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Edited by **Ruth Kempson, Tim Fernando**
and **Nicholas Asher**

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EDITORIAL PREFACE

Ruth Kempson, Tim Fernando, and Nicholas Asher

Ever since the nineteen-sixties, linguistics has been a central discipline of cognitive science, feeding debates within philosophy of language, philosophy of mind, logic, psychology — studies on parsing, production, memory, and acquisition — computational linguistics, anthropology, applied linguistics, and even music. However, one diagnostic attribute of what it takes to be a natural language has been missing from articulation of grammar formalisms. Intrinsic to language is the essential sensitivity of construal of all natural language expressions to the utterance context in which they occur and the interaction with other participants in that same utterance context that this context-relativity makes possible, with rich occasion-specific effects depending on particularities of the individual participants. Given the very considerable hurdles involved in grappling with this core property of language, and the lack of suitable formal tools at the time, it is perhaps not surprising that this diagnostic property of natural languages should have been set aside as peripheral when formal modelling of language took off in the mid- nineteen-sixties. However, the methodology that was then set up, despite the welcome clarity to linguistic investigation that it initially secured, has had the effect of imposing a ceiling on the kind of explanations for what the human capacity for language amounts to.

The justification for setting aside such a core attribute of language was grounded in the point of departure for the methodologies for formal modelling of languages being explored in the fifties and early sixties. Figures such as Harris, Chomsky, Lambek, each in their different ways transformed language theorising by their commitment to articulating formal models of language [Harris, 1951; Chomsky, 1955; Lambek, 1958]. The overwhelming priority at that time was to provide a science of language meeting criteria of empirical verifiability; and context variability was not taken to be relevant to the formal specification of any system meeting such criteria. Rather, grammars were presumed to induce sets of sentences; and the first hurdle was the fact that natural languages allow for infinite variety over and above such context variability, simply because any one sentence can be indefinitely extended. This led to the assumption that the generalisations constituting explanations of language must invariably take the form of a function mapping a finite vocabulary together with a finite set of rules onto an infinite set of (grammatical) sentences. With this requirement in mind, the move made was to take the relatively well-understood *formal languages* of logics as the pattern to be adapted to the natural language case, since these provided a base for inducing an infinite set of strings from a finite, indeed small number of rules, in so doing assigning structure to each

such string. The so-called Chomskian revolution [Chomsky, 1965] was then to embed such linguistic theorising in a philosophy underpinning the assumptions to be made in advocating such grammars. The capacity for language was then said by Chomsky to be grounded in an *ideal speaker/hearer's competence* [Chomksy, 1965], a concept articulated solely with respect to grammars whose empirical content resided in their relative success in inducing all and only the structural descriptions of wellformed strings of the language, in this too following the pattern of formal language grammars. Grammars of natural language were accordingly evaluated solely with reference to judgements of grammaticality by speakers, leaving wholly on one side the dynamics of language as used in interaction between participants. All use of corpus-based generalisations was dismissed as both insufficient and inappropriate. The data of so-called *performance* were set aside as irrelevant in virtue of the reported disfluency displayed in language performance, its supposed impossibility as a basis for language acquisition, and its obfuscation of the linguistic generalisations that have to be teased out from the intricate intertwining of linguistic principles with grammar-external constraints such as those imposed by memory limitations, processing cost and other constraints determining how linguistic expertise is realisable in language performance in real time.

This methodology was adopted unhesitatingly by the entire research community, irrespective of otherwise fiercely opposed frameworks. This presumption of separation between the competence system and its application in performance was indeed so strongly held that there was condemnation in principle even of defining grammar formalisms in terms relevant to their application in explaining such data. Properties of language were to be explained exclusively in terms of structural properties of grammatical and ungrammatical sentences, independently of any performance-related dynamics of what it means to process language in real time. In consequence, the only characterisation of context-dependence definable was that pertaining to sentence-internal phenomena and without any reference to phenomena not characterisable within the sententialist remit; there was no formulation of how language dependencies may be established in interaction; nor was there any characterisation of construal in terms of how such understanding might be built up in real time. All these were taken to be aspects of discourse modelling, which largely lacked any precise characterisation, or of language performance, leaving the phenomenon of context-dependence at best only partially characterised. Properties of dependency between one expression and another were, equally, taken to be explicable only in so far as these could be defined as a sentence-internal dependency, and accordingly defined structurally, and largely as a phenomenon of syntax.

The divide between the linguistic knowledge requisite for ideal speaker competence and other sources of information potentially applicable to natural language understanding became consolidated in the subsequent establishment of the concept of *I-Language* [Chomsky, 1986] which refers to an Internal/Individualistic/ Intensional(/Innate) body of knowledge, the appropriate object of study for linguistics being taken to be a mental faculty internal to individuals that can be

legitimately studied in isolation from external factors such as communicative context, variation, processing considerations, perceptual abilities etc. An attendant concept in psycholinguistics and the philosophy of language is the *modularity* assumption for the language faculty or the concept of *input system* this being the language module mapping strings of the natural language onto a so-called *language of thought* [Fodor, 1983]. Under this view, the language module, responsible for the structural properties of natural languages, is autonomous and qualitatively different from other cognitive abilities. The crucial ingredients of modularity are *domain specificity* and *information encapsulation* which means that the module is immune from information from other non-linguistic sources.

There were exceptions to this particular variant of the sententialist orthodoxy. The exceptions came from philosophers and the "West Coast" conception of semantics pioneered by Richard Montague in the late 1960s and early 1970s. Montague considered that principles of the semantic interpretation of natural language encoded in the typed lambda calculus should explain certain dependencies,[1] but again only at a sentence internal level. Montague's work led to the philosopher David Kaplan's influential treatment of indexicals [Kaplan, 1980], where a device, a Kaplanian *context*, external to the structural properties of grammar, was responsible for the interpretation of terms like *I, you, here* and *now*. Work by Stalnaker, Thomasson and Lewis provided a semantics of variably strict conditionals according to which the interpretation of the conditional link between antecedent and consequent depended upon an ordering source, a similarity over possible points of evaluation, that was sensitive to the interpretation of the antecedent as well as the current point of evaluation [Stalnaker, 1975; Thomasson and Patel, 1975; Lewis, 1973]. At the same time the seminal work by the philosophers Saul Kripke and Hilary Putnam on proper names and natural kind terms indicated that non-linguistic contextual factors affected interpretation [Kripke, 1980; Putnam, 1975]. Another subversive current that would find its way into semantics in the 1980s in the form of dynamic semantics was happily developing in computer science. Already in the 1970s it was realised that the semantics of programs involved a transition from one machine state to another, since the idea that transitions between machine states is central to the semantics of programs has been known since the Turing machine models, hence from the earliest days of computer science. Vaughan Pratt 1976 was arguably the first to explore the applicability of these notions to logic specifications subsequently leading to dynamic logic, but the importance of transitions between machine states was understood much earlier. In the late 1970s, Hans Kamp [1978; 1981] would discover that the interpretation of indefinites and anaphoric pronouns required the same conception of interpretation: the meaning of a sentence would be no longer simply a function from either its syntactic structure or some correlated language of thought structure onto some articulated concept of truth conditions, but rather a *relation* between one discourse context and another, a concept notably closer to the dynamics of performance. Theo Janssen's 1981 dissertation

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[1]This last assumption is rejected by Chomsky, who has never advocated the incorporation of a denotational semantics within the grammar.

would make explicit the link between the semantics for programming languages and the semantics for natural languages. Nevertheless, the Chomskian emphasis on syntactic competence and sentence internal studies of language was sustained unquestioningly in all theoretical frameworks for the next several decades.

Over the years, this led to an accumulation of puzzles - syntactic, semantic and pragmatic. A very large proportion of these puzzles coincide on the problem of the endemic context-sensitivity displayed by natural-language expressions, which have in each case to be explained relative to a methodology that is poorly suited to capturing such data. The problem is that context-sensitivity in all its various guises is no respecter of sentence or even utterance boundaries: ALL context-dependent phenomena can have their interpretations resolvable both within and across sentence and utterance boundaries. And, more strikingly still, all dependencies — even those identified as syntactic and sentence-internal — can be split across participants in conversational dialogue, as individuals have free ability to extend what another person says, to interrupt and take over the articulation of some emergent structure. The puzzles arose because the notions of modularity and the privileged position of the language faculty responsible for the production of grammatical strings and, as extended by Fodor for its interpretation in the language of thought, left no possibility for modelling these sorts of interactions, though exceptions were made for indexical expressions of the sort that Kaplan had studied. Any model taking these principles as basic was poorly adapted to reflecting both context dependency in general, and more particularly the way in which, in conversational exchanges, participants fluently engage in what may be highly interactive modes of communication.

This sentential prejudice has thus left its mark: such models, simply, provide no insight into the nature of context. Putative sub-sentential exemplars of context-dependence in interpretation have been defined in terms of static and global constructs of variable binding to determine fixed construals within a given domain, set by the boundary of a sentence. Supra-sentential exemplars are defined as outside such domains, hence different in kind, indeed complementary. This phenomenon was originally taken to be restricted to anaphora, invariably seen as divided into grammar-internal dependencies vs discourse-level dependencies. But as semanticists developed increasingly sophisticated formal tools for modelling context-relative aspects of nominal construal, of tense, of aspect, of adjectives, of verbs, and of ellipsis, it became apparent that the bifurcation into grammar-internal dependencies and discourse-based dependencies, with each treated as wholly separate from the other, leads to an open-ended set of ambiguities, as the immediate consequence of the sentence-internal remit for formal explications of language; no perspective unifying sentence-internal dependencies and cross-utterance dependencies was expressible therein. Even in the absence of overt expressions, i.e. with ellipsis phenomena, there was the same pattern of bifurcation between what are taken to be sentential forms of ellipsis and discourse forms of ellipsis. Furthermore, the possibility of there being ellipsis which is not expressible without reconstructing it at a sentence level until very recently has not even been envisaged. Rather,

by methodological fiat, the various forms of ellipsis have been analysed as constituting complete sentences at some level of abstraction ([Fiengo and Mary, 1994; Dalrymple *et al.*, 1991] are influential syntactic/semantic exemplars respectively). These prejudices fracture the sub-and super-sentential levels from the sentential level, with only this last understood to be the core of ellipsis for grammatical modelling.

Nonetheless, as the chapters of this volume demonstrate, the Chomskian conception of language as a sentence internal matter is evolving into a more nuanced model in those frameworks concerned with formal articulation of semantics. Dynamic semantics has now for thirty years provided analyses of a variety of phenomena — pronominal anaphora, tense and temporality, presupposition, ellipsis ([Kamp, 1978; 1981; Heim, 1982; 1983; Roberts, 1989; 1996; Kamp and Reyle, 1993; Asher, 1993; Van der Sandt, 1992; Fernando, 2001] to mention a few sources) — and the goal has been to provide an integrated analysis of each phenomenon addressed, without, in general, worrying whether the proposed analysis is commensurate with strict sententialist assumptions.[2] Yet evidence has been accumulating that even explanations of core syntactic phenomena require reference to performance dynamics; and grammatical models are now being explored that reflect aspects of performance to varying degrees and take seriously the need to define a concept of context that is sufficiently structurally rich to express the appropriate means whereby grammar-internal mechanisms and context-bound choices can be seen to interact in principled ways [Steedman, 2000; Hawkins, 2004; Phillips, 2003; Mazzei *et al.*, 2007; Asher and Lascarides, 2003; Ginzburg and Cooper, 2004; Kempson *et al.*, 2001; Cann *et al.*, 2005], with a shift of emphasis that includes exploration of grammars that are able to reflect directly the dynamics of conversational dialogue [Cooper, 2008; Ginzburg, forthcoming; Kempson *et al.*, 2011].

It might seem obvious that an approach which seeks to articulate a much richer concept of interaction between language expertise and its relativity to context for construal is scientific common sense, simply what the facts determine. However, from a methodological point of view, switching to such a perspective had seemed inconceivable. That any such shift has become possible is through the coincidence of two factors: first, the pressure of the continually expanding work of semanticists on context-dependency; second the emergence of formal models of dialogue with the potential to reflect the fine-grained and distributed character of interactions in conversational exchanges. Ever since the advent of dynamic semantics (and more informal but equally "contextualist" approaches to pragmatics: Grice 1975, Sperber and Wilson 1986, Horn and Ward 2000), recognition of the extent of the dependence on context of natural language semantics has been growing exponentially. There are now formal models of the context-relativity of full lexical-content words [Asher and Lascarides, 2003; Pustejovsky, 2005]; there are formal models of the systematic coercive and context-relative shifts available from one type of mean-

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[2]In so far as the phenomenon in question spanned sentence boundaries, a default assumption has been that such cases can be analysed as conjunction, in the absence of any other connective.

ing to another (see the chapters by Asher, Cooper); there are models of speech acts and their relativity to context (see the de Rooij chapter), of context-relative factors at the syntax/semantics interface (see the Cann and Kempson chapter, and on the application of probability-based decisions to language processing see the chapters of Penn, and Clark and Lappin). Behind many of these arguments is the issue of whether a level purporting to articulate structural properties of such context-relative interpretations should be advocated as part of the grammar. Moreover, advocacy of wholly model-theoretic forms of interpretation as sustained by upholders of the pure Montagovian paradigm (see [Partee, 1996] and other papers in [van Benthem and ter Meulen, 2010] (2nd edition)), has jostled with advocacy of wholly proof-theoretic formulations (see [Ranta, 1995; Francez, 2007]), with mixed models as well (Cooper this volume, and [Lappin and Fox, 2005; Fernando, 2011]), so there are a range of more or less "syntactic" views even within the articulation of natural-language semantics *sui generis*. At the turn into this century, this articulation of context-relativity is finally being taken up in syntax, with the development of models of syntax reflecting the incrementality of linguistic performance (Cann *et al.*, this volume). This move had indeed been anticipated in the fifties by Lambek's categorial grammar (with its "left" and "right" operators: [Lambek, 1958]) but was swept aside by the Chomskian methodology which rapidly became dominant.[3] In the neighbouring discipline of psychology, there has been a parallel vein of research with psycholinguists increasingly questioning the restriction of competence modelling to data of grammaticality allowing no reference to psycholinguistic modelling or testing (Baggio *et al.*, this volume).

Another interesting development has been the integration into mainstream linguistics of decision theoretic and game theoretic models exploiting probability and utility measures (van Rooij, this volume). Lewis [1969] already pioneered the use of game theory with the development of signalling games to model conventions, including linguistic conventions, work that was taken up by economists in the 1980s [Crawford and Sobel, 1982; Farrell, 1993]. Linguists have now used these techniques to model implicatures and other pragmatic phenomena, as does van Rooij, bringing a rich notion of intentional contexts to bear on linguistic phenomena. The use of game theoretic models also brings linguistic research back to the later Wittgenstein's emphasis on language use and interaction. And in formal language theory, bringing these various strands of research together, theorists are now arguing that the original innateness claims about the unlearnability of a natural language are misplaced [Clark and Lappin, 2011, this volume], and that probabilistically based grammars are viable, contrary to the Chomskian view. The scenario we now face accordingly is that the broad cognitive-science research community is progressively giving recognition to the viability of formal models of language that, in building on these influences, are very much closer to the facts of language performance.

The objective of this handbook is, through its chapters, to set out both the

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[3]Subsequent developments of categorial grammar incorporated type-raising operations to override the sensitivity to directionality intrinsic to the basic operators.

foundational assumptions set during the second half of the last century and the unfolding shifts in perspective taking place in the turn into this century, in which more functionalist perspectives are explored which nonetheless respect the formalist criteria of adequacy that initiated the extension of the formal grammar methodologies to the natural-language case. Moreover, this shift of perspective is displayed in discussions of syntax, semantics, phonology and cognitive science more generally. The opening chapter lays out the philosophical backgrounds provided variously by Frege, Wittgenstein and others (Peregrin), in preparation for all the papers that follow. A set of syntax papers follow, which consider issues of structure and its characterisation relative to orthodox assumptions of natural-language grammar made by minimalist and categorial grammars (Lasnik and Ugiareka, Morrill), with a philosophical evaluation of the foundationalist underpinnings of the minimalist program (Hinzen). The subsequent chapter (Penn) set outs how, relative to broadly similar assumptions about the nature of grammar, computational linguistics emerged from under the umbrella of machine translation as a theory-driving discipline in its own right. On the one hand mathematical linguistics took off with the development of Chomsky's early results on the formal languages hierarchy [Chomsky, 1959]. On the other hand, computational linguistic modelling of language very substantially expanded through highly successful methods adopting Bayesian concepts of probability. This constitutes a major conundrum for conventional assumptions about syntax. Far from progress in the development of automated parsing being driven by linguistic theory as these theories might lead one to expect, parsers based on sententialist grammars have largely been set aside in favour of parsers based on probabilities of expressions co-occurring, these achieving notably greater success rate, a robustly replicated result which is at least suggestive that something is amiss with the orthodox conception of grammar. Of the group of semantics papers, Bach and Chao set the point of departure with a discussion of natural language metaphysics; and van Rooij surveys the background research on context-dependence and the semantics/pragmatics boundary that is problematic for sustaining the established competence performance distinction, arguing nonetheless that the phenomena of content and speech act variability can be expressed without abandoning the semantics pragmatics distinction. The papers of Asher and Cooper then directly address the significance of the challenge of modelling the endemic flexibility of lexical content relative to context for natural language expressions, with Cooper invoking shades of later Wittgenstein in seeking to model language itself as a system in flux. The following papers jointly argue for need of a general shift in perspective. Baggio, van Lambalgen and Hagoort argue for a shift of methodology for cognitive science as a whole into one where language is seen as grounded in perception and action. They urge that the data on which linguists construct their theories should reflect data directly culled from performance, a move which requires radically reshaping the competence-performance distinction. Cann, Kempson and Wedgwood follow this spirit: they argue that syntax is no more than the projection of a representation of some content along a real-time dimension, as displayed in both parsing and production. In the realm of

phonology, Carr argues that the reason why the phenomenon of phonology seems invariably incommensurate with the patterns of syntax/semantics is precisely that it is only the latter which constitute part of the grammar. Clark and Lappin address the challenge of modelling the process of language learning by a child from the conversational dialogue data to which they are exposed, directly countering the influential claims of unlearnability of Gold [1967], which were based on the presumed need to identify learnability of all strings of a language, hence including the worst case scenario. They argue to the contrary from within formal language learning theory assumptions that language learning can indeed be seen as an achievable and formalisable task, if we see the acquisition of linguistic knowledge as taking place within the supportive interactive environment that is provided in ongoing conversation. Hurford explores the expanding horizons in the study of language evolution, arguing for a gradualist, functionally motivated view of language evolution, a view which is at odds with the sharp division of the competence-performance distinction as standardly drawn. McConnell-Ginet argues that the sensitivity to group allegiances displayed by individuals in relation to gender issues is context-relative and context-updating, in the manner of other types of context-dependence; and she concludes that the individualistic approach of conventional methodologies cannot be the sole mode of explanation of types of dependency which natural languages can realise. And the book closes with an overview of anthropological linguistics, explorations of the interface between language and culture, and the overlapping concerns of anthropologists, semanticists and pragmatists, as seen from the anthropological perspective (Beeman).

The bringing together of these chapters has been an extended exercise stretching across two sets of editors, and we have to express our very considerable gratitude to the authors, some of whose patience has been stretched to the limit by the extenuated nature of this process. We have also to thank John Woods and Dov Gabbay for turning to us for help in establishing a philosophy of linguistics handbook. And, most particularly, we have to express our fervent thanks to Jane Spurr for patiently and steadfastly nurturing this process from its outset through the minutiae of the closing editorial stages to its final completion. Jane handles the editorial and publication process as a continuing source of good humour, so that each difficulty becomes eminently hurdlable even when the finishing line threatens to recede yet again.

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