

all sequential or serial order. They all presuppose a rule-based system that can be enumerated in a "decidable" sense and that includes hierarchical enumeration during rule-application. Even the discussion of the computational approach presented by Schank and Birnbaum includes nuances of this.

There are relevant discussions of how one can acquire language and how it might map the real world into a "usable" representation that permits variability. However, these are presented at a theoretical level. There is not sufficient material included to "make the theory computational". It is very interesting to note that the processor, meaning the human brain, can constrain how the real world projects into a subjective perceptual world, and to provide discussion of same, but the issues of how such a processor might control such a happening are avoided. In contrast, for artificial intelligence, determining the process and the control presents the greatest problem.

The psychological perspective provides a brief historical introduction to the issues considered important by psychologists with respect to the language problem. Many of the concerns regarding the function of representations, and the relationship between theoretical and applied work and psycholinguistics are similar to those expressed by the computational discussions. However, the stress on evaluation of theories which is of utmost importance to psychological approaches does not appear of such concern in AI.

One area which the psychological discussion merely touches has to do with CONTROL of the processes. While control is mentioned, no suggestions as to how it should become a viable part of language process or theory from a psychological perspective are presented. Instead, all of the theories presuppose a sequential process, at least as they are presented in the included papers. No CONTROL alternatives are discussed, as if the problem is already solved.

One other psychological paper discusses whether there are language-specific tasks, i.e., tasks that cannot be "learned" or performed unless one has language. While the issues raised are interesting, the presentation and discussion of the evidence is far from convincing. Perhaps it is available elsewhere, but certainly is just touched upon here.

Finally, the discussion within the computational approaches to language is not anything that has not been presented many times before. Basically, two viewpoints are presented, one the semantically driven approach to language processing and the other which demonstrates that there are critical aspects of language understanding that can only be syntactically determined.

The arguments presented in Marcus's paper advocating a separate role for syntactic processing were the most clearly described in the book. If anyone is seeking example inputs which require syntactic decision processes that cannot be handled entirely within semantic processing, or cannot even be recognized as a problem if one is doing

strictly semantic processing, this paper includes several. They are all discussed from a linguistic standpoint and not a performance one, even though there is performance evidence to support a distinct role for syntax in processing. (Cf. the vast literature of neurolinguistics on aphasic language problems as well as evidence discussed with respect to children with language impairments.)

After finishing this book, I felt that I had re-read a discussion of many issues which were first being addressed in the early attempts to define cognitive science. They are still undecided, but there presently are more cohesive approaches being undertaken. While each paper presents discussion of important cognitive science issues, given the title of the book I had hoped there would be a more integrated discussion of how these issues might be resolved.

The book is useful as a reference for anyone seeking an introduction to the magnitude of problems within cognitive science. It also provides some historical perspectives which are not explicitly documented elsewhere. But, it does not reflect any more recent attempts to integrate the viewpoints expressed that are the focus of research in many schools of cognitive science, where the integration, the shared discussions of the problems, the common approaches are underway.

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COMPUTATIONS FROM THE ENGLISH.

Robert F. Simmons

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The book appears to be concerned with three major points. First, the reader can find a brief outline of the state of the art in many fields of Artificial Intelligence: natural language parsing, question-answering, questioning and summarizing of texts, paraphrasing and translating into different languages, and finally a survey on knowledge systems. Therefore the book is extremely useful to those who wish to know what has been done or can be done in AI. Secondly, it is also conceived as an introduction to procedural logic and how to apply it to the analysis of natural language and to the various performances listed above. Hence, the book is also important for those who want to achieve this specific programming competence.

The third point (which, however, is not explicitly declared by the author) has to do with the way natural language and the human cognitive system must be approached. Obviously, the approach described in the book is a procedural one; i.e., the author describes algorithms for performing various cognitive tasks, such as understanding natural language, producing natural

language sequences, question-answering, etc. However, the way the author considers linguistics and cognitive psychology in general does not appear to be the most productive one. The question that must be raised is the following: To what purpose can it be useful to introduce concepts and descriptions that are highly questionable from the point of view of recent results in formal linguistics and cognitive psychology, instead of assuming correct information also for what concerns these research fields? In fact, the aspects that have to do with cognitive psychology in general, and linguistics in particular, are only very roughly sketched in the book.

The study of natural language and cognitive psychology are not the major goals of Simmons's book, but nevertheless the problem remains serious; there is in fact a general question concerning the concrete possibility of achieving results in AI both from the point of view of the cognitive import, and the practical applicability, without considering and adopting the results of cognitive psychology. For instance, how can it be possible to build systems of automatic translation with a theory of grammar that accounts in a general way for the differences among languages? How can it be possible to build a question-answering system without considering the semantics of questions? How can one deal with a "large" vocabulary without analyzing the morphological

regularities and characteristics of each language? Even if these are not Simmons's major concerns, we think that he should at least provide guidelines in these directions, for instance by suggesting integrative readings.

Our opinion is that the level of precision and specification achieved by linguistics (and cognitive psychology in general) is not technically needed in computer science and artificial intelligence for the time being; however in a few years progress in these fields will be such that it will become impossible to create good products without the cooperation of linguists and psychologists. Moreover, in addition to technological improvements, one would also expect from AI new empirical discoveries on the human cognitive system and its procedural strategies in general; we hope that these goals will be achieved by future research.

By way of conclusion we can say that this book is an interesting and detailed introduction to procedural logic and related topics. Therefore, it is useful reading it, even if the linguist or the psychologist will not find anything new in his/her field.

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