Phonological aspects of nasality: An element-based dependency approach

Botma, E.D.

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In this dissertation, I have provided a phonological characterization of nasals, nasalized segments and processes of nasalization, based on a range of data from a large number of languages. To this end, I have developed the model of Element-based Dependency, a theory of phonological representations that combines insights from Dependency Phonology (see especially Anderson & Ewen 1987, Smith 2000) and Element Theory (see Harris & Lindsey 1995).

Element-based Dependency assumes a restricted number of manner, phonation, and place elements, and a restricted number of ways in which these elements can be combined. Place properties are represented in terms of the elements |U|, |I|, and |A|. Manner and phonation properties are represented in terms of the elements |/?|, |H|, and |L|; these have the following general interpretation:

(1) \[\begin{array}{ll}
|/?| & \text{complete closure} \\
|H| & \text{close approximation} \\
|L| & \text{open approximation}
\end{array}\]

The articulatory interpretation of |/?|, |H|, and |L| therefore corresponds to the three-way manner distinction in terms of degree of oral stricture, as is assumed in traditional articulatory phonetics.

In combination with a place specification, |/?|, |H|, and |L| denote plosive, sibilant, and vocalic manner. This is motivated by the observation that plosives, sibilants, and vowels are the unmarked segmental instantiations of the phonetic properties associated with |/?|, |H|, and |L|.

(2) \[\begin{array}{ll}
|/?| & \text{plosive} \quad (=\text{unmarked stop type}) \\
|H| & \text{sibilant} \quad (=\text{unmarked fricative type}) \\
|L| & \text{vowel} \quad (=\text{unmarked sonorant type})
\end{array}\]

Some representative structures are given in (3), where O and N are short for onset and nucleus:
The relatively simple structures of plosives, sibilants, and vowels therefore mirror the relatively unmarked status of these segment types.

\[ \text{[?]}, \text{[H]}, \text{and [L]} \] may enter into head-dependency relations, resulting in complex manner types. The basic manner structure of a nasal consonant, for instance, consists of a complex manner type in which [L] dominates [?]:

\begin{array}{c}
\text{O} \\
\text{L} \\
? \\
\end{array}

The structure in (4) expresses the fact that the nasal manner structure is that of a “sonorant stop”. This means that from a phonological perspective nasality is a derived concept. Indeed, I have shown in chapter 4 that nasality is not always present in sonorant stops (see also §2.2.5). In some languages, such as Rotokas and Pirahã, sonorant stops are phonetically realized as voiced oral stops. In other languages, such as Kpelle and Gbe, sonorant stops are realized as nasals only if harmonic nasalization is present.

In (4), the dependency relation that holds between [L] and [?] is motivated by the relation between, on the one hand, manner and prosodic interpretation and, on the other hand, manner and place. The presence of the head element [L] identifies nasals as sonorants for the purposes of prosodic interpretation. For instance, the fact that nasals, as consonants, are relatively unmarked in “vocalic” positions (e.g. nuclei and codas) can be attributed to their being [L]-headed. Nasals share this [L]-headed structure with vowels and approximants. Nasals have [?] as dependent (or “dominated”) manner element. This identifies nasals as stops for the purposes of place selection; the fact that nasals can employ the same range of place contrasts as plosives is due to both segment types having dependent [?] dominate place.

For some languages, the representation of nasals as “bare” sonorant stop structures is sufficient. In other languages, the phonological behaviour of nasals suggests that they must be represented as sonorant stop structures with an additional dependent element [L], as in (5):
The decision as to whether (4) or (5) is the appropriate representation of a nasal is discussed in chapter 2 (see especially §2.2.5). The most straightforward evidence for the presence of dependent |L| in nasals comes from those languages in which nasals trigger nasalization (i.e. spreading of dependent |L| to a sonorant) or voicing (i.e. spreading of dependent |L| to an obstruent). Examples of these processes are discussed in chapters 3 and 4.

One of the central assumptions of Element-based Dependency is that the phonetic interpretation of elements depends on the structural position in which they occur. A case in point is the element |L|. Generally speaking, i.e. in the absence of a specific phonological context, |L| has the articulatory correlate of open approximation and the acoustic correlate of periodicity. The specific interpretation of |L|, however, depends on its position in the phonological structure. If |L| occurs as a manner element (i.e. as a head element), the segment concerned is identified as a sonorant. If, on the other hand, |L| occurs as a phonation element (i.e. as a dependent element), its interpretation is variable: dependent |L| is interpreted as nasalization if there is also an |L| present in the head, and as voicing if there is no |L| present in the head. The three contexts in which |L| can occur are given in (6a-c). Observe that each of the structures in (6) is dominated by a subsyllabic constituent and dominates a place specification:

(6) a. | b. ├── “|L| present” | c. ├── “|L| absent”
    L │ L          L
    │ │          │
    │ │          │
    │ │          │

Three concrete examples are given in (7). In (7a), dependent |L| is interpreted as nasalization on account of the presence of another |L| in the manner component. In (7b) and (7c), dependent |L| is interpreted as voice, since here there is no |L| present in the manner component:
A general advantage of a context-sensitive interpretation of elements is that it limits the number of elements that must be assumed, thus minimizing the risk of overgeneration. The use of a restricted number of elements implies in turn that Element-based Dependency representations lack phonetic concreteness. This can be considered an advantage, since some phonological properties, such as sonorancy and nasality, lack a clear phonetic correlate (see §1.1).

With respect to \[L\], a context-sensitive interpretation of elements has a number of more specific advantages. First of all, the variable interpretation of dependent \[L\] as nasalization and voice predicts the non-existence of both distinctively voiced sonorants and distinctively nasalized obstruents (disregarding nasal contours, the representation of which is seen to vary from language to language). The non-existence of such segment types is desirable, since there is no evidence to suggest that obstruent nasalization and sonorant voicing are phonologically relevant.

The dual interpretation of dependent \[L\] also permits an insightful analysis of nasal harmony phenomena, i.e. those processes in which nasality surfaces as a property of not just a single segment (as in an English word like \textit{milk} [mɪlk]), but a range of segments. In Warao, for instance, nasality spreads rightswards from a nasal consonant to the end of a word, until it is arrested by an obstruent (as in a Warao word like \textit{mõãûpu} ‘give them to him’)

In one subtype of nasal harmony, nasalization surfaces as a property of all sonorants within the harmonic domain, while leaving obstruents unaffected. An example of a language in which this is the case is Tuyuca. The Tuyuca forms in (8) show that nasality, when present in a word, is a necessary property of all sonorants:

\begin{tabular}{lll}
(8) & Üfə & ‘to illuminate’ \\
& Hõl & ‘there’ \\
& ëmïl & ‘howler monkey’ \\
& Üïnï & ‘wind’
\end{tabular}

\begin{tabular}{lll}
(8) & mïp & ‘badger’ \\
& nïtï & ‘coal’ \\
& tïnô & ‘Yapara rapids’ \\
& nôsï & ‘bird’
\end{tabular}

The distribution of nasality in such forms can be straightforwardly accounted for if we assume that dependent \[L\], when present as a harmonic element, is attached to all and only \[L\]-specified manner components. In some Tuyuca-type languages, such as Southern Barasano, Tucano, Yuhup, and Gbe, there are independent arguments to analyze dependent \[L\] as a property of entire syllables.
However, in these languages, too, the harmonic target range is coextensive with the number of |L|-specified manner components within the harmonic domain.

A further advantage of the dual interpretation of |L| as nasalization and voice comes from phonological processes in which both nasalization and voice are relevant. One such process is postnasal voicing, i.e. the phenomenon whereby a voiceless obstruent surfaces as voiced under the influence of a preceding nasal consonant. An example of a language which displays postnasal voicing is the Puyo-Pongo dialect of Quechua. The forms in (9a) illustrate that suffix-initial voiceless stops in Puyo-Pongo Quechua surface as voiced when preceded by a stem-final nasal; the forms in (3b) illustrate that these suffix-initial stops surface as voiceless in other contexts:

(9)  a. /kam-ba/ [kamba] ‘you-GEN’
    /wakin-da/ [wakinda] ‘the house-OBJ’
    b. /sinik-pa/ [sinikpa] ‘porcupine-GEN’
    /wasi-ta/ [wasita] ‘the others-OBJ’

On the assumption that the nasal is represented as a nasalized sonorant stop, i.e. as a structure with a dependent element |L|, stop voicing can be expressed in terms of the spreading of this |L| to the dependent position of the stop, where it is interpreted as voicing (in (10) I assume that the nasal-stop cluster forms a coda-onset sequence):

(10)  

Thus, the interpretation of dependent |L| is determined by the manner components to which it is associated.

Further support for the dual interpretation of dependent |L| comes from processes in which nasals trigger either voicing or nasalization, depending on whether the targeted segment is an obstruent or a sonorant. An illustrative example of this type of process is found in Navajo. The forms in (11) illustrate that perfectives in Navajo are signalled by voicing of stem-final obstruents, as in (11a), and by nasalization of stem-final vowels, as in (11b):

(11)  IMPERF   PERF
     a. -ʔaa1   -ʔaal  ‘chew, eat’
        -ʔaaʃ   -ʔaa3  ‘few go’
        -lódɔ   -lódz  ‘lead’
b. -bí -bí ‘swim’
-ʔâ -ʔfl ‘classificatory compact object’
-ka -kâ ‘classificatory contained object’

This type of process provides further support for a single element, e.g. |L|, specifying both voice and nasalization. A number of Navajo-type phenomena are considered in chapter 4.

Another key assumption of Element-based Dependency is that laryngeal contrasts (as expressed in terms of dependent elements) are dominated by a subsyllabic constituent, i.e. an onset, a nucleus, or a coda, rather than by a segmental root node (see also Kehrein 2002). The Element-based Dependency representation of subsyllabic structure is given in (12):

\[
\begin{array}{c|c|c|c}
O, N, C & \text{manner} & \text{phonation} \\
\hline
\text{place} & & \\
\end{array}
\]

The organization in (12) expresses the fact that manner and place form the “segmental core”. The phonation component forms a dependent of this core. This is in line with the observation that it is unmarked for a segment to be specified for manner and place, but marked for a segment to be specified for phonation.

The general advantage of the organization in (12) is that laryngeal contrasts are assigned to the level in the prosodic hierarchy at which they are minimally contrastive. Assigning aspiration to the level of onsets predicts, for instance, that languages never form a phonological contrast which involves the relative order of nasality and aspiration (e.g. */m̩/~/m/) or the degree of overlap between nasality and, voicing, and aspiration (e.g. */E̩/~/Em/, */~/~/m/, etc.). The organization in (12) also accounts for the absence of a contrast between a laryngeal segment and the corresponding laryngeal modification (e.g. */m̩/~/m/), at least within the same subsyllabic position. The facts considered in §§5.2 and 5.3 suggest that these predictions are borne out.

Specific advantages of the Element-based Dependency approach are, first, that each laryngeal contrast can be represented in terms of a single dependent element, and, second, that no cooccurrence restrictions are required to account for the fact that some manner types are incompatible with some phonation types. Specifically, the incompatibility of obstruent manner and distinctive nasalization and of sonorant manner and distinctive voice follow naturally from the assumption that dependent |L| has a manner-specific interpretation.

Chapter 5 of this dissertation addresses the representation of laryngeal contrasts in relation to laryngeally modified nasals. The Element-based Dependency model predicts the existence of two such segment types: aspirated
nasals, which are represented in terms of a sonorant stop structure with dependent \( |H| \), and glottalized nasals, which are represented in terms of a sonorant stop structure with dependent \( |?| \). In onset position these segment types have the following structure:

\[
\begin{align*}
\text{(13) } a. & \quad O & d. & \quad O \\
& \quad L & H & \quad L & ? \\
? & ? & ? & ?
\end{align*}
\]

\textit{Aspirated nasal} \hspace{1cm} \textit{Glottalized nasal}

Cross-linguistic evidence suggests that the range of phonetic variation in laryngeally modified nasals is considerable. For instance, the variation observed in aspirated nasals includes realizations which may be characterized in phonetic terms as voiceless aspirated and breathy voiced. The point to note here is that the presence or absence of voicing depends on the timing and the degree of the glottal opening gesture, but is not itself phonologically relevant. In a similar vein, the phonetic variation that is observed in glottalized nasals includes preglottalized, postglottalized, and creaky voiced realizations. From the perspective of phonological contrasts, however, the important observation is that no language makes distinctive use of this variation. This supports the hypothesis that we are dealing with only two phonological segment types, represented in terms of dependent \( |H| \) and \( |?| \). The Element-based Dependency model thus offers a restrictive account of the relation between manner and laryngeal aspects of segmental structure.

The first five chapters of this dissertation provide a fairly self-contained outline of the Element-based Dependency approach to nasality: the main tenets of the Element-based Dependency model are introduced in chapters 1 and 2, the interpretation of dependent \( |L| \) as nasalization and voice is discussed in chapters 3 and 4, and the organization and representation of laryngeal contrasts, with special focus on laryngeally modified nasals, is addressed in chapter 5. The last two chapters address two issues of a more peripheral nature: chapter 6 considers the phonological relation between nasalization and laryngeal segments, and advances a number of arguments for the existence of nasalized laryngeals as a phonological segment type. Chapter 7 briefly examines a number of cases where nasals show “non-natural” class behaviour. It is proposed that this behaviour is the result of different, place-related types of markedness. The issues that are discussed in chapters 6 and 7 raise a number of interesting questions, which deserve more detailed answers than have been given in this dissertation. As such, they represent two possible directions in which subsequent work in Element-based Dependency may proceed.