

○ **M. VAN LAMBALGEN AND F. HAMM, *THE PROPER TREATMENT OF EVENTS***

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Are you into formal semantics and logic, and interested in the semantics of tense and aspect? If so, this thought-provoking volume is a 'must have'. It studies the semantics of tense and aspect 'from the vantage point of cognitive science' (p.xi) – looking at the way human beings construct time – and uses logic programming, more specifically constraint logic programming, as a formalism.

The book is divided into three parts. In the first part, 'Time, events, and cognition' (Chapters 1–3), the authors lay the foundation for integrating their formal apparatus within cognitive science and the psychology of time, arguing that humans do, in fact, *construct* time and that the linguistic coding of temporal notions is best explained in terms of planning and causality (p. xi). The second part, 'The formal apparatus' (Chapters 4–6), introduces a computational theory of planning, formulated in constraint logic programming and based on the event calculus from robotics. The authors acknowledge that the formalism is rather technical, and that it assumes a computational notion of meaning (which they believe to be essential for a cognitively relevant approach). In the last part, 'A marriage made in heaven – linguistics and robotics' (Chapters 7–12), the formalism is applied to a variety of data and linguistic problems. The book finishes with an appendix that briefly introduces the basics of logic programming.

Chapter 1 deals with time and its 'cognitive definition'. As a point of departure, the question 'what must our minds be like for tensed talk to make sense?' is asked, and this is linked to the claim that the linguistic coding of time can only be fully understood if the mental construction of time is taken into account (p.4). The authors conclude that the human sense of time derives from humans being goal-oriented agents, and hence the linguistic coding of time is also driven by the future-oriented nature of human cognition. Given that this chapter is the foundational chapter of the volume, a more in-depth discussion of the psychology of time might have been desirable, with even more evidence from psychology and related cognitive science disciplines than is provided. Chapter 2 motivates the event calculus approach taken later in the book: time is seen as being constructed out of events, which in turn are considered as basic building blocks for this undertaking. Therefore, much of this chapter is concerned with axiomatising the notion of event, and different constructions of events are discussed. Chapter 3, as the last chapter in Part I, establishes a connection between language and planning, which is assumed to

be imperative in the description of temporal expressions. The authors also maintain a clear anti-generativist view, arguing that the true nature of tense becomes clear only in discourse, but not in single sentences.

The second and third parts of the book aim at demonstrating that planning – if formalised suitably – leads to an explicit computational theory that integrates tense and aspect. The event calculus as formal apparatus introduced in Part II is essentially a formalism of planning (understood as a form of non-monotonic reasoning), and was developed for the purpose of path planning in robotics (this also explains the title of Part III). Chapter 4 provides a good introduction to the axiom system of the event calculus, as well as definitions of technical terms and predicates used in the formalisation. Following this, Chapter 5 proposes to identify the sense of an expression with the algorithm that computes the expression's denotation. This is done because 'if semantics wants to make contact with the huge psycholinguistic literature on language comprehension and production, it had better become computational' (p.49). Some of this evidence is listed at the beginning of the chapter, followed by a formal introduction of logic programming with constraints – constraint logic planning is used for representing the algorithms computationally – and some application examples. Chapter 6 puts the 'Finishing Touches' to the formalism, and is indeed very formal itself. This part of the book contains interesting meta-theoretical comments about advantages and disadvantages of different approaches.

From Chapter 7 onwards, the constraint logic programming formalism is applied to a variety of data, and addresses an extensive number of well-known linguistic phenomena. These include Aktionsart (Chapter 7), English tense (Chapter 8), French tense (Chapter 9), grammatical aspect (Chapter 10), coercion (category shifting – Chapter 11), and nominalisation (Chapter 12). Indeed, all of these chapters provide a new and exciting view on how these linguistic core issues can be treated rather successfully.

It should be emphasised that readers of the volume will need to have had some formal training in order to fully understand it. For instance, a solid background in logic (propositional vs. predicate logic, model theory, three-valued logic etc.) is required for the introduction to the basics of logic programming in the appendix. Also, some (mathematical) notation is assumed throughout the book – or is only later or implicitly explained. However, the formal parts of the book are completed in a very precise way, both regarding terminological use and logical derivations. In addition, the authors take care to always outline the underlying ideas before going into technical details, which in particular serves the purpose of overall integration. Last, but not least, the cognitive relevance of the formalism is outlined, and its application to different linguistic phenomena contributes decidedly to the grounding and explanatory power of the formalism.

Further materials such as slides for a course and examples of theses based on the book, as well as some proofs that have been omitted in the book, are made available on the website of the first-named author, at <http://staff.science.uva.nl/~michiell/>. However, the errata document that can be downloaded from this website (dated 19 October 2004 – a date before the publication of the volume) was empty at the time this review was written. Although there are not many typographical errors – ‘intuitionalistic’ (p.21), ‘morphological’ (p.150), ‘eventualities’ (p.185), ‘modification’ (p.215) etc. – a list of corrections regarding content errors would indeed be welcomed. As an example, it should read ‘(state, accomplishment)’ rather than ‘(state, activity)’ in (22e) on p. 113. Some other ‘slips’ are, for instance, wrong cross-referencing of example sentences (e.g. ‘(17)’ instead of ‘(52)’ on pp. 202f.) and chapter numbers (the Russell-Kamp and Walter constructions are introduced in Chapter 2, not Chapter 1 as claimed on, e.g. pp.96f.).

The book is the fourth in the series ‘Explorations in Semantics’, a series which aims at featuring new sophisticated research by leading semanticists (an aim which has been accomplished by this book), while offering a pedagogical component and emphasising student accessibility. Accordingly, the book offers exercises at the end of Chapters 5, 8, 9, 10, 11, and 12. However, solutions to the exercises are not included – neither in the book nor in the accompanying materials on the website.

Nevertheless, I would recommend this original and well-written volume as essential to anyone interested in the formal treatment of events and the semantics of tense and aspect.

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