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研究課題名(和文) 拡大エレメント理論を用いた分節内構造と韻律構造の相関関係の解明

研究課題名(英文) Investigating the interaction between segmental structure and prosodic structure using an extended model of Element Theory

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研究成果の概要(和文)：本研究では、分節内構造の解明に特化し、音韻知識を明らかにしようとするエレメント理論(ET)を用いた研究で得られた知見を、韻律構造にも拡大適用することで、形態素内のすべての音韻特性(分節内特性と韻律特性)を統一的に分析することを試みた。その結果、ETは、分節音間の線形属性を音韻表示から排除する非時系列音韻論(PfP)へと発展することとなった。この理論では、分節内構造のみならず韻律構造も、主要部・依存部関係を呈するエレメントから構成されているとし、この主要部・依存部関係の複雑なネットワークを、言語使用者が(単純な仕組みのもと)音声的に線状化すると考える。

研究成果の学術的意義や社会的意義

本研究を通じて、次の3点において、音韻知識に関する我々の理解を深めることとなった。第1に、異なる単位からなる異なる領域とこれまで考えられてきた分節と韻律表示を、エレメントと呼ばれる単位間の主要部・依存部関係のみで、統一的に表示することが可能となった。第2に、統語表示同様、分節間の前後関係は音韻属性ではなく、非対称的音韻構造を解釈した産物であると見做すことで、音韻系も統語系と言語学的に似た仕組みを呈することを示した。第3に、伝統的「音節」構造を用いず、エレメント同士の主要部・依存部関係からなる音韻表示を用いて諸分析が可能となったことで、音韻系における回帰階層構造の実在性が示された。

研究成果の概要(英文)：Element Theory (ET) is an innovative model of phonological knowledge in Generative Grammar which focuses solely on the internal structure of segments. This research has extended the scope of ET to include prosodic as well as segmental structure, redefining ET as a general theory of phonological representation rather than just a theory of segmental structure. All of a morpheme's phonological properties (melodic and prosodic) are now expressible in terms of elements.

In this and related (collaborative) research, ET has evolved into the model called 'Precedence-free Phonology' (PfP), which has the more ambitious aim of removing the need to state the linear ordering of segments in representations. Instead, segmental ordering falls out automatically when language users interpret the intricate network of head-dependency (H-D) relations that control prosodic and melodic structure. The claim is that H-D relations operate between all units (elements) in a unified prosodic-melodic structure.

研究分野：音韻論

キーワード：phonology elements melody-prosody interface segmental structure head-dependency

様式 C-19、F-19-1、Z-19、CK-19（共通）

1. 研究開始当初の背景

(1) In phonology there is a long-standing tradition of representing melodic (segmental) information and prosodic (organizing) information in separate modules using different representational units.

(2) Elements provide an appealing alternative to standard distinctive features, but they are limited to representing the melodic aspects of phonological representations, even though elements are known to interact with prosodic information.

2. 研究の目的

(1) This research aims to integrate the segmental and prosodic information contained in a morpheme's representation by creating a unified melodic-prosodic structure which refers to a single set of representational units (i.e. elements) throughout.

(2) The goal described in (1) is intended to capture the fact that segmental patterns are controlled to a significant extent by prosodic domains: there is an inherent link between melody and prosody in the phonological grammar.

(3) This research extends the role of head-dependency in phonological representations. It reveals how head-dependency relations are not only responsible for structure-building but are also crucial to the mechanism by which phonological structure is phonetically realized.

3. 研究の方法

(1) I conducted a thorough review of the use of elements in phonological analysis, taking into account not only standard versions of Element Theory but also related models which show variation in the inventory of elements employed and in the way elements function in representations. This involved a detailed evaluation of the recent literature and also frequent appearances at international conferences, where I was able to interact with research colleagues and receive valuable feedback on the work I presented.

(2) Most of this research was carried out in close collaboration with Kuniya Nasukawa (分担者), whose research work overlaps significantly with the aims of this project. Together we reviewed and re-analyzed existing accounts of phonological data, and also introduced new and revealing data from a broad range of languages including Japanese, English, Italian and Bulgarian. Our findings have been presented at domestic and international phonology conferences, and have been published in Japanese and English by leading linguistics journals and in edited volumes of research papers from well-known publishers.

4. 研究成果

Overview. This research has succeeded in turning standard Element Theory (ET) from a model of melodic (segmental) representation into a general theory of phonological representation capable of expressing a morpheme's prosodic (organizing) properties as well as its melodic properties. Moreover, it does this by combining melodic and prosodic information into a single unified structure, using a single set of structural units—namely, elements. As a result of this and related (joint) research, the ET model has evolved to such an extent that it now warrants the distinct label of 'Precedence-free Phonology' or 'PfP' (Nasukawa 2016; Nasukawa & Backley 2017).

Although the PfP model has its roots in standard element-based phonology, it has quite distinct characteristics and is driven by different and more ambitious aims. As its name suggests, PfP aims to eliminate from phonological representations all reference to the linear ordering of segments. Instead, it shows how the phonetic effect of ordered segments falls out automatically when language users interpret the complex network of head-dependency (H-D) relations that is assumed to exist in prosodic and also melodic structure. The approach argues that H-D relations operate between all units (elements) in melodic structure, just as they are assumed to do in prosodic structure.

Melody and prosody. The tradition in phonology is to clearly divide melody and prosody, since each employs different units and serves different purposes: units of melodic structure (e.g. features, elements) refer to properties of speech sounds and determine how those sounds are realized/perceived in spoken language; by contrast, units of prosodic structure (e.g. the constituents of syllable and foot structure) refer to the way those sounds are grouped together in words and phrases. Phonological representations are therefore split into two distinct levels, melody and prosody. This split is motivated not only by the assumption that different structural units are employed at each level, but also by the fact that phonological processes can target one level independently of the other.

It is less frequently acknowledged, however, that there are also reasons for not separating melody from prosody. Firstly, the two often interact—they are not entirely independent domains. For example, a given melodic property may be tied to a given

prosodic context, e.g. aspiration (as represented by the feature [+constricted glottis]) is usually associated with syllable onsets. The problem is that when interactions such as this are formally expressed, they appear to be arbitrary in nature since melody and prosody use different units—for instance, there is no necessary link between the melodic unit called [+constricted glottis] and the prosodic constituent called ‘onset’. As such, this association has the appearance of a stipulation. Secondly, according to some theoretical approaches, it is possible to pronounce ‘empty’ or unspecified prosodic structure. For example, this research assumes a set of representations based on the principles of Government Phonology (e.g. Charette 1991; Harris 1994), in which speakers can phonetically realize a syllable constituent—typically a nucleus—even if it contains no melodic units (features). The effect is to blur the traditional distinction between melody and prosody, since it allows prosodic structure to be pronounced even when melodic features are not specified.

With arguments both for and against a melody-prosody split, this research took the view that there is more to gain by integrating melody and prosody into a single structure than by keeping them distinct. To achieve a unified representation, it argued that the two levels (melody and prosody) should use a common set of structural units (Nasukawa & Backley 2015b); that is, the units in a representation should be general enough to capture melodic and also prosodic properties. It was proposed that this common set of units should consist of elements, the structural units used in ET.

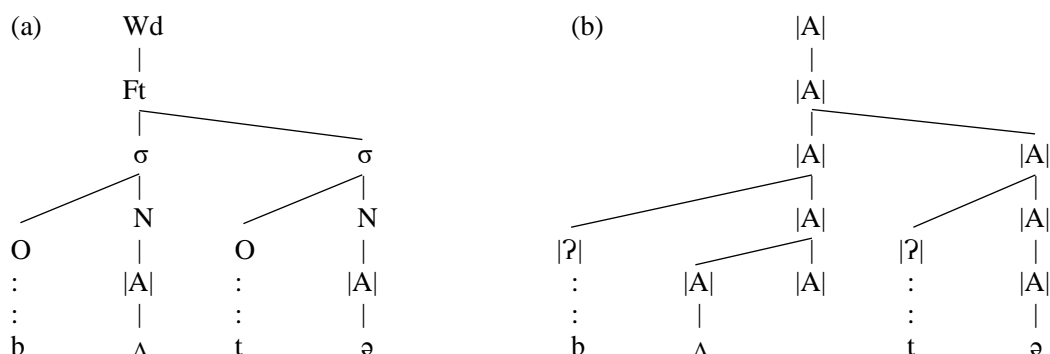
A unified melodic-prosodic structure. By using the same elements in both melody and prosody, PfP avoids the need to refer to traditional units of prosodic structure such as ‘onset’, ‘nucleus’, ‘rhyme’ and ‘foot’. Removing constituents such as these from phonological representations is desirable because it eliminates units/labels that are too specific (in the sense that they relate to only one part of a morpheme’s structure—namely, its prosody). And if we assume prosodic constituents have no place in representations, this leaves just elements to capture all the phonological properties of a morpheme in the lexicon. In PfP, therefore, elements have a dual function: they are present in melodic structure, where they function as interpretive (pronounceable) objects; and the same elements are also found in prosodic structure, where they perform an organizing role.

Clearly, this position contradicts most theoretical approaches in terms of how it expresses phonological information. On the other hand, it is not unreasonable to expect representations to refer only to melodic units (elements) because, after all, phonological representations are mainly concerned with melodic expressions (segments) and how these expressions are arranged into patterns within morphemes. And given that those patterns only involve melodic properties, we might expect that they should be represented by referring only to units of melodic structure (elements). This forms the basis of the PfP model developed here, where elements are phonetically interpreted at melodic level, and also, they enter into head-dependency relations with one another at various structural levels. The resulting chains of head-dependency relations can express the phonotactic and positional patterns that are traditionally expressed by units of prosodic structure.

Not all elements behave as prosodic units in the way just described: only the resonance elements |A|, |I|, |U| have this function, as these elements are associated with nuclei. The significance of nuclei is that they occupy the core part of the syllable rhyme, and rhymes serve as the building blocks of prosodic structure (cf. onsets, which make little contribution to prosodic structure). This makes the resonance elements—as opposed to the non-resonance elements |H|, |L|, |ʔ|—inherently suited to a dual role as units of both melodic and prosodic structure. In conventional approaches to prosodic structure, a nucleus serves as the head of a rhyme and is therefore projected to the next level of structure (i.e. the rhyme); from there it projects further to the syllable level, then to the foot level, and so on. What this research project proposes is that the same hierarchical structure be expressed exclusively in terms of |A|, |I|, |U|. At the melodic level these elements perform their familiar function of specifying contrastive properties in vowels; and at prosodic levels the head element of each vowel expression projects upwards to become the head of larger constituents corresponding to—in traditional terms—the rhyme domain, the syllable domain, the foot domain, and so on. In this way, the conventional labels for prosodic constituents (‘nucleus’, ‘rhyme’, ‘syllable’, etc.) are no longer needed, as these merely denote different projections of the same nuclear head element.

Under PfP’s unified melody-prosody structure, a nucleus should not be seen as a prosodic (organizing) unit in the usual sense. Rather than a structural node, it should be understood as an instantiation of its constituent melodic properties (resonance elements). That is, a nucleus has no properties of its own other than the melodic properties expressed by the elements it contains. Put simply, a nucleus *is* its constituent elements. Thus, we no longer need the label ‘nucleus’ because we can identify this structural object by referring to

its specified elements. On this assumption, the ‘prosodic’ hierarchy is constructed as follows. Assume that a ‘nucleus’ contains $|A|$ and $|I|$, with $|A|$ as the head of the expression $|A|I|$. This is phonetically realized in the usual way, and at the same time, its head element $|A|$ projects to become the head of the ‘rhyme’ node, then the ‘syllable’ node, the ‘foot’ node, etc. At each level of projection this head $|A|$ may support dependent structures (i.e. other elements), but the head itself is still just $|A|$. The following simplified structures represent the word /'batə/ butter; the standard structure is in (a) and its PffP equivalent is in (b).



(b) shows a PffP-type unified melodic-prosodic structure, with the same units (elements) at all structural levels. (No description of consonant structure is given, as the main focus is on prosodic structure, and consonants do not play a significant role in prosody.) The prosodic structure in (b) mostly resembles the standard version in (a); constituency is based on H-D relations (e.g. foot structure is binary and asymmetric) and the ‘syllable’ domain comprises a vocalic head plus a consonantal dependent. There are two notable differences, however. Firstly, in (b) elements are used in place of the usual prosodic constituents. And secondly, in (b) H-D relations exist at all structural levels, prosodic and melodic (Nasukawa 2014, 2015, 2016; Nasukawa & Backley 2017). This is a departure from standard Element Theory, in which elements are exclusively melodic in nature and only one element in a melodic expression is singled out as a head (all others have default ‘dependent’ status).

Vowel structure. In PffP, the head of a nucleus must be from the set $|A|, |I|, |U|$, this head becoming a prosodic head at the syllable level, the foot level, and beyond. In (b) the head is $|A|$. However, the choice of $|A|$ as a head is not related to the quality of the specified vowels in the word *butter*. Rather, it reflects a typological setting, formalized as a language-specific parameter. I claim that English belongs to the typological group in which $|A|$ is always the head of a phonological domain; this choice is determined by the acoustic quality of the (default vowel) carrier signal in the relevant ($|A|$ -type) language group, which typically have a schwa-like central vowel in ‘empty’ nuclei. (This is based on the assumption in that $|A|$ in its weak form is interpreted as [ə].)

In (b), the right-hand nucleus contains a bare head element $|A|$, which has the status of a prosodic unit (= unspecified nucleus) rather than a melodic expression. Since it contains no specified (contrastive) properties, it is realized as a default vowel [ə]. Compare this with the ‘full’ vowel [ʌ], which is structurally more complex: its head is also $|A|$, but here $|A|$ takes a dependent structure which happens to contain $|A|$ too. This highlights a unique and unexpected characteristic of the proposed model—namely, dependent structure (not head structure) expresses contrastive information: the role of dependents is to carry lexical information, while the role of heads is to support dependents. As a head with no dependent structure, the right-hand nucleus cannot carry lexical/contrastive information. So it is realized as a non-contrastive vowel [ə]. In prosodic terms this nucleus is a minimal structure—a bare nuclear head—which yields a minimum amount of linguistic information, i.e. it represents a nucleus with no contrastive properties. By comparison, the left-hand vowel in (b) has a structural dependent, which gives it full-vowel status and the potential to function contrastively (see Nasukawa and Backley (Forthcoming) for a full description).

Heads and dependents. What emerges from this research is the need to revise the roles of heads and dependents in phonological structure. Contrary to established thinking, PffP claims (Nasukawa and Backley 2015b) that the role of heads is to build structure (i.e. to support dependents, and to project to higher prosodic levels); on the other hand, heads are not important for phonetic realization and do not carry the burden of expressing contrastive segmental properties. Rather, this latter role is the responsibility of dependents, which (unlike heads) are not important for structure-building. Instead, their main function is to contribute to phonetic interpretation by providing the most salient melodic properties in segmental expressions. That is, heads have a structural role while dependents are rich

in linguistic (melodic) information. This reverses what is assumed in standard ET.

By redefining the roles of heads and dependents, PfP brings phonology more into line with syntax, where category heads (e.g. verbs, determiners, prepositions) have a low functional load or express predictable information, e.g. in the verb phrase *drink coffee* the semantic information expressed by the head *drink* is largely predictable from its dependent *coffee*, and in the prepositional phrase *in the garden* it is the dependent *the garden* which is highlighted (by being stressed) and which carries most of the ‘message’ (Backley 2018). That is, dependents in syntax have an informational role (semantic focus) while heads support those dependents by taking a structural role, as in the PfP model just described.

The advantage of reinterpreting the roles of heads and dependents in phonology is that H-D structure can be generalized across different modules of the grammar. According to current linguistic thinking, syntax and phonology are inherently different and should be analyzed independently. But if we admit that an interface exists between the two modules, then we might also expect them to at least ‘speak the same language’: specifically, if H-D relations are essential to syntactic structure and also essential to phonological structure, then why not assume that these relations operate in a similar way in both parts of the grammar? PfP places phonology alongside syntax within a generalized theory of linguistic structure where (i) units combine asymmetrically and (ii) H-D asymmetry puts restrictions on how units combine. The claim is that the H-D relations which exist in morpho-syntactic structure also exist in phonological structure. This achieves a closer parallel between the traditionally distinct domains of syntax and phonology.

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