PHONOLOGY

REVIEW

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1 Overview and structure of the volume

Perspectives on Element Theory (PET), edited by Sabrina Bendjaballah, Ali Tifrit and Laurence Voeltzel, is a collection of eight papers stemming from the *Elements: State of the Art and Perspectives* conference organised by the Laboratoire de Linguistique de Nantes (LLING UMR 6310 CNRS/Université de Nantes) on 14–15 June 2018. The papers represent a selection of those presented at the conference and a further contribution by Henk van Riemsdijk.

As claimed in the introduction, PET 'aims at providing an overview and an extension of the Element Theory [ET] program by exploring new lines of research' (PET: 1) developed along a few common threads that run across and tie together most of the chapters. These are fundamental 'theoretical and empirical questions that have been implicitly taken for granted until now' (PET: 1), such as the nature and number of privative melodic primes, the relationship between the inventory of primes and the structure in which they might be embedded, their relationship with phonetics, their role in suprasegmental phonology, and the hypothesis that the nature of the representational primitives and the principles governing their combination and distribution are shared by phonology and syntax. In the introduction, the editors provide a succinct and clear discussion of the crucial relevance of these questions for ET, as well as a brief historical overview of the most important stages in the development of this theory, which helps the reader to contextualise the proposals of the papers within the ET tradition.

As expected, despite the common threads running across PET, each chapter engages with (a subset of) these themes at different degrees of depth that clearly depend on the ideas the authors have been developing in their previous work. Interestingly, some of the authors have not previously worked on ET or the closely related Government Phonology (GP). This is the case for Elan Dresher, Eric Raimy and Henk van Riemsdijk, who approach some of the above-mentioned themes from their own perspectives and, crucially, discuss the ways insights provided by their own previous work might support or disprove some of the hypotheses put

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forward by ET. The other authors – Phillip Backley, Harry van der Hulst, Markus A. Pöchtrager, Kuniya Nasukawa, Nancy C. Kula and Connor Youngberg – are (more or less closely) related to standard ET/GP. These authors, too, deal with the above-mentioned themes based on their previous work, which in several cases challenges some of the core hypotheses concerning the representational and computational sides of ET/GP.

Neither the proposals of the first group of authors nor those of the second group are unheard of, as most of them they have already been published elsewhere. As a consequence, PET does not provide many really innovative proposals. However, it has the undoubted merit of collecting them together, thereby providing an accurate synoptic overview of some of the lines of research departing from the relatively standard ET assumptions outlined in (Backley 2011).

2 Fundamental topics and new proposals

In what follows, I provide an overview of the main themes of PET, focusing on the most innovative proposals concerning the main themes mentioned above.

2.1 Number of primes

The hypothesis that the representational primitives of phonology are privative has a long tradition (Anderson & Jones 1974; Schane 1984; Kaye *et al.* 1985). Within such a tradition, a recurrent question is how many representational primitives we should assume, the goal being the development of a restrictive theory (i.e. one featuring as few representational primitives as possible), while keeping a satisfactory level of empirical coverage. In Backley (2011), which provides a sort of standard ET model, the number of elements is reduced to six: |A|, |I|, |U|, |Ɂ|, |H|, |L|. Despite the popularity of Backley's model, attempts have been made to further reduce it. One such attempt is pursued by one of the contributors to PET, Pöchtrager, who, expanding on previous work replacing |Ɂ| by constituent structure (Jensen 1994), argues that |A| and |H| should also be replaced by structure (Pöchtrager 2006; Pöchtrager & Kaye 2013). In PET, Pöchtrager employs his model, GP 2.0, for a unified treatment of vowel quality, length and tenseness/laxness in RP English. As in his previous work, Pöchtrager relies on a conception of structure that resonates with X-bar syntax and, in this paper, argues that nuclei have a bipartite structure; that is, 'maximally two heads, xn and xN, with xn on top of xN', where xn/xN can (i) be empty or host |I|, |U|; (ii) take another constituent (i.e. N′, N″, or the (O)nset) as complement; and (iii) maximally project up to two bar levels. In RP English, the empty structures that can be derived by this system (i.e. those containing no |I| or |U|) are interpreted as [ɑː], [ɜː] or [ʌ], depending on their structural size. Crucially, these structures contain no |A|; what matters is the size of their phonological representation, as well as the *command* relationships entered into by the constituents of such structures. This system allows Pöchtrager to develop a detailed account of the relevant patterns, thereby providing support for his reductionist approach to the number of elements. Note, though, that n and N can also be considered as two different representational primitives, so it is not really clear if we can talk about reduction

stricto sensu. A similar reductionist programme is pursued by van der Hulst. His model, Radical CV (van der Hulst 2020), builds on the hypotheses that (i) a prime can occur under different nodes of a subsegmental tree, thereby receiving a different phonetic interpretation, and (ii) primes enter into head–dependent relations (Anderson & Ewen 1987). This allows for a drastic reduction in the number of primes, which boil down to C and V, representing two opposite, antagonistic specifications of a single phonetic dimension. This is because a contrast previously formalised by two primes can be conveyed by the same prime occurring at different nodes (onset head *vs.* onset dependent *vs.* rhyme head *vs.* rhyme dependent, manner *vs.* location *vs.* laryngeal, primary *vs.* secondary). For instance, depending on its position in the structure, the V prime can identify vowels and sonorants, but also [voice], [low] and [open place].

In PET, van der Hulst provides an overview of the basics of his model and discusses alternative theory-internal approaches to tongue-root distinctions (ATR, RTR) and nasality based on Gaam and Nez Perce harmonic systems. Furthermore, he draws a comparison between Radical CV and GP, noting that 'there is a sense in which the choice of only two elements in Radical CV converges with a particular version of GP that only adopts six elements'. This sense is one in which |A|, |I|, |U|, |ʔ|, |H| and |L| are conceived of as arranged in antagonistic pairs (similarly to C and V), where |A| and |ʔ| represent two opposite extremes on the resonance dimension, |L| and |H| on the frequency dimension, and |I| and |U| on the colour dimension. In standard ET, these dimensions are not given any formal status, whereas in Radical CV they are, in that they correspond to the Laryngeal, Manner and Place nodes, respectively, to which the Supralaryngeal superordinate node is added. Thus, whereas in standard ET we have six elements, in Radical CV we have two primes, plus four nodes. Note that, as in the case of Pöchtrager's n and N, these nodes can also be considered representational primitives, as they cannot be further decomposed, can be manipulated by phonological computation, and contribute to the phonetic interpretation of C and V.

Thus, standard ET and Radical CV are extensionally equivalent with respect to the number of primes, whereas Pöchtrager's model reduces their number to three (but see above). Note that the picture that emerges from comparing these approaches is characterised by a trade-off between the number of primes and structural complexity: whereas standard ET and conservative GP approaches minimise the subsegmental structure and maximise the number of primes (many elements on small trees), Radical CV and GP 2.0 minimise the number of primes by maximally exploiting the structural dimension (fewer elements on bigger trees; see Cavirani & van Oostendorp 2020 for further discussion of the trade-off between structural complexity and number of primes, and for a radical proposal featuring one prime).

Apart from Pöchtrager and van der Hulst (and, to a lesser extent, Youngberg), the other authors do not directly engage with the issue discussed in this section. A quick hint is also dropped by Dresher, who argues for a principle of feature economy, whereby 'phonological inventories prefer to reuse the same features' and suggests that 'constraints on what a feature can be [...] could bring the set of possible features closer to that of [ET]'. However, this 'is left for future research' (PET: 40–41).

2.2 Innateness of primes

Whereas the discussion concerning the number of elements has attracted the attention of several authors, the question of whether they are universal or emergent has rarely been addressed. Most authors, including most of the contributors to PET, assume that they are universal. There are exceptions, though.

One such is van der Hulst, who argues that 'features result from an innate categorisation principle that splits phonetic substance into two opposing categories' (PET: 113). This *Opponent Principle* is argued to be a sort of third-factor principle (categorical perception), and thus not part of UG. What is part of UG, according to van der Hulst, is the way in which these opposite categories are formalised/grammaticalised (i.e. C and V), as well as the set of universally ranked, articulatory grounded superordinate nodes, where manner outranks place. Note that this emergent-feature hypothesis, or, conversely, the idea that elements do not universally correlate with acoustics, allows the formal representational system proposed by van der Hulst (i.e. the representational primitives and their hierarchical organisation) to be extended to sign languages (van der Hulst 1993).

Something similar is held by Dresher. In his chapter, he provides an overview of the main ideas of the Contrastive Hierarchy Theory, treating representational primitives as binary and emergent. In this case, what is universal is the concept of a contrastive hierarchy; that is, the principle that allows the learner to build a phonological inventory by splitting the phonetic dimension of speech into categories depending on their contrastiveness and maximising the use of the features already postulated. Referring to previous literature (Samuels 2011), he also provides arguments supporting feature emergence that include the fact that innate features are (i) too specific to be used for modelling sign languages, (ii) empirically inadequate, and (iii) unnecessary, as some of the features need to be learned anyway based on phonological activity.

Apart from these two scholars, all contributors to PET, plus virtually all the scholars working with ET, assume that primes are innate and privative.

2.3 Privative primes and ternary oppositions

As mentioned in §2.1, a trade-off can be identified in the literature between the number of primes and the subsegmental structure in which they are arranged, as the enrichment of the latter allows for a reduction of the former. Another positive outcome of a rich subsegmental structure is that it allegedly allows the formalisation of ternary contrasts, which seems to favour binary feature systems over privative ones. This is the main topic of the chapter by Raimy, who, building on Avery & Idsardi (2001), proposes a model that can formalise ternary contrasts without using binary features. Simplifying, Raimy assumes, similarly to what is proposed by van der Hulst, that articulatory features (*gestures*) are organised in antagonistic pairs (e.g. [front] and [back]) and dominated by organisational nodes defining the *dimension* over which these features contrast (e.g. Tongue Thrust). These nodes, in turn, can be dominated by other nodes (e.g. Dorsal), which can, in turn, be dominated by other nodes, too (e.g. Oral Place). Crucially, these organisational nodes are argued to allow for a distinction between marked, superordinate and unspecified feature marking. Interestingly, Raimy illustrates

his proposal by developing an analysis of voicing assimilation in Polish varieties that contrast with the one by Cyran (2011), the main differences being that the latter uses elements and abides by the *laryngeal relativism hypothesis* (thus by the hypothesis that phonology is substance-free), whereas the former uses different primes and adheres to the *feature realism* hypothesis. This brings us to the next broad theme of PET.

2.4 The substance of primes

Another long-standing issue in ET is the relationship between the elements and the phonetic substance they correlate with, which is part of the broader issue concerning whether phonology is better conceived of as substance-free or substance-full. This theme is addressed by Raimy, who defends an intermediate position, dubbed *substance impoverished* phonology. This position is basically the one that is held by all the scholars working with ET, including those contributing to PET. For instance, Backley maintains that elements 'refer to the physical speech signal [but] also denote abstract phonological categories [that] express lexical contrasts' (PET: 15). Similarly, Dresher concedes that 'phonetics is clearly important, in that the […] features must be consistent with the phonetic properties of the phonemes [but the] specification of a phoneme could sometimes deviate from the surface phonetics' and, crucially, he considers, 'as most fundamental that features should […] reflect the phonological activity' (PET: 36). Along similar lines, van der Hulst accepts neither 'that features are "purely abstract" nor that structures can arise that are "phonological unicorns" (i.e. structures that are not phonologisations of actual phonetic events that occur in human languages)' (PET: 113).

Thus, despite perceiving phonological primes as cognitive objects that are not directly determined by phonetics, ET does not ignore their phonetic side and positions itself halfway between substance-free and substance-led phonology.

The question, if anything, concerns the phonetic module elements correlate with: Do they correlate with articulation or acoustics? The standard ET answer to this question is acoustics. This is maintained (albeit not discussed) by all the contributors to PET, with the exception of Dresher and Raimy, who instead argue for an articulatory grounding; and van der Hulst, who proposes that 'both acoustics and articulation deliver cognitive substance that provide the "raw material" that phonological elements categorize' (PET: 113).

2.5 Melodic primes and suprasegmental phonology

The hypothesis that primes have both a physical and a cognitive dimension allows us to exploit them for the representation of different kinds of organisational nodes, both in the subsegmental – as in van der Hulst's system, where they are formalised as C and V – and in the suprasegmental dimension. The latter possibility is explored by Backley in the opening chapter of PET, where he provides an overview of the theory that he has been developing in the last few years together with Kuniya Nasukawa: Precedence-free Phonology. In this new theoretical development, elements are arranged in hierarchical binary structures, where a head takes a complement and recursively projects up to and above the segmental level, and thus plays a role at,

and indeed formally replaces, the nucleus, rhyme, syllable and foot nodes. Furthermore, Backley proposes that heads (i) are restricted to the set of resonance elements, |A|, |I|, |U|, (i.e. those that correspond to nuclear domains); (ii) are decided on a language-specific basis; and (iii) have only a structural function, whereas the melodic function is performed by the dependent elements. Note that this system can be considered another instance of the general idea that increasing the structural complexity of representations allows a reduction in the number of representational primitives, as representational primitives such as N, R, σ and F (or whatever format one prefers to adopt) can be replaced by a resonance element.

A comparable attempt at unifying melody and prosody is pursued by van der Hulst. In this case, though, what is being 'recycled' in other levels are the primes that traditionally refer to syllabic constituents (i.e. C and V), which are used to encode the subsegmental properties of segments, as well as further projections of the nucleus (i.e. the rhyme and syllable nodes).

2.6 Phonology–syntax analogies

Structural analogies between phonology and syntax have long been noted (Anderson 1987) and continue to inspire the work of several scholars. This is clearly the case with Backley and Pöchtrager, who more or less explicitly model their phonological representations on X-bar theory (see also the papers collected in Nasukawa 2020).

In his chapter, van Riemsdijk provides further arguments for this assumption by exploring the role a general (possibly language-external) principle such as the Obligatory Contour Principle might play in syntax. In this case, thus, rather than importing into phonology some of the formal tools developed in syntax, it is phonology that serves as the source of inspiration for the conceptualisation of some aspects of syntax (which can hardly be considered a new development, if ones thinks about features). Beginning with a historical review of his previous work, which starts from a discussion of his source of inspiration, the work of Jean-Roger Vergnaud, and covers his earlier work on categories and projections and their relationship/cohesion, van Riemsdijk sketches a new approach to categorial representation that is very much reminiscent of autosegmental phonology. More specifically, he proposes a system with a Categorial Tier ('on which the values N and V are displayed in the form of a template: NVNVNV […] that is very much like the standard template CVCVCV in phonology'), a Level Tier for projections (where (H)eads and (M)aximal projections also form a template: HMHMHM), an intermediate Phrase Tier that contains placeholders (X) representing 'complete syntactic units' (i.e. phrases), and a Merge Tier that represents 'the spine of the (dendromorphic) projection as we know it'. Crucially, the objects on these tiers are privative features, whose distribution is governed by the OCP. Furthermore, to formally encode the difference between lexical and semi-lexical heads, he also proposes to make use of the ET notion of headedness: |M.H| for functional heads, and |H.M| for semi-lexical heads. This, as well as a thorough development of these ideas, is left for future research.

2.7 Other innovations

Besides the major themes just reviewed, PET also offers some interesting novel proposals. For instance, Nasukawa and Kula provide a strict CV (Lowenstamm 1996; Scheer 2004) analysis of epenthetic consonants in Bemba and Lungu that features a new phonological operation: overlap concatenation. This operation consists of the superimposition of the last CV sequence of a prefix and the initial CV sequence of the following form, and comes in two flavours that depend on the morphological context. When prefixes attach to stems, asymmetric overlap concatenation applies, and the material contained in the non-empty C/V node of one form merges with the C/V node of the other form. Thus, if the stem has an initial empty C, the content of the prefix-final C nodes can surface (giving the impression of epenthesis). On the other hand, if a prefix attaches to another prefix, symmetric overlap concatenation applies, and the initial CV nodes of the second prefix completely overwrite the final CV of the preceding prefix, no matter if the CV nodes of the former are empty.

Similarly, the chapter by Youngberg adds an interesting new computational device to GP, Intervocalic Government, and builds on (a revised version of) Pöchtrager's proposal concerning the structural nature of what in standard ET corresponds to |A| (a similar proposal concerning |A| can be found in Cavirani & van Oostendorp 2020). This new type of government is argued to be sensitive to the elemental makeup of the relevant V nodes and, crucially, to the presence of the structural version of |A|, which makes the nucleus containing it a good governor and, conversely, a bad governee. The empirical dimension on which this proposal is tested is represented by vowel sequences and hiatus resolution strategies in Tokyo and Owari Japanese.

3 Overall evaluation of the volume

All in all, PET succeeds in providing a picture of several new dimensions along which ET is being developed. Such a picture includes (i) a few innovative GP/strict CV computational devices; (ii) some discussion of fundamental properties of ET and their possible extension to syntax, coming both from scholars working with ET and from scholars who adopt different theories; and (iii) novel analyses of relatively well-known patterns.

Several of the proposals put forward in the various chapters, though not new, are nicely collected together and arranged in a consistent narrative, each chapter touching upon some of the topics addressed in the previous one. This results in a well-structured and smoothly flowing book that fulfils the goal announced in the introduction by the editors, namely the discussion of ET's fundamental 'theoretical and empirical questions that have been implicitly taken for granted until now', and portrays ET as a lively and fertile research programme. Because of this, PET represents an interesting read for scholars who are relatively familiar with the standard hypotheses of ET/GP and are eager to know more about the directions along which this research programme is developing, as well as how it can inform syntax.

A few typos can be spotted here and there (e.g. alignment problems in tables, examples and figures, and missing references), but they do not impact the readability or the overall quality of PET. If there is one aspect that could have been taken more

care of, possibly in the introduction, it is a critical discussion and a thorough comparison of the various proposals. Given the heterogeneity of the proposals, however, this would have been quite a cumbersome and probably unsuccessful endeavour.

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