case of the categorical syllogism. Later logicians of antiquity, such as the Stoics and the Megarians, initiated similar investigations into what is today known today as propositional logic; in the modern period this was further developed and completed by the fundamental contributions of Frege, Russell, Whitehead and others, thus forming the basis of what we now call classical first-order logic. Nevertheless, this did not bring an end to the difficulties of representing the forms of human reasoning. Further problems arise when one tries to apply classical modes of representation and the classical concept of validity beyond the confines of mathematical reasoning into everyday discourse about the world around us.

Unfortunately the early death of Carlos Alchourrón deprived us of the contributions to this new field of research that he would have certainly given us had he lived longer.

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