

Foreword

Psycholinguistics is the study of how we produce and understand language and how we acquire these skills. Among the skills that are universal to our species, these linguistic capacities are doubtless the most complex ones. When we speak, listen to spoken language or read, we are constantly accessing a huge mental lexicon, which is a repository of tens of thousands of words. We generate and parse these words at speeds that easily exceed four syllables, 10 phonemes or 20 letters per second. We are also constantly processing the syntactic relations among the words that we access. As a speaker we produce utterances that are surprisingly well-formed syntactically. In fact, this *on-line* computation of syntax is a crucial step in the generation of natural, fluent prosody. And as a listener or a reader, we simply cannot inhibit the automatic syntactic parsing that is always at work when we attend to linguistic input. This parsing steadily interacts with the construction of meaning. After all, the ultimate step in language understanding is to interpret what we hear or read, to derive the intention of the speaker or the author. And meaning is at the core of all language use. As speakers/listeners, but also as readers/writers, we are always in the process of negotiating meaning. We are using a rich arsenal of rhetorical devices in order to generate effective utterances or texts and to be co-operative listeners or readers. In short, processing language is a multi-levelled cognitive skill of bewildering complexity.

Computational modelling, one would suppose, is an obvious tool for coping with this complexity. Even if component systems, such as lexical selection, are theoretically well understood, their interaction in the fluent generation and perception of language will be unpredictable from these partial theories. Many sciences, such as economics or meteorology, share this problem and they have naturally moved to computational modelling as soon as hard- and soft-ware of sufficient power became available. Surprisingly, no comparable development has taken place in psycholinguistics. If one skims through the *Handbook of Psycholinguistics* (Gernsbacher, 1994), it is immediately apparent that computational modelling is *not* a major tool in psycholinguistics. On a highly generous interpretation of *computational*, no more than 5 per cent of this almost 1200-page handbook is concerned with computational modelling. It is, moreover, largely restricted to just two domains of theorizing, lexical access and mental discourse models.

Clearly, there is something to be developed here. To the best of my knowledge, the present book *is* the first of its kind in psycholinguistics. It presents a representative range of computational models in psycholinguistics, both symbolic and subsymbolic.

The editors have managed to keep a balance between models of perception and models of production, one that is typically absent from psycholinguistic texts or handbooks, where language production tends to be a marginal subject. There are good computational reasons for spreading attention evenly here. There is a tacit belief among many of my colleagues that language production is roughly language comprehension in reverse. In comprehension you go from an input utterance to some derived meaning, with the mental grammar and lexicon somehow mediating. In production you go from some initial notion to an output utterance, with the same grammar and lexicon somehow mediating. This picture is, however, far too simple. The computational requirements are deeply different for production and comprehension. An ideal delivery in production requires completeness and well-formedness at all linguistic levels involved. The pragmatics should be precisely tuned to the discourse situation. The words, phrases, sentences should be accurate and complete renditions of the information to be expressed. Syntax and morphology have to be complete and well-formed and the same holds for the segmental and suprasegmental phonology of an utterance. Finally, the phonetic realization has to conform to the standards of intelligibility, rate, formality of the speech environment. The ideal speaker *is* kind of a decathlete, a master of myriad linguistic crafts. The ideal writer must add well-formedness at the graphemic level. It is a special computational challenge to generate these well-defined linguistic structures completely and on the fly, 'from left to right' as language producers do.

The computational problem is a rather different one for the listener. Whereas a produced utterance has to be linguistically complete at all levels, that requirement does not hold in parsing. Almost every utterance that we encounter is multiply ambiguous, phonetically (*I scream*), lexically (*the organ was removed*), syntactically (*I enjoy visiting colleagues*), semantically (*there are two tables with four chairs here*) or otherwise. As listeners we hardly notice this. We typically do not compute all possible well-formed parses of an utterance, even though ambiguities can produce momentary ripples in comprehension. Parsing is hardly ever complete. Rather, we go straight to the one most likely interpretation, given the discourse situation. This is due to powerful context effects and a major computational problem is precisely to model these *top-down* effects in language understanding. So, where linguistic completeness is a main requirement for production modelling, contextual robustness is a major challenge for comprehension modelling. As language users we are experts on both, and so should be the ultimate computational models in psycholinguistics.

I have no doubt that this timely book will find its way into the psycholinguistic classroom and laboratory. Its chapters can also enrich courses in computational linguistics by adding a processing (or *performance*) dimension to the more traditional structural (or *competence*) approach. And more generally, it

will be a rich fund of ideas, methods and references for any student or professional in cognitive science who has a core interest in language.

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Reference

GERNSBACHER, M.A. (Ed.) (1994) *Handbook of Psycholinguistics*, San Diego, CA
Academic Press.