NASAL SUBSTITUTION IN ENGLISH, INDONESIAN, AND MINANGKABAUNESE: AN OPTIMALITY THEORY ANALYSIS

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Abstract

Makalah ini bertujuan untuk menyajikan konsep-konsep dasar dari Teori Optimalitas (Optimality Theory (OT)) dan penerapannya dalam menganalisis substitusi nasal (nasal substitution) di dalam tiga bahasa: Inggris, Indonesia, dan Minangkabau. Kajian difokuskan pada tiga kaidah, yaitu asimilasi nasal, pelesapan konsonan tak bersuara pasca nasal, dan pelesapan nasal sebelum vowel. Di dalam makalah ini akan coba ditunjukkan bahwa terdapat sejumlah kaidah dan kendala (constraint) yang berbeda-beda mengenai substitusi dalam bahasa Inggris, Indonesia, dan Minangkabau dan semua ini dapat dianalisis dengan menggunakan OT.

1 INTRODUCTION

Optimality Theory (OT -- introduced by Prince and Smolensky 1993, 2000, McCarthy and Prince 1993) can be considered the single most important development in generative grammar in the 1990s. It has profoundly changed (morpho-) phonological inquiry, and it has given an important impulse to the study of language learning. Although its impact on (morpho-)syntax is not as overwhelming as on phonology, the success of OT is remarkable. Perhaps the key to its success is its applicability in all areas of grammar, offering a new perspective on a wide range of problems in linguistics.

Boersma et. al. (2000) state that the major shift OT brought about in phonology is that from rule-based (initiated by Chomsky and Halle 1968) to an output model. This is an approach to grammar, most notably Phonology, based on the parallel evaluation of possible output forms with regard to a ranked system of violable constraints. These constraints are assumed to be universal, and the difference between child phonology and adult phonology, and between the grammars of different languages, now lies in the differences in the ranking of constraints. This paper aims to provide some basic concepts of Optimality Theory (OT) and their application in analyzing nasal substitution in three languages: English, Indonesian, and Minangkabaunese. The discussion focuses on three rules, namely ‘nasal assimilation’, ‘post nasal voiceless consonant deletion’ and ‘nasal deletion before a vowel. The emphasis is on the concepts and techniques rather than results or detailed argumentation.
2 BASIC CONCEPTS OF OPTIMALITY THEORY

The difference between formalist and functionalist approaches in linguistics has taken different forms in different subfields. For phonology, the functionalist approach has traditionally been phonetic in character. For some time, work in the phonetic literature has argued that the sound patterns of languages are effectively arranged to facilitate ease of articulation and distinctness of contrasting forms in perception. In this view, much of the patterning of phonology reflects principles of good design.

In contemporary phonological theorizing, such a view has not been widely adopted. Phonology has been modeled as a formal system, set up to minor the characteristic phonological behavior of languages. Occasionally, scholars have made a nod towards the phonetic sensibleness of a particular proposal. But on the whole, the divide between formal and functionalist approaches in phonology has been as deep as anywhere else in the study of language.

The novel approach to linguistic theorizing known as Optimality Theory appears to offer the prospect of a major change in current situation. At this point, OT, like other models of linguistics, proposes an input and output and a relation between the two (Archangeli 1997). In transformational grammar view, the input is the starting point; there is a series of operations performed on the input, and the result of these operations in the output. Crucially, if an operation makes some change in the input, that changed form serves as the input to the next operation. In OT, however, two formal mechanisms, Generator (GEN) and Evaluator (EVAL) mediate the relation between input and output. GEN creates linguistic objects and notes their faithfulness relations to the input under consideration. EVAL uses the language constraint hierarchy to select the best candidate(s) for a given input from among the candidates produced by GEN. The constraint hierarchy for a language is its own particular ranking of the universal set of constraints (CON).

Kager (1999) adds that the basic assumption of OT is that each linguistic output is optimal, in the sense that it incurs the least serious violations of a set of conflicting constraints. For a given input, the grammar generates and then evaluates an infinite set of output. Evaluation takes place by a set of hierarchically ranked constraints (C1 > C2 >… Cn), each of which may eliminate some candidate outputs, until a point is reached at which one output candidate survives. Kager (1999:8) furthermore describes the elimination process schematically as follows:

```
candidate a  →  C1  →  C2  →  Cn  →  Output
candidate b
candidate c
candidate d
candidate …
```

Input

---

Kager (1999:8) furthermore describes the elimination process schematically as follows:
The optimal output candidate is the one that is 'most harmonic' with respect to the set of ranked constraints. 'Harmony' is a kind of relative well-formedness taking into account the severity of the violations of individual constraints, as determined by their hierarchical ranking. The violation of a higher-ranked constraint causes greater distance to harmony compared to the violation of a lower-ranked constraint. Some violations must occur in every output candidate, as constraints impose conflicting requirement. Accordingly, lower-ranked constraints can be violated to avoid the violation of a higher-ranked one, but violation is always kept to a minimum, given the requirement of maximal harmony.

OT recognizes two types of constraints, markedness constraints and faithfulness constraints. Each individual constraint evaluates one specific aspect of output markedness or faithfulness. Kager (1999) and McCarthy (2002) state that markedness constraints require that the output forms meet some criterion of structural well-formedness. The following examples show that such requirements may take the form of prohibitions of marked phonological structures, including segment types (a), prosodic structure (b), or occurrences of segment types in specific situation (c). However, markedness constraints may just as well be stated positively, as in (d - f):

a. Vowels must not be nasal.
b. Syllables must not have codas.
c. Obstruents must not be voiced in coda position
d. Sonorants must be voiced.
e. Syllables must have onsets
f. Obstruents must be voiced after nasals.

(Kager 1999:9)

Faithfulness constraints require that output preserve the properties of their basic lexical forms, requiring some kind of similarity between the output and its input. The following examples describe some faithfulness constraints:

a. The output must preserve all segments present in the input.
b. The output must preserve the linear order of segments in the input.
c. Output segments must have counterparts in the input.
d. Output segments and input segments must share values for [voice]

(Kager 1999:10)

Two more assumptions to be made about constraints in OT are universal and violable requirements on some aspect of linguistic output forms. Constraints are universal and all constraints are parts of Universal Grammar (UG). Due to the language specific ranking of constraints, a constraint that is never violated in one language may be violated but still be active in a second language, and be totally inactive in a third language. Constraints are violable, but violation must be minimal. No constraint is violated without a compelling reason: avoiding the violation of another higher-ranked constraint (McCarthy 2002).
The ranking of constraints can be demonstrated by a TABLEAU: this lists two (or any number of) output candidates vertically in random order, and constraints horizontally, in descending ranking from left to right (McCarthy 2002). The individual cells show the violation-marks (*) incurred by each candidate relative to each constraint. The optimal candidate is called out by the pointing hand (♀). The exclamation mark (!) is used to indicate that the violation is already fatal, and the shading of the cells is used to show that the violation content is no longer relevant. The following tableau shows the general model of how OT works:

<table>
<thead>
<tr>
<th>Input /</th>
<th>/</th>
<th>C1</th>
<th>C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>♀</td>
<td>candidate a</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>candidate b</td>
<td></td>
<td>!</td>
</tr>
</tbody>
</table>

3 NASAL SUBSTITUTION

Nasal substitution is only one of a number of phonological processes that serve to eliminate nasal/voiceless obstruent sequences. Nasal substitution occurs in English, Indonesian, and Minangkabaunese. Pater (1999) states Nasal substitution refers to the replacement of a root-initial voiceless obstruent by a homorganic nasal. If the obstruent is voiced, a homorganic cluster results, and NC (nasal/voiceless obstruent) cluster are permitted root internally (1c):

In Indonesian, as well as in Minangkabaunese, the voicing of root-initial obstruent determines the outcome of /məN/ prefixation. When the consonant is voiceless, it coalesces with prefix-final nasal to produce a nasal with the same place of articulation as the obstruent, in a process referred to as nasal substitution. The same thing occurs to prefix /məN/ in Minangkabaunese.

(1a) contains some examples of this process in Indonesian, while (1b) describes the same process in Minangkabaunese:

(1) a. /məN+ɔREAK/  məmakər to wear, to use
    /məN+tarɪʔ/ mənarɪʔ to pull
    /məN+kɪrɪm/ məqɪrɪm to send

b. /maN+piliʔ/ mamilɪʔ to choose
   /maN+tuɭɪʔ/ manulɪʔ to write
   /maN+kɛːtʃɛʔ/ maŋɛːtʃɛʔ to talk

In traditional analyses of nasal substitution, the limitation to voiceless consonants is expressed as a featural restriction on the scope of relevant rule. No attempt is made to derive this restriction from principles active elsewhere in Indonesian, or in other languages. Peter (1999) and Kager (1999) point out that Indonesian is far from alone in its avoidance of nasal-voiceless obstruent clusters, and invokes a substantive output constraint against these clusters, *NC, as the formal driving force behind processes like nasal substitution, post-
nasal voicing, nasal deletion, and denasalisation. The following constraints are used to describe the above process (based on Pater 1999 and Kager 1999):

\*NC
No nasal plus voiceless obstruent sequences

LINEARITY-IO
The output reflects the precedence structure of the input, and vice versa

MAX-IO
Input segments must have output correspondents. (‘No deletion’)

DEP-IO
Output segments must have input correspondents. (No epenthesis)

IDENT-IO (OBSVCE)
Correspondent obstruents are identical in their specification for voice (‘No changes in the voicing of obstruents’)

IDENT-I \(\rightarrow\) O (NASAL)
Any correspondent of an input segment specified as F must be F (No denasalization)

<table>
<thead>
<tr>
<th>Input</th>
<th>DEP</th>
<th>IDENT</th>
<th>MAX</th>
<th>ROOT</th>
<th>IDENT [OBSVCE]</th>
<th>*NC</th>
<th>LIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>/(\text{mN}+\text{p})/akar|</td>
<td>IDENT</td>
<td>MAX</td>
<td>ROOT</td>
<td>IDENT [OBSVCE]</td>
<td>*NC</td>
<td>LIN</td>
<td></td>
</tr>
<tr>
<td>/(\text{mN}+\text{p})/akar|</td>
<td>IDENT</td>
<td>MAX</td>
<td>ROOT</td>
<td>IDENT [OBSVCE]</td>
<td>*NC</td>
<td>LIN</td>
<td></td>
</tr>
<tr>
<td>/(\text{mN}+\text{p})/akar|</td>
<td>IDENT</td>
<td>MAX</td>
<td>ROOT</td>
<td>IDENT [OBSVCE]</td>
<td>*NC</td>
<td>LIN</td>
<td></td>
</tr>
<tr>
<td>/(\text{mN}+\text{p})/akar|</td>
<td>IDENT</td>
<td>MAX</td>
<td>ROOT</td>
<td>IDENT [OBSVCE]</td>
<td>*NC</td>
<td>LIN</td>
<td></td>
</tr>
<tr>
<td>/(\text{mN}+\text{p})/akar|</td>
<td>IDENT</td>
<td>MAX</td>
<td>ROOT</td>
<td>IDENT [OBSVCE]</td>
<td>*NC</td>
<td>LIN</td>
<td></td>
</tr>
<tr>
<td>/(\text{mN}+\text{p})/akar|</td>
<td>IDENT</td>
<td>MAX</td>
<td>ROOT</td>
<td>IDENT [OBSVCE]</td>
<td>*NC</td>
<td>LIN</td>
<td></td>
</tr>
</tbody>
</table>

When the root-initial obstruent is voiced, a simple place assimilation will occur. This kind of phonological process can be found in English (2a), Indonesian (2b), and Minangkabau (2c):

(2) a. /\(\text{IN}+/\text{possible}\) /\(\text{IN}+/\text{possible}\)
    /\(\text{IN}+/\text{direct}\) /\(\text{IN}+/\text{direct}\)
    /\(\text{IN}+/\text{correct}\) /\(\text{IN}+/\text{correct}\)

b. /\(\text{mN+}\text{b}\)/ /\(\text{mN+}\text{b}\)/
to buy
    /\(\text{mN+}\text{d}\)/ /\(\text{mN+}\text{d}\)/
to get
    /\(\text{mN+}\text{g}\)/ /\(\text{mN+}\text{g}\)/
to change

c. /\(\text{mN+}\text{b}\)/ /\(\text{mN+}\text{b}\)/
to buy
Refnaldi

/maN+dapeʔ/  mandapeʔ  to get

/maN+ganti/  manɡanti  to change

The following constraints are used to describe the process occurring in the above examples.

| Input /ɪN₁+/p₂ossible | DEP | IDENT | MAX | ROOT | IDENT [OBSVCE] | LIN | ÊNC
|-----------------------|-----|-------|-----|-------|----------------|-----|-----
| ître [ɪm₁]p₂ossible   |     |       |     |       |                |     | *
| [ɪm₁,2]p₂ossible      |     |       |     |       |                |     | *
| [ɪp₁]p₂ossible        |     |       |     |       |                |     | *!
| [ɪm₁]b₂ossible        |     |       |     |       |                |     | *!
| [ɪ]p₂ossible          |     |       |     |       |                |     | *!
| [ɪn₁θ]p₂ossible       |     |       |     |       |                |     | *!

The above analysis is quite complicated. What really occurs is simply place assimilation and no other constraints are needed. Because of that I would use what Pater (2001) applies to simplify the above analysis by using the following constraints:

**NAS ASSIM**
Nasal Assimilation should occur

**CRISPEDGE [PRWD]**
No element belonging to a Prosodic Word may be linked to a prosodic category external to that Prosodic word

**UNIFORM**
No element of the output has multiple correspondents in the input
(No coalescence)

| Input /ɪN₁+/p₂ossible | NAS ASSIM | UNIFORM | CRISPEDGE [PRWD]
|-----------------------|-----------|---------|----------------
| itre [ɪm₁]p₂ossible   |           |         | *
| [ɪm₁,2]p₂ossible      |           | *!      |               
| [ɪp₁]p₂ossible        |           |         |               
| [ɪm₁]b₂ossible        |           |         |               
| [ɪ]p₂ossible          |           |         |               
| [ɪn₁θ]p₂ossible       |           | *!      |               

The above analysis can be used to analyze the examples in (2a), (2b), and (2c) because they seem to have similar behaviors.

The most interesting point that should be noted is the elimination of nasal in Minangkabaunese. In general, it is known that there is no phonological process concerning /mʌN/+ word beginning with a vowel in Indonesian and /iN/+ word beginning with a vowel in English. However, the underlying representation of these to languages is different. Indonesian uses /mʌn/ as the underlying representation, not /mʌn/ (Pater 2001). On the other hand, English
uses /in/ instead of /iŋ/ as the underlying representation. The following examples show how this kind of prefixes are treated in each language. The examples in (3a) are for English, (3b) for Indonesian, and (3c) for Minangkabaunese.

(3) a. /iN/+audible inaudible

b. /məN+ambil/ məŋambil to take

b. /məN+adʒar/ məŋadʒar to teach

c. /maN+adʒa/ maadʒa to teach

c. /maN+ukuə/ maukuə to measure

<table>
<thead>
<tr>
<th>Input/maN+ukuə/</th>
<th>Nas Del</th>
<th>IDENT-IO (NASAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/maŋukaə/</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>/maŋukua/</td>
<td></td>
<td>*!</td>
</tr>
</tbody>
</table>

The very surprising thing happens when we try to insert the Indonesian data in (4b) into the analysis that we have done to (1a) and (1b). This is because the output that we expect is different from the output that we get in (1a) and (1b).

(4) a. /məN+simpan/ məŋimpan to keep, to save

b. /məN+sisir/ məŋisir to comb

b. /məN+tʃari/ məŋtʃari to search, to seek

c. /məN+tʃuri/ məŋtʃuri to steal

c. /məN+dʒual/ məŋdʒual to sell

c. /məN+dʒilid/ məŋdʒilid to bind

The above data implies that the constraints and the analysis we have done to the data in (1a) and (1b) should be revised because *NC is not applicable for all voiceless obstruents. It seems to me that this is only applicable for non-delay release obstruents. The tableau for the delay release obstruents in Indonesian and in Minangkabaunese is like the table used in analyzing the data in (2a), (2b), and (2c).

The other group of data that can be found in Indonesian is the case of two prefixes occurring at the same time. For example:

(5) a. /məŋ+pər+luas/ məŋpərluas to enlarge

b. /məŋ+pər+kaja/ məŋpərkaja to enrich

It is clear that this instance of nasal substitution is beyond the reach of *NC. This kind of data could be best analyzed by picking out the prefix-root boundary as the locus for this process which is resolved by relying on
CRISPEDGE [PRWD]. Between prefixes (and root-internally) CRISPEDGE [PRWD] is vacuously satisfied and NAS ASSIM is fulfilled by simple assimilation. Because assimilation results in a change of the underlying place specification of the nasal, a faithfulness constraint on place identity is violated, and must be ranked beneath constraints favoring other outcomes:

<table>
<thead>
<tr>
<th>Input: /mɛŋ+pər+luas/</th>
<th>NAS ASSIM</th>
<th>CRISPEDGE [PRWD]</th>
<th>UNIFORM (ITY)</th>
<th>IDENT [PLACE]</th>
</tr>
</thead>
<tbody>
<tr>
<td>/mɛm₁,ɔrluas/</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/mɛmp₁,ɔrluas/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>/mɛgps₁,ɔrluas/</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4 CONCLUSIONS

McCarthy (2002:10) summarizes the core universal elements of the OT architecture as follows:

\[
\text{input} \rightarrow \text{GEN} \rightarrow \text{candidates} \rightarrow \text{EVAL} \rightarrow \text{output}
\]

GEN receives an input and emits a set of candidates that depend upon the input. EVAL applies the language-particular constraint hierarchy H to this candidate set, locating its most harmonic member. The most harmonic candidate is the output; it may be a phonological surface form, a syntactic S-structure, or some other linguistic object.

The analysis of nasal substitution in English, Indonesian, and Minangkabaunese shows the possibility for a wide range of complex phonological phenomena by the interaction of a small number of simplex constraints. The claim of universality, that all constraints are universal, is of interest not because baroque conglomerate constraints are being analyzed as 'universal', but because simplex constraints, often externally motivated, can be combined in various rankings to produce richly different sets of grammars. A single constraint that may be highly ranked in one language may play a role in a large class of environments yet be roundly violated elsewhere in another language, and may play a role only in some minor class of contexts in a third language.

REFERENCES


Boersma, Paul and others. 2000. “Introduction to Optimality Theory: Phonology, Syntax, and Acquisition.” In Dekkers et. al. (eds),


