Preface

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We are very glad for the opportunity of dedicating the present issue of *Organon F* to modal logic, a subject that can be said to lie at the intersection of philosophy, mathematics and computer science. Nowadays there are innumerable applications of modal logic in various specific fields and it would be highly challenging to provide a detailed and all-encompassing report. The present issue is rather intended to represent a pause of reflection: it provides fundamental information on the history of modal logic from the early works of C.I. Lewis and draws attention to some current directions of research. This is the reason why we chose "Reflecting on the legacy of C.I. Lewis: Contemporary and Historical Perspectives on Modal Logic" as a title. We hope that the contents will be useful not only for readers already acquainted with the subject, but also for the broad philosophical audience interested in the formal analysis of concepts.

As the second half of the twentieth and the first two decades of the twenty-first century testify, modal logic is not simply a mathematical tool to structure our argumentations in a rigorous fashion. It is actually a way to philosophize, a multi-use framework to represent philosophical problems, and an overwhelming vocabulary to capture our basic intuitions about knowledge, meaning, reference, ethics, and, obviously, modal matters. With such a strong and determinate field comes a long and far-reaching history. The history of modal logic is indeed a subtle and complex story. Many logicians and philosophers

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were in the foreground for many years; they initiated long-lasting debates, introduced novel concepts, axioms, and techniques, or just pursued alternative philosophical lines that are still there to be examined.

Just to take one example, consider G. Bergmann. His polemical "The Philosophical Significance of Modal Logic" (1960) is quite similar to W.V.O. Quine's project to critically examine the modal notions against the background of our technical and philosophical commitments. Though Bergmann's paper is still cited sometimes, he is quite unknown in the story, even despite the fact that both of Bergmann and Quine forged their mature views at the same time and took similar examples; J. Hintikka (1963/1969) even claimed that Bergmann and Quine insisted on very similar questions. Bergmann published technical papers (1949; 1956) as well as philosophical inquiries about the modalities (1948a; 1948b; 1948c), but no members of his 'Iowa-school' took his line of thinking any further in these matters.

The history of modal logic is usually focused on its modern initiator, namely on C.I. Lewis and on his dissatisfaction with B. Russell and A.N. Whitehead's *Principia Mathematica*. Lewis thought that the way Russell and Whitehead handled the notion of 'implication' in their book was highly misleading. In *Principia Mathematica* implication is expressed through a truth-functional conditional (called 'material implication') which we can represent as $\supset$ and is such that $p \supset q$ turns out to be always true except when p is true and q is false. Thus, according to such a representation of implication, a true proposition is implied by any (true or false) proposition and a false proposition implies any (true or false) proposition. Lewis decided to look for alternative ways of capturing the intuitive meaning of 'implication' in order to avoid similar paradoxes. Though he started working on these ideas right after the publication of Russell and Whitehead's *magnum opus*, his results were published in his own philosophical-logical *epos*, *A Survey of Symbolic Logic* (1918), and later elaborated in more details with C.H. Langford in *Symbolic Logic* (1932).

After the introduction of a new operator for 'strict implication' ($\prec$), which conveys a necessary connection between the antecedent and the consequent, Lewis faced various philosophical and technical obstacles. (Note that from Lewis' first book on the issue only a few pages, not more than fifty out of four hundred, concerned the problem of the modalities.) Lewis provided much material for logicians and philosophers, and his reception was quite dynamical; sometimes philosophers got the louder voice over logicians, sometimes it was

the other way around. Lewis' influence can be measured in various ways, but it might be enough to point out that even in the 1950s, years after R. Carnap's major work on the modalities, most of the logic journals (like *The Journal of Symbolic Logic*, the *Notre Dame Journal of Formal Logic*, the *Bulletin of the American Mathematical Society* or *Studia Logica*) were filled with articles that either criticized or tried to improve Lewis' work. Things began to change only after Kripke's influential paper (1959) paving the road for a semantic perspective on modal logic, though it took again a few more years till Lewis entirely left the canon. But he is back now, both as a philosopher (Olan and Sachs 2017) and as a logician.

Lewis was not the first logician who considered a formal approach to modal logic (H. MacColl and even B. Russell spent some of their time on this issue), but it was certainly Lewis who put modal logic back on the table for generations and who developed such systems for the modal notions that kept busy hundreds of philosophers, logicians and mathematicians in the forthcoming century. We believe that his historical background, philosophical influence, and logical complexity have earned the respect and attention they deserve. Even after one hundred years from the publication of *A Survey of Symbolic Logic*, there are still issues, concepts and problems that Lewis could offer us —historically, logically, and philosophically as well.

As far as the structure of the present issue is concerned, the reader will find eight research articles, that can be arranged in two groups. The first group consists of the following contributions: "Modal Logic before Kripke" by Max Cresswell, "Semantics without Toil? Brady and Rush meet Halldén" by Lloyd Humberstone, "C.I. Lewis, E.J. Nelson, and the Modern Origins of Connexive Logic" by Edwin Mares and Francesco Paoli, and "Alternative Axiomatizations of the Conditional System VC" by Claudio Pizzi. These articles were submitted upon invitation and were reviewed by the guest-editors together with external experts. The article by Cresswell provides a concise overview of the main results obtained in modal logic before S. Kripke's work on relational semantics; among other things, it points out some aspects of the early development of modal logic that are quite often overlooked in historical introductions to the topic, such as the completeness results due to A. Bayart. The article by Humberstone shows that Halldén incompleteness represents a fundamental obstacle for any attempt to obtain systematic (and trivial) characterization results in modal logic via a homophonic semantics where the metalanguage includes a copy of the logical vocabulary of the object language simulating

its behaviour. The article by Mares and Paoli illustrates E.J. Nelson's early work on connexive logic, which was motivated by the desires of avoiding some paradoxes of strict implication and of developing a more fine-grained analysis of the notion of entailment; furthermore, it discusses C.I. Lewis' reaction to such an approach. Finally, the article by Pizzi provides some new axiomatic bases for a system of conditional logic originally proposed by D. Lewis as his favourite choice for the analysis of counterfactuals; furthermore, it points out some problems related to the trivialization of modalities in the logical framework at issue.

The second group consists of the following contributions: "On a Supposed Puzzle concerning Modality and Existence" By Thomas Atkinson, Daniel Hill and Stephen McLeod, "Wiredu contra Lewis on the Right Modal Logic" by David Martens, "On 'actually' vs 'dthat': Truth-conditional Differences in Possible Worlds Semantics" by Genoveva Martí and José Martínez-Fernández, and "Semantic Tableau Versions of Some Normal Modal Systems with Propositional Quantifiers" by Daniel Rönnedal. These articles were selected out of all submissions received via a double-blind reviewing procedure. The article by Atkinson, Hill and McLeod provides a novel solution to a philosophical puzzle concerning the notions of necessity, possibility and existence originally formulated by K. Fine. The article by Martens critically reconstructs K. Wiredu's thesis that the 'right' system for the formal analysis of modal notions should be at least as strong as S4. The article by Martí and Martínez-Fernández shows how possible worlds semantics can be used to rigorously capture some difference in meaning between the operators 'actually' and 'dthat'. Finally, the article by Rönnedal proposes a modular approach to build labelled tableaux for a family of normal modal systems based on a language with propositional quantification.

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