The Proper Treatment of Events

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In one sense, Lambalgen and Hamm's book is easy to summarize. It examines a variety of temporal phenomena in natural language from an event-based perspective. It provides a formalization of the notion of **event** (using a modification of Shanahan's [1997] version of the Event Calculus, a many-sorted first-order theory), defines a dynamic-style semantics for the system, and discusses how constraint logic programming can be used to cash out its computational content. But such a summary, while broadly speaking accurate, would leave out what gives this book its flavor. For what we have here is essentially a detailed exploration of the ramifications of a single idea.

The idea is that to properly understand how temporal expressions in natural language work, we must understand how human beings construct time, and that the cognitive construction of time is best explicated in terms of planning and causality. Planning is the glue that lets human minds integrate past, present, and future, and episodic memory (which Lambalgen and Hamm view as a "generalised capacity for imagining or constructing possible worlds") is the key to this capacity.

The general position just sketched is laid out in Part I of the book ("Time, Events, and Cognition"). Part II ("The Formal Apparatus") and Part III ("A Marriage Made in Heaven—Linguistics and Robotics") add flesh to this position. And the authors are determined to add as much substance as possible.

The formal apparatus used is a computational theory of planning—a version of the Event Calculus reformulated in constraint logic programming. The authors opt for such a formulation not simply because it minimizes the distance between the theory and its implementation, but also because they broadly agree with Moschovakis's (1993) interpretation of the Fregean notion of sense: The sense of an expression is the algorithm that computes its reference. Their formalization allows for individual objects, real numbers (to represent time), time-dependent properties (or fluents, as they are usually called), variable quantities (degrees of happiness, the state of completion of a book review), and event types whose tokens mark the limits of time-dependent properties. Event Calculus allows for reification (that is, properties may fill argument slots in predicates) and makes it easy to model nominalization. Causality, the key relation between events, is presented in two variants: instantaneous change and continuous change. Moreover, in addition to this general background theory, they also allow for the constructions of "scenarios," microtheories stating the specific causal relationships holding in a given situation (this machinery underlies their account of lexical meanings). But these remarks only scratch the surface of a detailed theory, a theory that is carefully axiomatized. The authors consider various models for their theory, paying particular attention to minimal

models, for they make a closed-world assumption in which anything that is not forced to happen does not happen.

All of this leads naturally to what might be called a "dynamic" account of meaning. But the authors distance themselves both from DRT (Kamp and Reyle 1993) (because of its reliance on Davidson-style events with predicates corresponding to thematic roles) and from Amsterdam-style dynamic semantics (Groenendijk and Stokhof 1991) (which they view as treating computation implicitly rather than explicitly). Although isolated elements of the approach just sketched may have the ring of familiarity, the details are all-important. For it is the painstaking combination of these choices that gives their approach its individuality, and the details are always chosen with one end in mind: cashing out their fundamental conviction that planning and causality are crucial to the cognitive construction of time.

Part III of the book (which, at around 160 pages, is by far the longest section) puts this apparatus to work to construct a theory of tense and aspect. Every VP is associated with a default scenario (that is, a microtheory) that determines the *Aktionsart* of the verb. The word "default" is important: temporal and aspectual operators, and many other linguistic items, may coerce the verb to assume a different *Aktionsart*. And the underlying machinery accommodates this easily. In Chapter 10, for example, Lambalgen and Hamm are able to give a simple treatment of the imperfective paradox, and in Chapter 11 they treat a wide range of coercive phenomena in more detail. Once again, this review only hints at the ground covered. For example, there is a chapter devoted to the *passé simple* and *imparfait* in French, and another that treats nominalization.

This is an interesting book. It is not particularly easy to read, and not merely because some parts (notably Part II) are technically dense (indeed, readers with some logical background are likely to find Part II the most straightforward). The authors are faced with a difficult presentational task: They have *lots* of ideas, and all are intended to serve one intellectual end—and at times the strain of merging the various themes shows. Chapter 1, which sets out the underlying idea that time is cognitively constructed, will probably irritate some readers: It sketches the leading idea in a rather rudimentary fashion, yet subsequent chapters act as if all the points it mentions have been firmly established; they have, at best, been indicated. Many chapters show signs of hasty writing (accompanied by all-too-frequent asides that limitations of space make more detailed exposition impossible). Moreover, although there are signs that the authors wanted to make the book pedagogically attractive (some chapters contain exercises, and there is an appendix discussing the basic ideas of constraint logic programming), important ideas are sometimes used before they have been explained. I would certainly think twice (and prepare very carefully) before unleashing this book on a class.

And yet the book works, and indeed in a curious way these (relatively minor) faults highlight its good points. For it is impossible to read this book without being impressed by the determination of the authors to get their message across; their occasional lapses enhance this sense of urgency. Taken as a whole, the book is an impressive achievement. It will certainly prove of interest to theoretical linguists, philosophers, and cognitive scientists. And, yes, it *should* prove of interest to computational linguists and other NLP practitioners too. As should be clear from the review, this book treats temporal and aspectual phenomena from a perspective very different from that of current corpus-based work. But it does so systematically and with great precision. Although it is unlikely that every detail will survive the test of time, the general themes it so rigorously explores may well help provide structure and coherence to more empirically based approaches. Interested in temporal semantics? Then this is essential reading.

References

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