Acta Linguistica Academica Vol. **67** (2020) 1, 29–38
DOI: 10.1556/2062.2020.00003

Lexicalising phonological structure in morphemes

Kuniya Nasukawa
Tohoku Gakuin University, Japan
nasukawa@mail.tohoku-gakuin.ac.jp

Abstract: By comparing different theoretical models of phonological representation, this paper considers (i) what kinds of properties are lexically specified in morpheme-internal phonological structure, and (ii) how this morpheme-internal phonological structure is constructed before being stored in the mental lexicon. The aim is to contribute to the ongoing development of a model which can characterize the lexicalisation of phonological structure within morphemes.

Keywords: lexicalisation; morpheme-internal phonological representations; head–dependency relations; precedence relations; representational economy

1. Introduction

Within Generative Grammar, the minimalist approach to syntactic analysis assumes that syntactic objects (SOs) are created through the recursive application of Merge onto syntactic items. For example, the lexical items α and β are taken from the lexicon and then concatenated by Merge to create a new object $\{\alpha, \beta\}$. Merge applies not only to lexical items (e.g., α and β), but also to derived objects (e.g., $\{\alpha, \beta\}$) which are themselves the product of Merge (e.g., $\gamma + \{\alpha, \beta\} \rightarrow \{\gamma\{\alpha, \beta\}\}$). The repeated application of Merge to its own derivatives generates an infinite number of recursively structured objects, which are then sent to the interface systems, Sensorimotor (SM) and Conceptual-Intentional (CI) (Chomsky 2010).

In phonology, on the other hand, the focus has been on what kinds of properties are lexically specified in morpheme-internal phonological structure; little attention has been paid to how morpheme-internal phonological structure is constructed before being stored in the mental lexicon. Given this state of affairs, this paper considers the mechanism by which morpheme-internal phonological structure is lexicalised by comparing different theoretical models of phonological representation.

The paper is organised as follows. Section 2 considers the kinds of properties that previous studies have assumed to be lexically specified in morpheme-internal phonological structure; it does this by comparing four theoretically different models of phonological representation. This provides the foundation for section 3, which identifies the processes by which phonological representation is lexicalised before being stored in the lexicon. Finally, from various perspectives such as derivational economy and the relation between phonology and syntax, section 4 discusses the placement of each theoretical model in the faculty of language in terms of its approach to the lexicalisation process.

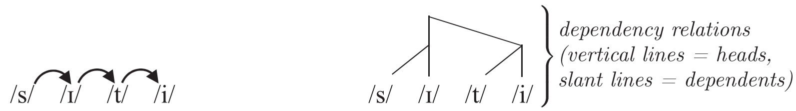
2. The design of morpheme-internal phonological structure in the lexicon

To investigate how morpheme-internal phonological structure is constructed before being stored in the mental lexicon, we must first consider existing approaches and look at the kinds of properties that they assume are lexically specified in morpheme-internal phonological structure. Identifying these lexically-specified properties is possible if we start with the output of lexicalisation and work backwards through the process itself.

Due to space limitations, the discussion will focus on two relational properties between structural units. These are precedence relations and head–dependency relations. Precedence relations between categories are unique to phonology, being entirely absent from syntax. They may be represented as in (1a).

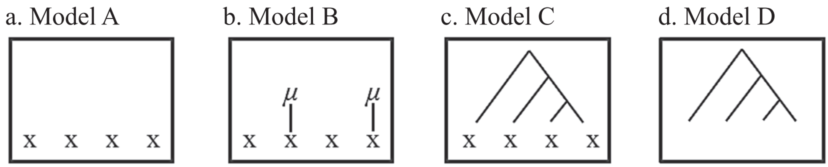
(1) Relational properties (e.g., /sɪti/ ‘city’)

a. precedence b. head-dependency



By contrast, head–dependency relations between categories are not unique to phonology; they are also found in syntax. In most current theories of phonological representation, both properties operate at least at the interface level, where structural units are accessed by the Articulatory-Perceptual (AP) systems in order to be phonetically realised. However, theories differ on the question of what kinds of relational properties are lexically specified in morpheme-internal phonological structure. The present paper highlights these differences by focusing on four theoretical models, labelled here as A, B, C and D.

(2) Lexical specification of supra-segmental relational properties in a morpheme (x = segment, timing unit or skeletal position)



Model A in (2a) is the classic model of phonological representation, as found in Chomsky & Halle (1968); it employs precedence relations but not head–dependency relations. That is, the representation comprises a linearly ordered string of segments (each of which consists of a bundle of features), but with no explicit reference to syllable structure. Even in derived forms after the application of phonological rules, there is no construction of syllable structure.[1]

By contrast, model B assumes that a lexical representation is not identical to its derived representation, as found in McCarthy & Prince (1986) and Bromberger & Halle (1989). Like model A, it specifies a linearly ordered string of segments, but unlike A it builds syllable structure during derivation, this being based on the positions to which **morae** are assigned. That is, lexically unspecified dependency relations are introduced to create syllable structure at the non-lexical level.

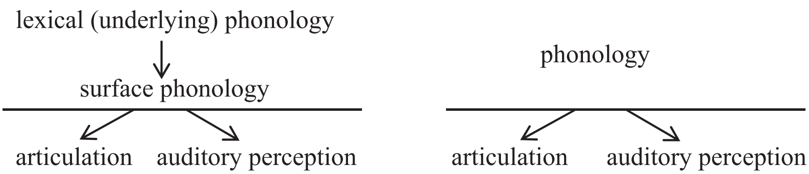
Unlike models A and B, which allow phonological derivation at multiple levels, as in (3a), model C is mono-stratal in the sense that any type of phonological representation can be mapped onto a phonetic outcome: a well-formed lexical representation can be phonetically realised as it is without the need for any derivational process. (A well-formed representation which is morphologically derived can be also mapped onto a phonetic outcome.) This model, as shown in (3b), characterises the Government Phonology (GP: Harris 2004) approach.

In the classic GP model (Kaye et al. 1990; Kaye 1995; Harris 1994; 1997; 2004), syllable structure is included in phonological representations. This means that precedence relations between segments and also prosodic relations are specified in a morpheme's lexical representation. By specifying both segmental and prosodic structure in the lexicon, a representation of the kind assumed in model C can be accessed by the AP systems without the need for derivation.

[1] In a broad sense, Lateral Theory (a Strict CVCV model of Government Phonology) may be classified as a form of A since Scheer (2004; 2013) also denies syllable structure as a formal property.

(3) Strata in phonology

a. Multi-stratal phonology b. Mono-stratal phonology



Precedence-free Phonology (PfP: Nasukawa 2014; 2016; 2017a;b;c; Nasukawa & Backley 2019) is another mono-stratal model. Unlike model C shown in (2c), however, PfP makes no reference to precedence relations between segments. It is depicted as model D in (2d). This approach can be traced back to Takahashi (2004) and Nasukawa (2011) where, in direct contrast to model B in (2b), precedence relations are redundant since they can be predicted from the head–dependency relations in a given structure.[2] In this model, phonological structure consists entirely of melodic units (or more specifically, "elements"), which are structurally basic and which serve a dual function: they represent melodic properties and they also project onto higher levels as organising units (Nasukawa 2017a;b;c).

3. Building phonological structure before it is stored in the lexicon

Based on the preceding discussion, the four models will now be described in terms of how they build lexical representations before storing them in the lexicon. Although the point has not been discussed explicitly in the literature, it can be assumed that precedence relations between segments play an important role in the construction of lexical representations in models A, B and C, where segments are first arranged in linear order.

(4) Formation of segmental strings (e.g., /sɪti/ 'city')

a. /s/ + /ɪ/ + /t/ + /i/ → b. /s ɪ t i /

As shown in (4), segmental strings are formed by successively adding single segments to the string, thereby creating a flat (non-hierarchical) structure.

[2] It is unclear which model GP2.0 (Pöchtrager 2006; 2015; Pöchtrager & Kaye 2013) belongs to, since GP2.0 literature does not discuss the status of precedence relations in any detail.

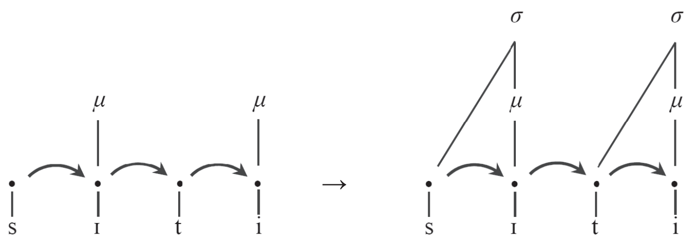
The concatenation of two segments might be regarded as a simple application of Merge in which only precedence relations between segments are specified. This approach to the construction of lexical representations is characteristic of models A, B and C.

Among these models, only A stores flat structures such as (4b) in the lexicon. B and C differ by introducing prosodic structure into the representation; this is done by referring to head–dependency relations between certain segment types – moraic versus non-moraic and nuclear versus non-nuclear.

In the case of B, the flat structure in (4b) is enriched by specifying certain segments as moraic before being stored in the lexicon, as in (5a).

(5) Model B ("•" = Root node, which acts as a timing unit)

a. Lexical representation b. Derived representation

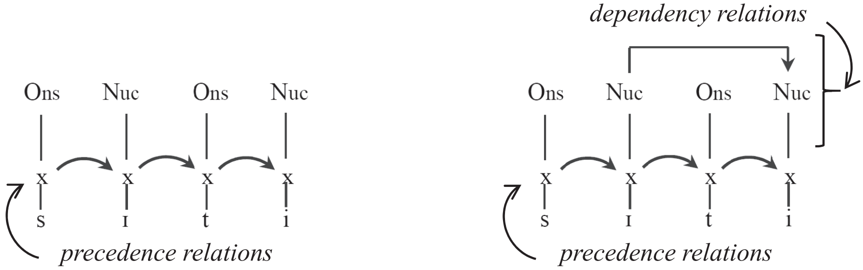


The lexical representation itself contains no syllable structure. Instead, syllable structure is constructed at the post-lexical level, being based on the specification of moraic versus non-moraic segments. This is shown in (5b).

Like A and B, model C refers to precedence relations to create a linear string of segments. It also follows B in introducing prosodic structure based on head–dependency relations. This takes the form of syllable structure which is formed by projecting properties that are already given at the segmental/skeletal level, as given in (6).

(6) Model C

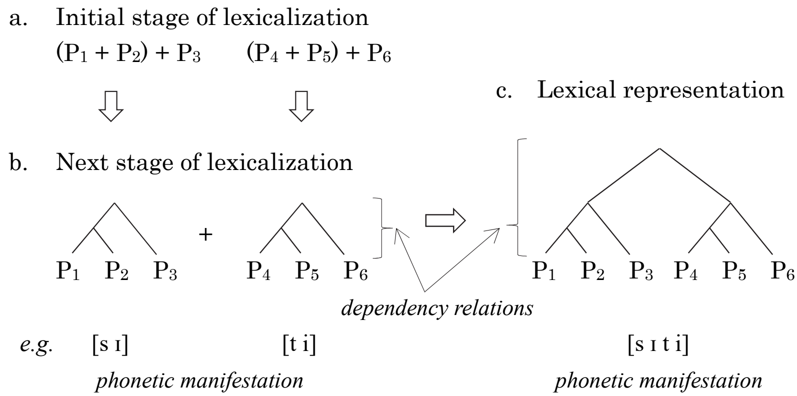
a. Initial stage of lexicalisation b. Lexical representation



However, C differs from B in that it stores in the lexicon a set of representations which refer to both precedence relations and head–dependency relations. As a mono-stratal model, C does not distinguish between underlying and surface representations (Kaye et al. 1990; Kaye 1995; Harris 1994; 1997; 2004); a full specification of relational properties is therefore required at the lexical level.

As described above, models A, B and C are united by the fact that they all employ precedence relations between segments (or more precisely, between timing slots or skeletal positions). By contrast, model D shown in (1d) excludes precedence relations from lexical representations: instead, only structure consisting of phonological primes (elements) is specified when a morpheme is represented in the lexicon, this structure relying on dependency relations between the primes themselves. In this way, no reference is made to syllable constituents such as onset, nucleus, rhyme or syllable. Representations of this kind are found only in the Precedence-free Phonology literature (Nasukawa 2014; 2016; 2017a;b;c; Nasukawa & Backley 2017; 2019). In this model, linearisation – the creation of a linear string of constituents – is merely a by-product of the way head–dependency relations are phonetically realised. As such, there is no need for precedence relations to be specified at any point.

(7) Model D ("P" = phonological prime/feature, "+" = Merge)[3]



As illustrated above, structure is formed simply by concatenating two units (in this case, primes), rather than via precedence relations (which are not

[3] The syllable structure in (7c) differs from that in (5b) and (6b) in ways which are outside the scope of this paper. For a detailed explanation, readers may refer to Nasukawa (2017b).

specified). Concatenated sets may then be further concatenated so that, ultimately, the entire structure becomes hierarchical, as in (7c). This approach is reminiscent of mainstream syntactic theory (Chomsky 2010), in which the creation of sets from derivatives (recursive Merge) generates recursively hierarchical structure. Regarding lexical representations, head–dependency relations must be fully specified in a morpheme at the lexical level since all lexically specified structures must, as in model C, be phonetically interpretable. This is because model D, like model C, is mono-stratal in nature.

According to Nasukawa et al. (2019), phonological structure is linearised according to the principle that dependents are realised before their heads. As illustrated in (7c), this operates from the top level downwards: the dependent syllable-sized set /si/ first, then the head syllable-sized set /ti/; at one level lower, the (dependent) onsets /s/ and /t/ are linearised before their (head) nuclei. That is, the most deeply-embedded part is realised first and the ultimate head last; the parts in between are ordered following the same mechanism.

4. Further remarks on lexicalisation

There is no clear way of determining how the lexicalisation of morpheme-internal phonological structure is best achieved in the context of Generative Grammar, since the advantages and disadvantages of any given model vary depending on the theoretical stance being taken. Consider model D, for instance. If it is assumed that phonology and syntax are inherently different – on the grounds that phonology requires precedence relations to be specified whereas syntax is precedence-free (Bromberger & Halle 1989) – then model D must be deemed inappropriate since it makes no reference to any aspect of precedence either in syntax or in phonology. On the other hand, D is appropriate if you take the position that phonology and syntax are the same – that is, precedence is no more than a by-product of the phonetic externalisation of a structure built from head–dependency relations, leaving representations free of precedence specifications.

Further research is therefore needed on the topics addressed here. If it is assumed that phonology and syntax are inherently different, for example, then we are required to explain why precedence relations are unique to phonology and why syntax is precedence-free (cf. Chomsky 2005). The existing literature does not seem to have considered this point from a phonological perspective. On the other hand, an approach based on model D assumes that phonology is the same as syntax, so it should be able to provide supporting evidence to show that phonological phenomena can be analysed without referring to precedence relations (cf. Takahashi 2004; van der Hulst 2010; Nasukawa 2011).

There is also the question of derivational economy, at least in relation to phonology. As far as the lexicalisation process is concerned, model C is the least economical since both precedence relations and dependency relations are formed by referring to segmental units. In comparison, the other models A, B and D are derivationally economical: A and B require only the use of precedence relations between segments, and D employs only head–dependency relations before a morpheme-internal phonological structure is stored in the lexicon.

However, in terms of derivational economy beyond the lexical level, B is the least economical because the building of syllable structure relies on the specification of morae. At the post-lexical level, on the other hand, the other three models A, C and D are derivationally economical since no structure-building is required which relates to relational properties within the morpheme domain. It may be assumed that the restructuring processes employed in all four models are morphology-driven, though this point is not explicitly made in the case of model A.

Given the prospect of further research work in the directions just outlined, it is hoped that the present discussion will benefit researchers in their pursuit of an adequate model of the lexicalisation of phonological structure within morphemes. Moreover, the resulting model will ideally be one which sits comfortably in the theoretical stance which those scholars choose to adopt.

Acknowledgments

This work was supported by the following MEXT/JSPS KAKENHI grants: Grant-in-Aid for Scientific Research on Innovative Areas #4903 (Evolinguistics) Grant Number JP18H05081, Grant-in-Aid for Scientific Research (S) Grant Number JP19H05589, Grant-in-Aid for Scientific Research (A) Grant Number JP19H00532, and Grant-in-Aid for Scientific Research (B) Grant Numbers JP15H03213 and JP17H02364. I gratefully acknowledge comments on an earlier draft by Katalin Balogné Bérces, Shanti Ulfsbjorninn, Phillip Backley and two anonymous reviewers.

References

Bromberger, Sylvain and Morris Halle. 1989. Why phonology is different. Linguistic Inquiry 20. 51–70.

Chomsky, Noam. 2005. Three factors in language design. Linguistic Inquiry 36. 1–22.

Chomsky, Noam. 2010. Some simple evo devo theses: How true might they be for language? In R. K. Larson, V. Déprez and H. Yamakido (eds.) The evolution of human language: Biolinguistic perspectives. Cambridge: Cambridge University Press. 45–62.

Chomsky, Noam and Morris Halle. 1968. The sound pattern of English. New York: Harper & Row.

Harris, John. 1994. English sound structure. Oxford & Cambridge, MA: Blackwell.

Harris, John. 1997. Licensing inheritance: An integrated theory of neutralisation. Phonology 14. 315–370.

Harris, John. 2004. Release the captive coda: The foot as a domain of phonetic interpretation. In J. Local, R. Ogden and R. Temple (eds.) Phonetic interpretation (Papers in Laboratory Phonology 6). Cambridge: Cambridge University Press. 103–129.

Hulst, Harry van der. 2010. Re: Recursion. In H. van der Hulst (ed.) Recursion and human language (Studies in Generative Grammar 104). Berlin: De Gruyter Mouton. xv–lii.

Kaye, Jonathan D. 1995. Derivations and interfaces. In J. Durand and F. Katamba (eds.) Frontiers of phonology: Atoms, structures, derivations. Harlow: Longman. 289–332.

Kaye, Jonathan D., Jean Lowenstamm and Jean-Roger Vergnaud. 1990. Constituent structure and government in phonology. Phonology 7. 193–231.

McCarthy, John J. and Alan Prince. 1986. Prosodic morphology 1986. Linguistics Department Faculty Publication Series 13.

Nasukawa, Kuniya. 2011. Representing phonology without precedence relations. English Linguistics 28. 278–300.

Nasukawa, Kuniya. 2014. Features and recursive structure. Nordlyd 41. 1–19.

Nasukawa, Kuniya. 2016. A precedence-free approach to (de-)palatalisation in Japanese. Glossa: A Journal of General Linguistics 1. 1–21.

Nasukawa, Kuniya. 2017a. Extending the application of Merge to elements in phonological representations. Journal of the Phonetic Society of Japan 21. 59–70.

Nasukawa, Kuniya. 2017b. The phonetic salience of phonological head-dependent structure in a modulated-carrier model of speech. In B. Samuels (ed.) Beyond markedness in formal phonology. Amsterdam & Philadelphia: John Benjamins. 121–152.

Nasukawa, Kuniya. 2017c. The relative salience of consonant nasality and true obstruent voicing. Amsterdam & Philadelphia: John Benjamins. 146–162.

Nasukawa, Kuniya and Phillip Backley. 2017. Representing moraicity in Precedence-free Phonology. Phonological Studies 20. 55–62.

Nasukawa, Kuniya and Phillip Backley. 2019. Phonological evidence for segmental structure: Insights from vowel reduction. Phonological Studies 22. 51–58.

Nasukawa, Kuniya, Phillip Backley, Yoshiho Yasugi and Masatoshi Koizumi. 2019. Challenging universal typology: Right-edge consonantal prominence in Kaqchikel. Journal of Linguistics 55. 611–641.

Pöchtrager, Markus Alexander. 2006. The structure of length. Doctoral dissertation. Universität Wien.

Pöchtrager, Markus Alexander. 2015. Binding in phonology. In H. van Riemsdijk and M. van Oostendrop (eds.) Representing structure in phonology and syntax. Berlin & New York: Mouton de Gruyter. 255–275.

Pöchtrager, Markus Alexander and Jonathan Kaye. 2013. GP2.0. SOAS Working Papers in Linguistics and Phonetics 16. 51–64.

Scheer, Tobias. 2004. A lateral theory of phonology. Vol 1: What is CVCV, and why should it be? Berlin & New York: Mouton de Gruyter.

Scheer, Tobias. 2013. Why phonology is flat: The role of concatenation and linearity. Language Sciences 39. 54–74.

Takahashi, Toyomi. 2004. Syllable theory without syllables. Doctoral dissertation. University College London.