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# Preface

MARTIN ORWIN, CHRISTINE HOWES AND RUTH KEMPSON

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## 1 Language and Music - Why interaction?

This volume brings together contributions from people all involved in exploring horizons which open up when viewing language and music in terms of the common core which they share, viz. being mechanisms for interactive engagement with others, hence their effective securing of joint group activity. These views fly in the face of current orthodoxies both in linguistics and in music. They are anathema to many linguists. For a long long time—a period spanning sixty, one hundred, even two hundred years depending on whether the perspective is Chomskian, that of de Saussure, or even the Port Royale grammarians—linguists have, with few exceptions, sustained the view that a language should be studied as an object in its own right, independent of the vagaries of usage, grounded in a theoretical construct of the “idealised speaker/hearer” and the individual’s “capacity for language” (their “competence”: Chomsky [1965]). And since language is a means of conveying information through the infinite set of sentences that make it up, a grammar of a language is said to comprise a small finite set of rules defining form-meaning pairs for all and only the grammatical sentences of that language. This articulation is taken to have nothing to do with the dynamics of “performance” by language users: indeed theorists take it upon themselves not to make any reference to such dynamics presuming that to do so threatens theoretical viability. In similar spirit, until very recently, music theorists presenting formal accounts of music have broadly viewed music textually, to be characterised as the set of notes which comprise the piece, together with some notion of potential meaning for the music in terms of the affect those notes, when played, induce in their audience.

### 1.1 The stranglehold of the competence/performance gulf

Once this competence-performance dichotomy and its attendant methodology for formal modelling of language had been articulated explicitly by Chomsky [1965], this view swiftly became pervasive. Against this background, theories of performance had to be constructed which could explain how such an abstract concept of linguistic knowledge could be put to use; theories of communication (pragmatics) had to explain how the output of such grammars could form the

basis for an explanation for successful communication in context. Theories of language acquisition had to explain how such knowledge could be learned—they couldn't, as so much of what a child is exposed to was on this view made up of dysfluencies that had to be ignored—and concepts of innate knowledge became common currency. Despite increasing mutterings that such theories are grounded in an inappropriate data base [Featherston, 2007, Hofmeister *et al.*, forthcoming, amongst others], theoretical linguists have by and large come to terms with the fact that their formal models of language are never directly evaluated but only through the filter imposed by these other interface explanations. The models, on this view, can only be evaluated directly relative to their success in matching individual judgements of sentences as grammatical or not.

Moreover, this capacity for language was taken almost without exception to be encapsulated, its syntactic properties in particular being independent of, and so not reducible to, other cognitive mechanisms, so the feeding relation of influence between language and other cognitive subsystems had to be one way only. What linguists theorised as internal properties of grammar, and the output structures these properties determined, were presumed to be the point of departure for consideration of other cognitive subsystems, relative to which performance models had to provide a basis for explaining the complexity of language performance given users' immediate context-relative concerns. Semanticists took upon themselves the goal of articulating a concept of context while nonetheless sustaining a model-theoretically defined concept of compositionality for sentence meaning, so that these meanings could be seen as the result of the compilation of content for word meanings as evaluated relative to context and as directed by the syntax. Pragmatists took upon themselves the task of explaining how such grammar output, with an assigned logical form, could yield the rich array of pragmatic effects both at the level of explicit propositional content and at the level of indirect so-called implicature effects. In an attempt to meet these goals, a great deal of effort has been spent by semanticists on articulating the appropriate concepts of context and sentence meaning, and by pragmatists on articulating the nature of the higher-order intentions of speakers and of hearers that might serve to explain how any such sentence-meaning, albeit possibly partial, might lead to successful communication of some arbitrarily rich set of pragmatic effects. Psycholinguists, if similarly dominated by the linguists' methodology, had to deliver explanations commensurate with predictions of some selected grammar formalism as to expected complexities in the interpretation or production process. Over time, since the 1960s, semanticists and pragmatists working broadly within this methodology have vastly increased our appreciation of context-relativity, so that there is now due recognition of its systemic nature. Yet the articula-

tion of context-dependence is nevertheless normally presumed to be able to be made commensurate with a grammar formalism reflecting a language capacity in isolation from context by suitable choice of abstraction over high level constructs. As we shall see, recognition of the threatening inconsistency in such a stance has led to increasing discomfort with these underlying methodological assumptions, as witness the invocation of information-structural concepts within the grammar, and the advocacy of aspects of pragmatics within the grammar formalism [Chierchia, 2013].

The influence of this methodology right across cognitive science was overwhelming: in vision [Marr, 1982] and in music [Lerdahl and Jackendoff, 1983, Steedman, 1996, Katz and Pesetsky, 2009]. In philosophy of psychology the only objects amenable to empirical study have been taken by some to be individual modules, each characterisable in terms exclusive to the articulation of its input-output relations and not in more general terms, with language being a prime candidate for such a module [Fodor, 1983]. In the extreme view, the mind is taken to comprise hosts of modules, each encapsulated from the other [Sperber and Wilson, 2002]. From this broad perspective, formal accounts of music have modelled music as a network of interdependencies between notes in a structure, described in terms internal to the object itself and not in terms of the how of music performance, or the interactions between the parties which the projection of the music requires. Nonetheless, some have argued that language needs to be grounded in its functions for communication [van Valin and LaPolla, 1997], and Kempson and Orwin argue [this volume] that the core syntax mechanism of language should be seen as a mechanism for interaction. There is a comparable trend in music theorising, led by Wiggins, Cross and their colleagues [Wiggins, 2012, Cross, 2012, a.o.]. So in both domains, there is increasing recognition that some shift in perspective is needed if we are to account for these two fundamental human capacities.

In the language case, the heart of language is its flexibility with respect to context and the way it provides for an ongoing and fluid updating of information between parties in an exchange; this is a diagnostic attribute of natural language that cannot be ignored. It is uncontentious now that there is in language a mapping from form to information-content relative to context; but if we are to look at language as a set of tools which makes this possible, we have to look at the process it induces in order to see what it is that such a tool-box (as Cooper and Ranta [2008] so vividly expressed it) brings to the picture. Once we look at language in these terms, we see how such tools can be collaboratively used, parties joining in on a conversation to create the development of information in some sense together. In similar spirit, though without the distraction of supposedly fixable content as output, the heart of music is to be found in the dynamics of how it draws in participants whether active, where

music is made together, or passive, where there are performers and audience. As in conversational exchanges in language, performers can hand on what they have developed for someone else to run with, so that the dichotomy between producer and perceiver is blurred; and the effect in ongoing music is for participants, whether performers or audience, to be doing something together, each in their different roles. The interactional patterns of behaviour in music and language are at least quasi-conventionalised, involving activities stored as routinisable chunked sequences of actions. These may be general composite routines, or specific to individual genres. The benefit of storing such chunked action sequences is that for a single recall, a composite sequence of actions can be retrieved. Such routinisations then come to have the force of constraints on practice and expectations on practice; and once these receive extra solidification within a written convention, they may come to have the force of a code relative to which participants expect and are expected to conform, with improvisation and spontaneous re-construction coming to be seen as secondary, maybe even peripheral. Despite the radically different forms displayed in the music and language domains, this reliance on routinised forms yielding coded constraints on practice is an attribute common to both. Nevertheless, the progressive development of routinisations, then conventions of practice, in no way undermines the grounding in performance dynamics out of which these routinisations emerge. Indeed the characterisation of music, like that of language, has to go beyond the articulation of that which is expressible within the confines of constructed written conventions: without the perspective on music which sees it as an activity bringing humans together through its coincidence of rhythm, tonality and timbre, all that can be explained are those forms of music which have a consolidated written form, a tiny minority in the panoply of music-making around the world. The articulation of merely these conventions as constituting the heart of what constitutes music threatens to miss what we take to be essential to music, just as it would if we took this to be the sole remit of explanation for language. Hence the growing recognition that the foundations of the core human cognitive activities of music and language need to be re-considered in more dynamically grounded ways.

## 2 The emergence of dynamic perspectives

How did the move to a perspective for modelling either language or music in terms of the dynamics of the activity get set in train?

In the language case, there have been influences from a number of directions. One influence, from a data-driven perspective, has been from Conversation Analysis, which emerged out of sociology but which is now a growing field within linguistics itself. And, from a theory-driven perspective, within the remit of grammar, the influence has come from semantics in particular. Con-

versation analysts take it that interactive language use is the basic phenomenon to be explained, and to that end avoid the high-level abstractions adopted by the vast majority of theoretical linguists in favour of detailed insights into the temporal production and understanding of utterances in sequential context. This characterisation might suggest that the gulf between conversation analysts and formal theoreticians is unbridgeable, yet there have always also been those of a more functionalist bent within the community of formal language modelling throughout the last half century, amongst them a notable early program being that of the Prague Functional Linguistics group [Daneš, 1974]. More recently, a number of researchers have argued that, though the operations internal to the grammar are its proper remit, constraints on the limits of grammar are more properly expressed in terms directly grounded in use considerations; though such moves are generally promulgated without disturbing the underlying methodological assumptions (e.g. Newmeyer [2005], for whom the grammar itself remains an orthodox competence grammar). Thus, despite numbers of variants, the goals of nontheorists and theorists working on language are drawing together, with an increasing number of formalists coming to share at least some of the CA assumptions.

### **2.1 The context-dependence of interpretation**

Support for the view that formal grammars must be able to characterise the central use of language as displayed in conversational dialogue has come from a surprising source, the high priests of formal language-modelling, logicians/semanticists working at the language-logic interface. These were among the very first linguists that had to confront an increasing sense that conventional methodologies might be imposing an unacceptably narrow remit of explanation. Ever since model theoretic semantics was articulated by Montague in the late sixties and early 70's, it was apparent that any semantic explication of language has to reflect the context-relativity of its construal, and over the years, it became increasingly clear that this context-relativity of language is endemic. This is not merely a one-shot context relativism definable over some characterisation of denotational truth-conditional content constituting a concept of sentence-meaning as the output of the grammar: every step of the way involves context dependency—in anaphora, in tense and aspect construal, in quantifier construal, in adjunct construal, even in the systematicity displayed by individual morphemes in contributing to interpretation.

In getting to grips with this relativity, some analysts were brave enough to grasp the nettle of needing to articulate an intermediate concept of semantic representation underspecifying output interpretations, in so doing separating the direct mapping from sentence-string onto model-theoretically definable content. The leader in this was Hans Kamp with Discourse Representation

Theory [Kamp, 1981], with many other developments following; and, despite repeated and fierce attempts to reduce all such constructs to some model-theoretic alternative in which nondeterminism is expressed directly in the semantics [Groenendijk and Stokhof, 1991, Jacobson, 1999, a.o.], some form of intermediate representation seems inevitable. The question is what status such an intermediate construct has *qua* representation, being little more than a placeholder relative to which a content can be developed. The issue relative to which this question has to be answered is in what form to sustain a principle of compositionality in the face of needing to capture how single words can be seen to have pluralistic modes of construal without simple bifurcations, and expressing this in terms of a word's content being always in some sense underspecified and so extendible in context. The challenge of capturing a mapping from partial construct to full interpretation lies in giving due recognition to the fact that interpretation is in some sense built up incrementally in ways that, while being sensitive to subsentential structural restrictions, are not limited to sentence-boundaries. This straddling of sentence-boundaries is shared by anaphora, ellipsis, tense-construal, even quantifier construal: all of them involve constraints relative to some notion of structure local to their point of introduction, hence arguably a sentence-internal phenomenon, yet all allow dependencies of construal that stretch across more than one sentence. The demarcation created by some initial capitalised word and a completing full stop has no fixed analogue in informal conversation.

There is thus an increasingly pervading sense amongst semanticists that the methodology of sentence-based grammar writing has created an arbitrary ceiling on expressivity of the needed generalisations, with the sentence-delimitation of grammars forcing arbitrary distinctions between grammar-internal and grammar-external dependencies, relative to which the semantics has to be defined, a distinction which has no independent justification beyond the dictates of the methodology. Principal among recent semantic models purporting to meet these challenges is the development of Type Theory with Records, (TTR, applied in this volume by Cooper to the challenge of modelling music), with a concept of record type that can allow equally domain-general and domain-particular attributes, and is in principle always extendible so the concept of open-endedness is intrinsic to the system, a sentence-sequence but a starting point for an open-ended process of interpretation building. And as semanticists are increasingly turning to dialogue, as led by Cooper, Ginzberg and colleagues, the issue of wanting not merely to generalise across sentence-boundaries, but also to articulate concepts of incrementality below the sentence level becomes ever more pressing. This is despite the insistence of the methodology that no grammar formalism articulates generalisations in terms of the build-up of interpretations relative to their time-linear projection.



## 2.2 The problem of encapsulation

This sense of a ceiling repeats itself within the domain of syntax, where the correlations of music and language have already been explored. The parallelisms between language and music have tempted linguists for years, and amongst each community of advocates of a linguistic framework have been those who see parallels between what they do and what seems to ground music. Both language and music involve chunking spans of time, and, within that, articulating dependencies. In both cases, these can be seen as expectations that may accumulate across nested sequences requiring appropriately matched and normally local resolution: these constitute syntactic or morphosyntactic dependencies in the language domain, tonal or rhythmic dependencies or expectations in music. The systematicity of language as articulated in a particular framework has been used as a basis for defining some analogue within the domain of music, in so doing hoping to progress our understanding of music in like manner to our understanding of language. But the resulting models of music are invariably static and global, viewing music structures as some whole determined by the properties of their parts and how these are combined, with no reference to the dynamics of how such structures might unfold in real time.

With neuroscience increasingly in a position to probe parallelisms between music and language in terms of neurological correlates, the co-exploration of language and music has already provided a rich ongoing vein of research so that predictions made by formal models are now able to be made subject to experimental investigation. The evidence emerging from this work is that there may be correspondences in the processing of language and music, suggesting that language and music share certain neural resources (see Patel [2008] for overview and evaluation). The issue then is how to interpret the results; and the question is whether language and music could, indeed, be said to use the same neural resources for processing. The disappointment with conventional linguistic methodology is that it sets a rigidly low ceiling on the significance of these results. As noted by Patel, this methodology precludes any co-articulation of language and music correlates because the language faculty, by definition, is encapsulated, articulated separately from all other subsystems, and articulated in domain-specific vocabulary that is not shared by other cognitive subsystems. To deepen the problem, grammars are said to be multi-level, or modular, with syntactic generalisations expressed in wholly different terms from semantic generalisations, and both commonly in terms different from that of morphosyntactic generalisations, and so on. So our grammars are commonly not merely taken to be encapsulated, but to involve separate sub-domains, each articulated in its own terms, possibly with formal “glue-level” mappings from one vocabulary onto another (as formally articulated in particular in Lexical Functional Grammar). There is variation of

course between the frameworks, but the point is general, notwithstanding the variability: the glass ceiling which we might have hoped to break through, in order to express generalisations across cognitive domains, is taken by our own familiar methodologies to be rammed down and locked into place, precluding any such expansionist moves. And so it is that Patel argues in conclusion, given the empirical and experimental evidence coming from cognitive neuroscience of the shared parallelisms between language and music, that the two domains display shared resources in processing, but the representations integrated in that processing are domain specific.

However, we have the possibility of a breakthrough. If we liberalise the methodology which demands that formalisms for grammar be defined without any reference to performance facts, and allow in its place systems which reflect some form of domain-general, real-time dynamics, then a new outlook suggests itself. The proposal is to license grammar formalisms which induce growth along a reflection of the timeline of processing, mapping partial representations of content into partial representations of content along a monotonically developing path of increasingly richly articulated structure, using this for looking at language as the vehicle for expressing structural and semantic generalisations. This is a perspective shared by a number of formalisms, in particular that of Type Theory with Records [Cooper, 2012] and Dynamic Syntax [Kempson *et al.*, 2001, Cann *et al.*, 2005]. TTR is being developed by Cooper, Larsson and colleagues as a basis for modelling perception, and now also music [Cooper, this volume]. And Dynamic Syntax addresses even notions of syntax in domain-general terms, and, by explicitly modelling both parsing and production in terms that reflect the online progressive construction of representations of content [Kempson and Orwin, this volume], has provided a means of reflecting the dynamics of conversational exchange directly with the possibility of doing something analogous for music. Both of these approaches have made this shift of focus by taking on the challenge of modelling conversational dialogue as central to their remit of language-modelling; and it is in dialogue that the dynamics of interaction is most spectacularly displayed.

### 2.3 Dialogue Modelling

In conversation, and in musical performances of all sorts, there is rich interaction between the parties to the activity. In the language case, speakers and hearers can switch roles over and over again in conversation. An erstwhile hearer can take over as a speaker as though they had been speaking all along, for in shifting to being a speaker they will be continuing to unfold the structure so far partially built as a hearer. A speaker, similarly, can shift into being a hearer as though they had been a hearer all along. This pairing of production and parsing is echoed in music performance. Music, like language processing, is

a transparent vehicle for co-construction of musical units, with one performer able to step back to enable another to take over, then later to join in again, to form some composite whole. In the West we tend to identify this with one particular type of music, that of jazz, where improvisation plays a fundamental role in all jazz from Louis Armstrong to Ornette Coleman, and other genres in which improvisation plays a central role such as blues and bluegrass. But the pattern goes well beyond improvisation. Interaction between contributing agents is evident in all forms of music. As Benson [2003] has demonstrated, even in the most highly routinised forms of music—the possibly large-scale concert performances of Western European music—the musical performance invariably involves interpretative reconstruction by the performer(s), who have to treat what is given in the written score as instructions to be interpreted relative to individual occasion-specific judgement, involving interaction between performers, composer, and audience. In the inverse direction, there is large reliance on routinisations in almost all forms of improvisatory music, as without them, the effect of interaction is much harder to achieve. So, in music and language alike, sequences of actions that get taken by individual choice at some point in time may become highly routinised [Widdess, this volume], and over time will be called up with increasing ease as a means of providing coherence to the piece or style. Thus, the level of freedom in either domain may become increasingly constrained by convention, and once in written form, by encoding. Nonetheless, the phenomenon itself, whether music or language, is a perfect vehicle for interaction between humans within real-time locally recognisable chunks. In this new perspective on language, the vocabulary for articulating the structures to be induced is that of conceptual, semantically transparent, representations, so in principle shared by other subsystems of the overall cognitive system; and as several authors explore in this volume, there is an issue of what are appropriate analogues in the music domain. Such perspectives open up whole new horizons of enquiry: we are led to expect parallels between music and language that go well beyond mere sharing of resources.

With semanticists now turning to the modelling of dialogue, with its intrinsic incrementality, there is strong buttressing evidence of the interactive nature of language processing coming from psycholinguists. Ever since Clark [1996], there has been work on conversational dialogue, and what it shows for language interaction and the relationships between parsing and production in the co-constructive activities that take place in talk exchanges. However, there are interesting grounds here for debate and empirical investigation. On the Clark view, grounded in Gricean pragmatics and presuming conventional sentence-based grammar frameworks, the dynamics of dialogue, and the interaction of participants in switching from one role to another, depend on recognition by either party of the intentions of the other so that they can plan a composite

whole through the interactive recognition of these intentions. On the alternative view in which language itself has evolved as providing mechanisms for interaction, such effects may be the result merely of the implementation of the system, so that apparently interactive effects can result without having to presume on levels of higher-order intention-recognition by all parties to the exchange. In so far as this latter position is confirmed, we have further parallelism with music, where reconstructing the intentions of one's co-music-maker has, at best, a peripheral role to play.

### 3 The present volume

The papers of this volume distribute themselves across this spectrum of research activity. Mills explores the nature of ensembles in both music and language, and sets out ways of experimentally probing the relationships between individuals forming such ensembles, starting from a broadly Clark-based set of assumptions. Orwin's paper is the historical first exploration of applicability of the Dynamic Syntax methodology to music [Kempson *et al.*, 2001, Cann *et al.*, 2005, a.o.] in which he argues that, with its core concept of incrementality plus update, and requirement-driven dynamics, language displays clear parallels with music. As he points out however, any such applicability is not without problems, requiring generalisation of the concept of semantic type to make this possible. Cooper's paper directly addresses this issue, arguing that the concept of record type articulated within the Type Theory with Records framework [Cooper, 2012] provides the necessary suitably abstract concept of type to allow a common vocabulary to ground both perception and language, and from that basis, to ground music also. He argues that interaction depends on the perception of events and illustrates how his type theoretic approach can capture the coordination of events in both music and language. Of particular interest in music is the nature of beat events and their role in coordination. Gregoromichelaki evaluates in detail recent research developments that have led to the claim that both music and language be analysable as mechanisms for interaction, setting this explicitly dynamic and procedural perspective against previous attempts to model language and music in the more static terms provided by orthodox methodological assumptions. Taking their cue from Wiggins [2012] that music is a cognitive construct and from Cross [2012] that it is grounded in participant interaction, Kempson and Orwin set out the case for analysing language as a set of mechanisms for interaction relative to Dynamic Syntax assumptions, showing how the very mechanisms independently argued in that framework to capture such syntactic stalwarts as long-distance dependency and expletives can also be seen as mechanisms not merely for incremental growth but, specifically, for interaction. They then turn to showing how the dynamics of interactive conversation exchanges can be illustrated directly

from music performance, in a Somali oral poetry genre in which the music is essentially at the service of the oral recitation of the poem. Chatzikyriakidis explores the consequences of the domain-generalness intrinsic to the Dynamic Syntax framework. He turns to current debate on polyrhythms and the issue of whether multiple rhythms can be constructed as such, discretely held, by a single performer/processor, or whether they are constructable only either as a succession of local dependencies, or stored/routinised as a single complex chunk. On this basis he probes the possibility that this aspect of music displays an analogue of an established grammar-internal constraint that precludes multiple instances of any one type of ongoing uncertainty. The issue remains open, but the putative parallelism between music and language in this limit-setting on processing non-determinism remains a live possibility. Widdess, from a musical perspective, presents an analysis of Indian raga performance, displaying considerable rhythmic subtleties, and draws out the complex interactions between routinised chunks of playing in improvisation, showing how these involve schemas of varying size that can be incrementally manipulated in tandem across text, rhythm and pitch to allow for interaction between soloist, accompanist, and audience. From the linguistics side, Clift *et al.*, as conversation analysts, take up the issue of context-dependence in language, demonstrating across a number of cases that utterances, and the actions that are conducted through utterances, are understood not simply by reference to their composition but also their position in an interactional sequence. They argue that enriching our concept of linguistic context to include sequential organisation will enable us to develop a motivated analysis of the relationships between linguistic structure and communicative function. Two papers finally introduce research projects addressing the simultaneous cross-modal interaction of language and music. Duffy and Healey provide a detailed ethnographic study of instrumental music lessons in which both student and tutor use language and music as a means of interaction, with seamless shifts between the one and the other modality, either modality being able to be used for the various language-familiar phenomena such as correction, clarification etc. They show moreover that participants can freely switch modalities at any point in such an exchange, rather than having to stay systematically within one modality, providing evidence for the domain generality of the general dynamics of such interactions. Hawkins *et al.*, having given a survey of the background leading to the type of experimental research on language-music interactions, introduce and demonstrate an experimental methodology for probing cross-modal interactions involving language and music, in which paired participants are asked to play on novel instruments talking freely as they do so. As with the Duffy and Healey paper, the results, here experimentally validated, specifically confirm the domain generality of such interactions since there are crossover effects of

speed and rhythmicity from one modality to the other.

The overall display of research which these papers provide, albeit in some cases provisional and programmatic, nonetheless demonstrates the fine state of the art in research probing language-music interactions, with corpus-based studies (both music and language), formal studies (both semantic and syntactic), and development of experimental methodologies (both for individual-ensemble interactions and for cross-modal music-language interactions). The papers are in the main the outcome of a research workshop entitled *Language and Music as Mechanisms for Interaction?*, held under the aegis of the Philological Society at Queen Mary University of London, November 9th 2012. We are grateful to the then President of the Philological Society, Professor Sylvia Adamson, and the Philological Society Council for their encouragement to set up this one-day workshop. We also wish to thank the Society, the Electrical Engineering and Computer Science Department and the Centre for Digital Music for jointly making the workshop possible. We are especially grateful to Jane Spurr for getting this volume into public dissemination in the shortest possible time once the completed manuscript had become available.

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