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An Optimality-Theoretic Study of Nasalization in Mbaise

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Abstract

Within the ambit of Optimality Theory, this paper examined the phonological distribution of nasalized consonants and nasalized vowels in the Mbaise dialect of Igbo (spoken in Nigeria) with a view to identifying the relevant constraint hierarchies controlling their surface realization. Using the West African Linguistic Society Questionnaire and a researcher-designed wordlist, the data were obtained via structured oral interview from two competent native speakers of the dialect, and were analyzed using a descriptive approach grounded on the chosen theoretical framework. Arising from the analysis were the following findings: Mbaise operates two systems of nasal specification – the contrastive type affecting consonants and the context-induced type affecting vowels; nasalized consonants are phonemic while nasalized vowels are allophonic; the nasalized consonants are largely restricted to intervocalic position while the nasalized vowels appear after tautosyllabic nasal(ized) consonants. It was argued that the surface realization of the nasalized consonants is controlled by IDENT-CONS/NAS whereas that of the nasalized vowels is controlled by *$NV_{[-nasal]}$. Despite the difference in their phonological distribution and functional status, Mbaise nasalized consonants and nasalized vowels have a structural

relationship within the syllable in which they occur. Therefore, it was concluded that their well-formedness is governed by a single hierarchy: IDENT-CONS/NAS, *NV$_{[-nasal]}$ >> *FRIC/NAS, *LIQ/NAS >> *CONS/NAS, *V/NAS >> IDENT-IO(nasal).

Keywords: nasalized consonants, nasalized vowels, phonological distribution, functional status, Mbaise, Optimality Theory

1. Introduction

In strictly phonetic term, nasalization is a case of co-articulation in that it involves producing a vowel or continuant consonant in such a way that air simultaneously flows through the nasal and oral cavities. From a phonological perspective, Maduagwu and Dare (2016) defines nasalization as "a phonological process where a non-nasal segment acquires the nasality of an adjacent nasal segment" (p. 3). Making an illustration, they aver that an oral vowel may be nasalized if it occurs before or after a nasal consonant. Nasality is a universal property of language that is peculiar to consonants but often copied by vowels and underlying oral consonants in some phonological context. Although it may be argued that vowel nasalization is more common in natural languages, there are several cases of consonant nasalization that have been reported in a number of languages in the existing literature, e.g., Yoruba (Akinlabi, 2000), Warao (McCarthy, 2008), Urhobo (Aziza, 2010), Malay (Czaykowska-Higgins, Dobrovolsky, & Katamba, 2011), and the Ife dialect of Yoruba spoken in Bante region of Benin Republic (Maduagwu & Dare, 2016). It is germane to state, however, that sonorants, especially glides, are more prone to nasalization than other types of consonants.

Nasalization, the focus of the present study, can be accounted for using various phonological approaches, such as the classical Generative Theory advanced by Chomsky and Halle (1968) and Autosegmental Phonology propounded by Goldsmith (1976), depending on the perspective from which the phenomenon is conceived. Interestingly, nasalization can be analyzed not only within a rule-based generative model like the two just highlighted, but also within an encompassing constraint-based framework such as Optimality Theory, a grammatical model developed by Prince and Smolensky (1993). Optimality Theory has a major advantage over its predecessors: it unites description of idiosyncratic features of individual languages with the

universal properties of languages in general. Instead of focusing on language-specific rules which, on several occasions, need to apply iteratively to capture serial derivations, attention is paid to how the grammar of a language recognizes the actual, observable output forms via certain inherent principles called 'constraints' that are universally defined. It is assumed that describing or analyzing a phonological phenomenon in the context of a constraint-based theory provides more grounds for achieving a more convincing explanatory adequacy.

In light of the above, this paper pre-occupies itself with a descriptive study of nasalization in Mbaise, a dialect of Igbo spoken in Imo state, Nigeria, using Optimality Theory as its tool of analysis. Various studies, notably Emenanjo (2015), have established the fact that Mbaise attests five phonemic nasal consonants: [m, ŋ, n, ɲ, ŋ^{w}], and a few nasalized consonants such as [f̃], [h̃] and [s̃]. The dialect does not attest nasal vowels; however, all oral vowels in the dialect become nasalized after either a nasal or nasalized consonant as shown in (1).

(1) Nasalized vowels in Mbaise

a. árá [árá̃] 'breast'
b. ízu [ízũ] 'to steal'
c. izi [izĩ] 'to clear the nostrils'
d. ányi [áɲĩ] 'our'
e. erìnà [erìnà̃] 'Don't eat!'

The examples in (1) demonstrate that nasalized vowels in Mbaise are not phonemic but contextually derived.

Therefore, this paper examines the phonological distribution and functional status of nasalized consonants and nasalized vowels in Mbaise with a view to determining the constraint hierarchies which govern their surface realization. In addition, the paper attempts a model proposal hinged on Optimality Theory of how the two systems of nasality operate in the dialect. The subsequent sections of the work address the following: brief background information about Mbaise; a discussion of nasalization; a review of the chosen framework; data presentation and analysis; and conclusion.

2. Literature Review

2.1 Mbaise

Mbaise, as a name of a geographical area, is located precisely in Imo State, South-Eastern Nigeria. It is made up of three Local Government Areas (LGAs) – Aboh Mbaise, Ahiazu Mbaise and Ezinihitte Mbaise, with an area covering about 404 Km^2 bounded on the North by Mbaano and Mbaitolu/Ikeduru LGAs, on the East by Isiala Ngwa and Ngor Okpuala LGAs, on the South by Obowo and Umuahia LGAs, and on the West by Owerri North, and has a population of about a million people based on the 2006 National Population Census (Enwere, 2018).

As a linguistic term, however, Mbaise (or Mbaise-Igbo) is one of the several dialects of the Igbo language. Igbo is one of the three major Nigerian languages spoken by tens of millions of people in the South-Eastern geo-political zone of Nigeria. In a relatively recent classification of the Benue-Congo languages, Blench and Mallam (2004) classified Igbo under the Western Benue-Congo sub-phylum. Igbo is a language of many dialects. According to Emenanjo (2015), beyond the anthropologically-based classifications of the Igbo people and their dialects into five, namely Southern Igbo, Northern Igbo, North-Eastern Igbo, Eastern Igbo and Western Igbo, recent phonologically-based classifications have thrown up eight dialect clusters by Nwaozuzu (2008), six by Ikekeonwu (2001), and nine by Manfredi (1991).

There are twenty-nine (29) consonants and eight (8) vowels in the Mbaise dialect of Igbo. These sounds include: p, b, f, v, t, d, s, z, r, l, ʃ, ʒ, ʧ, ʤ, j, k, g, kp, gb, k^w, g^w, m, n, ŋ, $ŋ^w$, ɲ, ɣ, w, h, i, ɪ, e, a, u, ʊ, o, ọ. Mbaise does not have underlying nasal vowels in its phoneme inventory; oral vowels can only be nasalized in the environment of nasal sounds. However, the dialect attests a number of nasalized consonants, that is, consonants that are expected to be oral by default but whose nasality is phonemic in the dialect. Examples of these consonants are [f̃], [h̃] and [s̃]. Mbaise is a tonal dialect, with two distinct register tones – high tone, designated [´], and low tone, represented as [`]. There is also a tonal phenomenon known as down-step or step tone, represented as [ˉ]. Tone performs both lexical and grammatical functions in Mbaise. The dialect operates the open syllable typology in that none of its syllables (and even words) terminates in a consonant, and the syllable types evident in the dialect comprise V (Vowel), CV (Consonant-Vowel), and N (syllabic nasal). Just like vowels, the syllabic nasals also bear tone. Nasality is a pronounced phonological feature of Mbaise, as it affects both vowels and consonants. Thus, subjecting the

phenomenon to a descriptive analysis is of necessity in this paper especially considering the fact that no known study in the extant literature has addressed it in the context of Optimality Theory.

2.2 Nasalization

Nasal is a term used in the phonetic classification of speech sounds on the basis of manner of articulation. It refers to sounds produced while the soft palate is lowered to allow an audible escape of air through the nose (Crystal, 2008). Both consonants and vowels may be articulated in this way. Crystal further says that nasal consonants occur when there is a complete closure in the mouth, and all the air thus escapes through the nose. Examples in English are the final consonants of *ram* [ræm], *ran* [ræn], and *rang* [ræŋ], where the closures are in bilabial, alveolar and velar positions, respectively. It is argued that several other nasal sounds are possible, e.g., in palatal position [ɲ], as in Spanish *mañana* [maɲana]. Voiceless nasal sounds also exist, as when a nasal consonant follows [s] in English, e.g., *small* and *snooze*.

Nasals are extremely common in natural languages; they are so common that Ferguson (1963), as cited in Botma (2004), claims that every language has at least one primary nasal consonant. Botma, however, explains that this position is too strong, given that there are some languages, such as Rotokas, Piraha and Lushootseed, which lack nasal consonants, at least at the level of underlying structure. It is argued that 97% of languages are described as having underlying nasals (Maddieson, 1984). This indicates that nasals, albeit not universally attested, are cross-linguistically very frequent.

With nasalization, the air in the mouth escapes through both the mouth and the nose following the lowering of the velum (Emenanjo, 2015). It follows from this fact that for nasal (or nasalized) vowels, air escapes through the nose and the mouth simultaneously. The vowels are transcribed with a tilde [˜] above the symbol, e.g., [ã]. According to Crystal (2008), nasal vowels are opposed to oral vowels in a number of languages, such as French and Portuguese. He argues further that English has no distinct nasal vowels, but nasalization is often heard on English vowels when they display the articulatory influence of an adjacent nasal consonant, as in *mat* and *hand*. The vowel in a word like *man* may be articulated with the soft palate lowered throughout, because of this influence. Such cases where the nasality comes from other sounds would be referred to as 'nasalized' vowels; the term 'nasal vowels', on the other hand, suggests that the nasality is an essential identifying feature of the sound (Crystal, 2008). Botma (2004) also echoes this

observation by arguing that in languages in which nasalized vowels are derived, these vowels are usually nasalized by a neighboring nasal consonant. For example:

(2) a. /ma/ [mã]

b. /am/ [ãm]

(2a) is an example of progressive vowel nasalization, since the triggering nasal precedes the vowel while (2b) is an example of regressive vowel nasalization, since the triggering nasal follows the vowel.

According to Clark and Yallop (2000), nasalization may be described as 'inherent' when speakers do not exert strong control over the raising of the velum, allowing nasalization to become an 'unintended' characteristic of all their vowels, even when not adjacent to nasal consonants. They argue further that nasalization may also be a general property of speech, for reasons of individual articulatory habit, dialect type, or pathological condition such as a cleft palate. Such nasalization is often described as 'pervasive'.

2.3 Theoretical Framework: Optimality Theory

Optimality Theory (OT, hereafter) is a linguistic model which proposes that the observed forms of language arise from (or are a product of) the optimal satisfaction of conflicting constraints (Kager, 1999). OT defines grammars as systems or functions that act on inputs and map them to outputs. However, OT does not see the outputs as being derived from the inputs but that the outputs are generated as possible competing forms on the basis of a given input. The systems or functions are GENerator (GEN), CONstraint (CON) and EVALuator (EVAL). They operate in a systemic way. The GEN component takes an input made available by the lexicon and supplies an infinite number of possible output forms on the basis of the given input; the CON function makes available a set of constraints and ranks them hierarchically; while the EVAL system assesses the output forms in a parallel fashion with respect to the constraint hierarchy. From the parallel assessment, EVAL then picks the output form that fares better than the rest, and is therefore regarded as the optimal candidate, that is, the 'grammatically well-formed structure' (Prince & Smolensky, 2004, p. 3) or the 'actual output of the grammar' (Kager, 1999, p. 21).

The strongest creed which OT firmly upholds is that these three components are inherently operational in the grammars of all natural languages, the only point of divergence is reflected in

the different rankings of the given constraints. More specifically, OT assumes that constraints are linguistically universal in such a way that there is no constraint found in one language that does not exist in another (Oyebade, 2008), although their relative activity or inertness which is determined by ranking varies from one language to another. For instance, the constraint which forbids coda (conventionally formalized as NO-CODA in OT literature) is highly ranked, hence undominated in the grammar of Yorùbá because the phonotactics of the language does not permit any word or syllable to terminate in a consonant. Even foreign items which 'smuggle' themselves into the lexicon of the language must bow to this powerful phonotactic constraint through certain phonological processes such as vowel insertion. For languages that allow word/syllable-final consonants, such as English, OT's general assumption still holds: such languages also have the constraint in their grammars. The only difference in the grammars of Yorùbá and English with respect to NO-CODA is that while Yorùbá ranks it highly, English ranks it lowly. In a layman's language, one would say that the constraint is active in Yorùbá but relatively inert in English.

Another universal property of CON is that the constraints are always in conflict (Kager, 1999; McCarthy, 2002, 2008; Prince & Smolensky, 2004). Using an illustration, a constraint which requires an identity between an input and an output may conflict with another constraint whose goal is to ensure well-formedness of the output form via some phonological change. For example, the English word 'bread' loaned into Yorùbá has the input /bred/ but is modified as [búrɛ́dì], the actual output in the Yorùbá grammar. Within the framework of OT, an anti-epenthesis constraint, DEPENDENCY (DEP), would rule out [búrɛ́dì] in favour of [bred] by its definition which stipulates that each element in the output must have a corresponding element in the input. On the other hand, NO-CODA which forbids syllable-final consonants would rule out [bred] in favour of [búrɛ́dì].

The foregoing superficial discussion is illustrative of OT's assumption that "the constraints operating in a particular language are highly conflicting and make sharply contrary claims about the well-formedness of most representations" (Prince & Smolensky, 2004, p. 3): DEP would prefer the output form to be [bred] while NO-CODA would choose [búrɛ́dì] instead. It is quite interesting to discover that OT does not only recognize the fact that conflicts do exist between constraints, it also provides an innovative strategy for resolving them. According to Pulleyblank (1997) "The inevitable tension is resolved in each language by assigning particular rankings to the conflicting constraints" (p. 101). Thus, the markedness constraint NO-CODA dominates the

faithfulness constraint DEP (NO-CODA >> DEP) in the grammar of Yorùbá since the correct output form permitted is [búrɛ́dì], and not [bred] (Oyinloye, 2015).

Finally, another characteristic feature of CON is violability. Kager (1999) avers that "violability of constraints is an essential property of OT, representing a radical break away from derivational models, as well as from (other) constraint-based theories, such as Declarative Phonology, which assume that constraints are 'hard' or 'inviolate'" (p. 12). Violation of constraints is inevitable because once a candidate attempts to satisfy or obey some higher-ranked constraint, violation of a lower-ranked one would be incurred. Although violation is permitted in OT, a restriction is imposed: violation must be minimal because forms with lesser violations are more harmonic than forms with greater violations. The miniature analysis of an English loanword modification in Yorùbá sketched above is an empirical illustration of constraint violation. It could be observed that the two conflicting constraints – NO-CODA and DEP – are violated by the two competing output forms, [búrɛ́dì] and [bred]: [búrɛ́dì]'s attempt to obey NO-CODA leads to a minimal violation of DEP whereas [bred]'s attempt to satisfy DEP incurs a fatal violation of NO-CODA. A conclusion about constraint violability hereby suffices. No matter how highly ranked a constraint is, it can be violated by at least some candidate; and no matter how 'strong' an optimal candidate is, it must have violated at least some constraint.

The brief overview of OT done above focuses heavily on the constraint component because the theory's core principles and, more importantly, its modus operandi, are anchored on the interaction of constraints in the grammar. The second reason for such focus is hinged on the goal of this paper. This paper seeks to identify the constraint hierarchies that are responsible for the surface realization of nasalized consonants and nasalized vowels in Mbaise.

3. Methodology

Being a qualitative research, primary data for this research were collected from two (a male and a female, aged 71 and 65, respectively) competent native speakers of Igbo and the Mbaise dialect. The language informants grew up speaking the dialect in their native community – Ezinihitte Mbaise Local Government Area of Imo state, Nigeria. They had lived in this community for many years before moving to the city of Jos, Plateau state, North-Central Nigeria, where they currently work and earn a living. It is important to state that the language of communication used in their

homes prior to and as of the time of collecting the data was the Mbaise dialect. One of the researchers of this paper is also a native speaker of the dialect; thus, his native linguistic intuition was exploited in making generalizations about the data. Before collection of data, the two participants (language informants) selected for the study were sensitized to what the research entailed so as to enable them make an informed decision about whether or not to take part in the research. Thus, their consent was sought in person by the researchers and they both agreed to respond to the questionnaire as well as have their speech recorded. The researchers ensured that the data elicited from them were kept strictly confidential.

Two principal instruments were used for data collection. The first was the West African Linguistic Society Questionnaire designed as a list of words and phrasal/sentential expressions in English, made up of 206 items altogether. The lexical items comprised 37 nouns, 13 verbs, and 28 numerals while the items in the phrasal and sentential category, which were 128 in number, were basically noun phrases and simple sentences, both declarative and interrogative. This was supplemented by a researcher-designed wordlist of 300 items of various grammatical classes specifically designed to capture the phonological process of nasalization, among other concepts. In addition to the two research instruments, an average of 50 Mbaise speech items that reflect nasalization were used. In structuring the speech patterns, expressions containing nasals were used as much as possible to establish the facts. This is because prosodic phenomena, among which is nasalization, are highly susceptible to contextual influences.

The period of data collection spanned over a month and the recording of the data was done in the informants' place of residence, Jos. The environment had the barest minimum level of background noise. The method was unscripted in the sense that the language informants were not required to read any texts; rather they were verbally presented with English versions of utterances and were required to supply correspondences in the dialect. The informants were instructed to be as natural as possible during all the recording sessions. Also, allowance was made for errors by first engaging the informants in pre-recording discussion to informally intimate them with expectations. They were also allowed to repeat utterances as well as say things in a variety of ways during recording sessions. All the recordings were made with the use of mobile phones and stored on a laptop. The recording was done in such a manner that the informants were as relaxed and unguarded as possible in the course of the data elicitation. All the data were transcribed, but only 37 items of two broad categories were purposively extracted and presented for analysis: words

which contain Mbaise phonemic nasal and nasalized consonants and words which specifically reflect the process of vowel nasalization. The selected items were representative of the data needed to exemplify nasalization in the dialect. Finally, the secondary data comprising genetic classification of Mbaise, as well as the geographical location of the speakers and their population were sourced from various relevant literature. The data were analyzed using the descriptive approach via an application of the tenets of the chosen theoretical framework.

Analyses of the selected items were shown in tableaux and an explanatory discussion followed each of the tableaux. The symbol '>>' was used between constraints to mean 'rank above or higher than' while a comma ',' between constraints imply that the constraints are not ranked with respect to each other. An asterisk (*) used in a constraint means 'avoid a certain feature or structure'; but within a tableau, it was used to indicate a violation of a given constraint. An exclamation mark placed after an asterisk indicates a fatal or severe violation of a given constraint. Finally, an arrow outside the context of a tableau was used to show derivation of an output from a given input. However, an arrow within a tableau was used to identify the optimal candidate, that is, the actual output form attested by the grammar of the dialect.

4. Results

In Mbaise, the phonological distribution and the pattern of nasalization of nasalized consonants is different from those of nasalized vowels. Within the tenets of OT, the analyses of the two categories of nasalization are presented in Sections 4.1 and 4.2, respectively.

4.1 Nasalized Consonants in Mbaise

For the purpose of the present study, we characterize the construct 'nasalized consonants' as consonants which, by default, are expected to be underlyingly oral but otherwise phonetically specified for nasality. In addition to having five distinct nasal consonants [m, ŋ, n, ɲ, ŋ^{w}], Mbaise also attests a number of nasalized consonants which fall into three broad categories: fricatives (e.g. [f̃, ṽ, s̃, z̃, ʃ̃, h̃]), central liquid (e.g. [r̃]), and labio-velar glide (e.g. [w̃]). The nasalized consonants are phonemic, just as the canonical nasal consonants, and their phonological distribution is largely restricted to inter-vocalic position in the dialect. Their contextual restriction is a slight deviation from the universal assumption that contrastive forms or features are not usually restricted in their

phonological distribution. On this premise, we argue that nasalized consonants are marked segments in Mbaise, as opposed to the canonical nasal consonants which are cross-linguistically unmarked. The nasalized consonants contrast with their corresponding oral ones, as there is evidence in the dialect which shows that the oral counterparts of these consonants also occur inter-vocalically. The examples given in (3-8) empirically justify this observation.

(3) (a) ire ‘to sell’
(b) iɾ̃e ‘to burn’
(4) (a) izu ‘to buy’
(b) iʒ̃u ‘to train’
(5) (a) iso ‘to avoid’
(b) iʃ̃o ‘to follow’
(6) (a) ihu ‘to see’
(b) iɦ̃u ‘to roast’
(7) (a) ifu ‘to go out’
(b) iɸ̃u ‘to blow out’
(8) (a) ivu ‘to harvest (e.g., cassava)’
(b) iʋ̃u ‘to hatch (e.g., egg)’

The minimal pairs in (3-8) justify the phonemic status of nasalized consonants in Mbaise. It is, however, important to point out that, while the nasality of the consonant is not triggered by the surrounding vowels (as they are obviously oral), its inherent nasality triggers the nasalization of the following (oral) vowel such that the actual output forms of data (3b-8b) can be represented respectively as: [iɾ̃ẽ], [iʒ̃ũ], [iʃ̃õ], [iɦ̃ũ], [iɸ̃ũ], and [iʋ̃ũ]. Emenanjo (2015, p. 52) has averred that “it is still a subject of controversy as to whether nasality in this circumstance is a feature of the consonant or the vowel that follows the consonant”. We put this controversy to rest by positing that the nasality witnessed in (3b-8b) is the underlying feature of the consonant; the feature is only acquired by the succeeding vowel via a process of nasalization. This position is entrenched by the fact that Mbaise vowels, all of which are underlyingly oral, generally acquire nasality after either an unmarked nasal consonant or a marked nasalized consonant. (A detailed analysis of this is provided in Section 4.2).

Following the foregoing, the critical research question is: Why does Mbaise have contrastive nasalized consonants when the ideal situation in human languages is for canonical nasal

consonants to be contrastive and the nasalized ones to be phonetically derived? The answer can be straightforwardly given within the context of OT as follows: nasalized consonants in Mbaise are underlyingly specified for nasality and the nasality contrast must be preserved at the surface. In OT, preservation of any kind of contrast is governed by a faithfulness constraint known as IDENT-IO defined in (9).

(9) IDENTITY-INPUT, OUTPUT (IDENT-IO): The feature specifications of an input segment must be preserved in its output correspondent.

IDENT-IO is a family of constraints consisting of several members depending on the featural specifications of a particular input segment. Since the phenomenon under investigation is nasalization, the featural specification, therefore, is *nasality*, and this feature is prosodically affiliated with an underlying consonant. On this premise, preservation of nasality contrast in Mbaise nasalized consonants is governed by the constraint, adapted from IDENT-IO, in (10).

(10) IDENT-CONS/NAS: The feature [nasal] of a consonant in the input must be preserved in the corresponding consonant in the output.

Given that Mbaise nasalized consonants are distinctive, IDENT-CONS/NAS must dominate the relevant markedness constraints which generally militate against nasal segments. These constraints are defined in (11).

(11) a. NO-CONSONANT/NASAL (*CONS/NAS): Avoid a consonant that is specified for nasality.

b. NO-LIQUID/NASAL (*LIQ/NAS): Avoid a liquid that is specified for nasality.

c. NO-FRICATIVE/NASAL (*FRIC/NAS): Avoid a fricative that is specified for nasality.

The analysis of the form [iɾ̃ẽ] is presented in Table 1.

Table 1: Analysis of /iĩre/ → [iĩrẽ] 'to burn'

/iĩre/	IDENT-CONS/NAS	*FRIC/NAS	*LIQ/NAS	*CONS/NAS
→ a. iĩrẽ			*	*
b. irẽ	*!			
c. ire	*!			

The basic information portrayed by the ranking argument in Table 1 is that IDENT-CONS/NAS is ranked above all the remaining constraints; there is no mutual ranking between *FRIC/NAS and *LIQ/NAS since both a fricative and a liquid can be nasalized in Mbaise; and *CONS/NAS is ranked lowest in the hierarchy because the dialect attests nasal and nasalized consonants.[1] Indeed, the broad ranking which governs the optimality of nasalized consonants in Mbaise is IDENT-CONS/NAS >> *CONS/NAS. This can be interpreted in the following way: although a consonant specified for nasality is banned by virtue of universal markedness, the grammar of Mbaise requires that a consonant that is underlyingly specified for nasality must appear at the surface with the feature specification. This summarily implies that preservation of nasality contrast in Mbaise nasalized consonants is achieved at the expense of violating a markedness (well-formedness) constraint which generally bans nasal or nasalized consonants. In a bid to avoid a consonant being specified for nasality, candidates (b) and (c) opt against nasalizing the intervocalic liquid [r]. However, such choice implies a fatal violation of the highest-ranked constraint IDENT-CONS/NAS which stipulates that an underlying nasalized consonant must not lose its nasality in the phonetic form. Candidate (a) obeys this constraint and, therefore, wins, notwithstanding its violations of *LIQ/NAS and *CONS/NAS.

[1] It should be pointed out that one may incorporate other markedness constraints, such as *$NV_{[-nasal]}$ and *V/NAS, into the ranking in Tableau 1 and the other tableaux in this section due to the fact that an underlying oral vowel becomes nasalized in the surface representation. We, however, opted against such move in this section because the constraints are more relevant to the analysis in the succeeding section where attention is specifically devoted to vowel nasalization.

Table 2: Analysis of /iɦ̃u/ → [iɦ̃ũ] ‘to roast’

/iɦ̃u/	IDENT-CONS/NAS	*FRIC/NAS	*LIQ/NAS	*CONS/NAS
a. ihu	*!			
b. ĩhũ	*!			
→ c. iɦ̃ũ		*		*
d. ihũ	*!			

In Table 2, only one candidate (that is, (c)) obeys the undominated faithfulness constraint IDENT-CONS/NAS even though it violates two anti-nasal markedness constraints. For this reason, the candidate is picked as the winner, that is, the observable form of the input /iɦ̃u/. The other three candidates, on the other hand, lose out for violating the undominated constraint.

The foregoing analysis of the phonological distribution and well-formedness of nasalized consonants in Mbaise reveals an interesting fact about these phonological segments: faithfulness outranks markedness. It could be observed that the faithfulness constraint IDENT-CONS/NAS consistently dominates the general anti-nasal markedness constraint *CONS/NAS as well as the segment-specific anti-nasal markedness constraints *FRIC/NAS and *LIQ/NAS. This finding is in consonance with one principle of OT which says that segmental or featural contrast is governed by the domination of faithfulness constraints over their markedness counterparts.

4.2 Nasalized Vowels in Mbaise

The phonological distribution of nasalized vowels in Mbaise is a fact about surface forms: vowels become nasalized when they are preceded either by a nasal consonant (e.g., m, n, ŋ) or a nasalized consonant (e.g., ɦ̃, r̃, w̃). Consider the data in (12) and (13), respectively, to illustrate this generalization.

(12) (a) ímí [ímḿ] ‘nose’

(b) ḿmíri [ḿmḿri] ‘water’

(c) ḿma [ḿmã] ‘good’
(d) ányá [áɲ́á] ‘eye’
(e) ányínyá [áɲ́ɲ́á] ‘horse’
(f) ínye [íɲẽ] ‘give’
(g) únù [únṵ̀] ‘your (pl)’
(h) anọ́ [anɔ̃́] ‘four’
(i) ọ́nú [ɔ́nṹ] ‘mouth’
(j) ngọ [ŋɔ̃] ‘drink’

(13) (a) áh̃à [áh̃à] ‘name’
(b) ńh̃e [ńh̃ẽ] ‘thing’
(c) áh̃ù [áh̃ṵ̀] ‘that’
(d) ńr̃í [ńr̃ḯ] ‘food’
(e) úr̃á [úr̃á́] ‘sleep’
(f) ir̃ẹ́ [ir̃ɛ́] ‘five’
(g) ir̃a [ir̃ã] ‘to wash’
(h) ázù [ázṵ̀] ‘fish’
(i) ánw̃u [ánw̃ũ] ‘sun’
(j) ńw̃á [ńw̃á́] ‘child’

Data (12) illustrate how a nasal consonant conditions a succeeding oral vowel to acquire nasality while data (13) are instances of vowel nasalization after a nasalized consonant. Since the output vowels get their nasality from the preceding nasal(ized) consonant, it implies that the phonological distribution of the nasalized vowels is context-sensitive. In optimality-theoretic term, their distribution is controlled by a highly ranked pro-nasal markedness constraint which bans an oral vowel from succeeding a nasal consonant. This constraint is defined in (14).

(14) *NV$_{[-nasal]}$: Avoid a sequence of a nasal consonant followed by an oral vowel.

As established earlier, there are no underlying nasal vowels in Mbaise. However, all vowels after tautosyllabic nasal(ized) consonants are nasalized. Hence, the constraint defined in (14) is undominated in the entire grammar of the dialect. Furthermore, the markedness constraint *NV$_{[-nasal]}$ must dominate the faithfulness constraint IDENT-IO(nasal) for an important reason: well-formedness of phonological words with nasalized vowels is defined by specifying an oral vowel for nasality in the output. That is, an oral vowel that is unspecified for nasality in the input acquires

the nasality feature in the output due to the influence of a neighboring nasal(ized) consonant. Thus, while the actual output form would obey *NV$_{[-nasal]}$, it would violate IDENT-IO(nasal). It is important to point out that the ranking of *NV$_{[-nasal]}$ above IDENT-IO(nasal) in Mbaise with respect to the phonological distribution of nasalized vowels aptly corroborates McCarthy's (2008, p. 92) assertion that "if some linguistic item has a restricted distribution, then faithfulness to that item is ranked below some markedness constraint or constraints that control the distribution". Additionally, *NV$_{[-nasal]}$ must also dominate the context-free anti-nasal markedness constraint which generally bans a nasal(ized) vowel. Consider the definition of this constraint in (15).

(15) NO-VOWEL/NASAL (*V/NAS): Avoid a vowel that is specified for nasality.

The constraint in (15) must be ranked below *NV$_{[-nasal]}$ because output forms entertain nasalized vowels. Furthermore, in so far as nasality contrast in vowels is lacking in the entire grammar of Mbaise, then IDENT-IO(nasal) must be dominated by both of the markedness constraints *NV$_{[-nasal]}$ and *V/NAS.

The foregoing discussion is summarized by the basic ranking in (16), which is illustrative of Mbaise phonological grammar.

(16) *NV$_{[-nasal]}$ >> *V/NAS >> IDENT-IO(nasal)

Let us consider two items from the data presented in (12) and (13) for analysis to justify the ranking proposed in (16). We pick items (12d) and (13a).

Table 3: Analysis of /ạ́ɲá/ → [ạ́ɲã́] 'eye'

/ạ́ɲá/	*NV$_{[-nasal]}$	*V/NAS	IDENT-IO(nasal)
→ a. ạ́ɲã́		*	*
b. ạ́ɲá	*!		

The fully faithful candidate in Table 3 is (b) but it incurs a fatal violation of *NV$_{[-nasal]}$ for failing to nasalize the vowel after the palatal nasal consonant [ɲ]; hence, it loses to candidate (a). Notice that the winner, that is, candidate (a), is not faultless itself as it incurs violations of *V/NAS and IDENT-IO(nasal). However, such violations are not serious enough to prevent it from winning because the constraints are dominated by the highest-ranked constraint in the hierarchy. In the spirit of OT, optimality is achieved in such a way that a lowly ranked constraint is violated in order to satisfy a highly ranked one. It is mandatory for the optimal candidate in Table 3 to violate

*V/NAS and IDENT-IO(nasal) if satisfaction of *$NV_{[-nasal]}$ must be ensured. This piece of evidence justifies how OT resolves conflict among constraints via ranking such that the candidate that is more (or most) harmonic with the given hierarchy is chosen as the optimal candidate by EVAL.

We could as well compare the actual output form, [áŋ̃á], with two more candidates in order to further justify the ranking in (16). The analysis is presented in Table 4.

Table 4: Further justification of the ranking: *$NV_{[-nasal]}$ >> *V/NAS >> IDENT-IO(nasal)

/áŋá/	*$NV_{[-nasal]}$	*V/NAS	IDENT-IO(nasal)
→ a. áŋ̃á		*	*
b. ã́ŋá	*!	*	*
c. ã́ŋ̃á		**!	**

The analysis in Table 4 reveals that, whereas the undominated constraint *$NV_{[-nasal]}$ settles the competition between candidates (a) and (b), it cannot uniquely determine the winner between (a) and (c) because both candidates nasalize the vowel after the nasal consonant; thus, the competition has to be settled elsewhere. Because candidate (c) gratuitously nasalizes another vowel, it runs afoul of *V/NAS and IDENT-IO(nasal) at two points each. On the other hand, candidate (a)'s choice of nasalization is more economical than (c)'s as demonstrated by the number of violation marks incurred on *V/NAS and IDENT-IO(nasal). For this singular reason, EVAL chooses (a) as the winner. This proves that the economy principle *Do only when it is necessary* is highly respected in OT; any move that contravenes this stipulation is in danger of sub-optimality. That is why candidates with minimal violations are preferred to those with severe violations in the theory.

Tableau 5: Analysis of /áh̃à/ → [áh̃à̃] 'name'

/áh̃à/	*$NV_{[-nasal]}$	*V/NAS	IDENT-IO(nasal)
→ a. áh̃à̃		*	*
b. áh̃à	*!		
c. ã́h̃à	*!	*	*
d. ã́h̃à̃		**!	**

Four candidates are presented in Table 5. Candidates (b) and (c) incur a fatal violation of the undominated markedness constraint *NV$_{[-nasal]}$, which forbids a sequence of a nasal consonant followed by an oral vowel. Therefore, they are ruled out as potential winners. Observe that candidates (a) and (d) both satisfy this constraint and they both disobey *V/NAS and IDENT-IO(nasal). However, candidate (a) wins because it incurs fewer violations than candidate (d); the former has one violation mark each for the two constraints but the latter has two violation marks each. This, again, empirically confirms OT's claim that, although violation is permitted, the output forms with fewer or minimal violations are given priority over output forms with more or serious violations. This theoretical assumption cum empirical justification is a characterization of the principle of economy in Universal Grammar.

In reference to linguistic typology, the case of Mbaise vowel nasalization is similar to what is tenable is some other languages, such as Mandurese in which there is no contrast between vowels with respect to nasality (Stevens, 1968 as cited in McCarthy, 2008). In Mbaise, there is perfect complementary distribution of nasalized vowels and their oral counterparts as there is no environment where nasality is contrastive in vowels. This, however, is in contrast with languages, such as Yorùbá, Urhobo, Nancoury, etc., in which nasal and oral vowels are contrastive. In Yorùbá and Urhobo, vocalic nasality contrast is neutralized in certain environment – for example, only after nasal consonants in Yorùbá (Oyinloye, 2019), but after nasal(ized) consonants and nasal vowels in Urhobo (Aziza, 2010). In Nancoury, however, nasality contrast in vowels is absolute in that nasal and oral vowels contrast in all environments (Radhakrishnan, 1981 as cited in McCarthy, 2008).

The final task in this paper is to explore the possibility of accounting for nasalized consonants and nasalized vowels in Mbaise using a single constraint hierarchy. This possibility is tenable on the ground that both sets of segments are inter-connected when they coexist in the same syllable. An underlying nasalized consonant automatically turns the following underlying oral vowel to a nasalized one in the phonetic form since all vowels become nasalized after either an unmarked nasal consonant or a marked nasalized consonant. Therefore, if all the constraints used in both cases are made to interact by ranking them accordingly, the same result will be obtainable. The ranking is proposed in (17).

(17) IDENT-CONS/NAS, *NV$_{[-nasal]}$ >> *FRIC/NAS, *LIQ/NAS >> *CONS/NAS, *V/NAS >> IDENT-IO(nasal)

The ranking in (17) can be interpreted in the following way: well-formed Mbaise words containing nasal(ized) consonants and nasalized vowels jointly obey IDENT-CONS/NAS and *NV$_{[-nasal]}$ given the fact that the nasal(ized) consonant in the input is preserved with its nasal feature at the surface and any vowel that follows it will automatically acquire nasality. This joint obedience is the reason behind the lack of mutual ranking between the two constraints. Also, preservation of the nasal feature of a consonant and acquisition of nasality by an adjacent vowel in the surface representation inevitably lead to violations of the four anti-nasal markedness constraints: *FRIC/NAS, *LIQ/NAS, *CONS/NAS, and *V/NAS, as well as violation of the faithfulness constraint IDENT-IO(nasal) which demands [nasal] identity between corresponding input and output segments. We justify the validity of this proposal by submitting items (12g) and (13f) for analysis, which is shown in Tables 6 and 7, respectively.

Table 6: Analysis of /únù/ → [únṵ̀] 'your (pl)'

/únù/	IDENT-CONS/NAS	*NV$_{[-nasal]}$	*FRIC/NAS	*LIQ/NAS	*CONS/NAS	*V/NAS	IDENT-IO(nasal)
a. únù		*!			*		
b. ṵ́nù		*!			*	*	*
c. ṵ́nṵ̀					*	**!	**
→ d. únṵ̀					*	*	*

In Table 6, the ranking requires that the input /únù/ be converted to [únṵ̀] by the process of vowel nasalization. All the candidates obey the highly ranked faithfulness constraint IDENT-CONS/NAS, implying that the parallel evaluation of the candidates has to proceed to the next highly ranked markedness constraint *NV$_{[-nasal]}$. The first two candidates refuse to nasalize the vowel after the alveolar nasal consonant [n], thereby leading to a fatal violation of *NV$_{[-nasal]}$. The competition between the last two candidates presents an interesting scenario as far as degree of violation of constraints in OT is concerned. They obey the first four constraints in the hierarchy but violate the last three. However, the number of violation marks incurred on *V/NAS and IDENT-IO(nasal) by

the two candidates settles the contest between them. The penultimate candidate violates the two constraints at two points while the last candidate does so at one point. By virtue of minimal violation, the last candidate is more harmonic with the hierarchy than the penultimate candidate; hence, it is chosen as the optimal candidate, i.e., the actual output form.

Table 7: Analysis of /iš̃ẹ́/ → [iš̃ɛ́] 'five'

/iš̃ẹ́/	IDENT-CONS/NAS	*NV$_{[-nasal]}$	*FRIC/NAS	*LIQ/NAS	*CONS/NAS	*V/NAS	IDENT-IO(nasal)
a. iš̃é		*!	*		*		
→ b. iš̃ɛ́			*		*	*	*
c. isé	*!						*
d. ĩsɛ́	*!					**	**
e. ĩš̃é		*!	*		*	*	*
f. ĩš̃ɛ́			*		*	**!	**

Six candidates are generated on the basis of the input /iš̃ẹ́/ in Tableau 7. The two undominated constraints in the hierarchy rule out candidates (a), (c), (d), and (e) for either of two reasons: failure to preserve the nasal feature of the underlying nasalized fricative [s̃] in the surface representation (cf. candidates (c) and (d)) or refusal to nasalize the oral vowel [ɛ] after the nasalized fricative (cf. candidates (a) and (e)). Candidates (b) and (f), on the other hand, perform equally on all the constraints except for the difference in their degree of violation on the last two. Given that *NV$_{[-nasal]}$ only requires nasalization of an oral vowel after a nasal(ized) consonant and nothing more, it therefore implies that any additional vowel nasalization would incur additional violation mark on *V/NAS and such move would, of course, be fatal. It is on this basis that candidate (f) is knocked out in favor of candidate (b).

The analysis presented in Tableaux 6 and 7 shows that despite the difference in the phonological distribution and the functional status of nasalized consonants and nasalized vowels

in Mbaise, a single hierarchy of constraints can uniformly derive them. This is because both sets of segments have some structural relationship when they are contained in the same syllable.[2] The structural relationship is defined by the fact that the nasalized consonant usually transfers its nasality onto the adjacent succeeding vowel.

5. Results and Discussion

The systematic analysis of the phonological distribution and functional status of nasalized consonants and nasalized vowels in the Mbaise dialect of Igbo done above is summarized by the constraint hierarchies presented in (18a) and (18b), respectively; and the interaction of both sets of segments is explained by the uniform hierarchy in (18c).

(18) (a) *Contrastive Nasality in Consonants*

Faithfulness >> Context-Free Markedness (C-FM)

IDENT-CONS/NAS >> *FRIC/NAS, *LIQ/NAS >> *CONS/NAS

(b) *Context-Induced Nasality in Vowels*

Context-Sensitive Markedness (C-SM) >> Context-Free Markedness >> Faithfulness

$*NV_{[-nasal]}$ >> *V/NAS >> IDENT-IO(nasal)

(c) *Interaction of Contrastive Nasality and Context-Induced Nasality*

Faithfulness	C-SM	>>	C-FM	>>	Faithfulness
IDENT-CONS/NAS	$*NV_{[-nasal]}$	>>	*FRIC/NAS	>>	IDENT-IO(nasal)
			*LIQ/NAS		
			>>		
			*CONS/NAS		
			*V/NAS		

The ranking in (18a) indicates that faithfulness to consonant nasalization in the input (IDENT-CONS/NAS)) takes priority over the anti-nasal forces of *FRIC/NAS, *LIQ/NAS, and *CONS/NAS. Hence, nasality in consonants is contrastive. The ranking in (18b), however, reveals that well-formedness of the output with respect to the sequence of a nasal(ized) consonant and a nasalized vowel ($*NV_{[-nasal]}$) takes precedence over the anti-nasal force of *V/NAS, as well as faithfulness of output to input with respect to nasality (IDENT-IO(nasal)). Thus, nasality in vowels is contextually

[2] Of course, both sets of segments always coexist in the same syllable in Mbaise due to the fact that the predominant syllable structure in the dialect is CV.

derived. Finally, the ranking in (18c) shows that both faithfulness to consonant nasalization in the input (IDENT-CONS/NAS)) and nasalization of a vowel after a nasal(ized) consonant (*$NV_{[-nasal]}$) are of utmost importance over any anti-nasal markedness constraint and a faithfulness constraint demanding nasal identity between corresponding input and output segments (vowels and consonants).

As demonstrated in Section 5, Mbaise operates two distinct systems of nasalization: a system of contrastive nasality affecting consonants and a system of context-induced nasality affecting vowels. In consonance with OT's instantiation of the construct 'Richness of the Base', the two systems are product of interactions of markedness and faithfulness constraints at the output level. In other words, they are realized strictly at the surface, contrary to the tradition in the derivational theory in which the notion of contrast is operational at the level of lexical (underlying) representation (Kager, 1999). Interestingly, McCarthy (2008) asserts that "in OT, contrast or lack of it is determined by the grammar, so contrast and distribution are facts about surface structure alone" (p. 92). This clearly entrenches the general axiom that OT is strictly an output-oriented theory in that well-formedness of forms or structures is determined solely at the surface. In light of the foregoing discussion, we hereby propose an optimality-theoretic model for the two systems of nasal specification in Mbaise. This proposed model is presented in Figure 1.

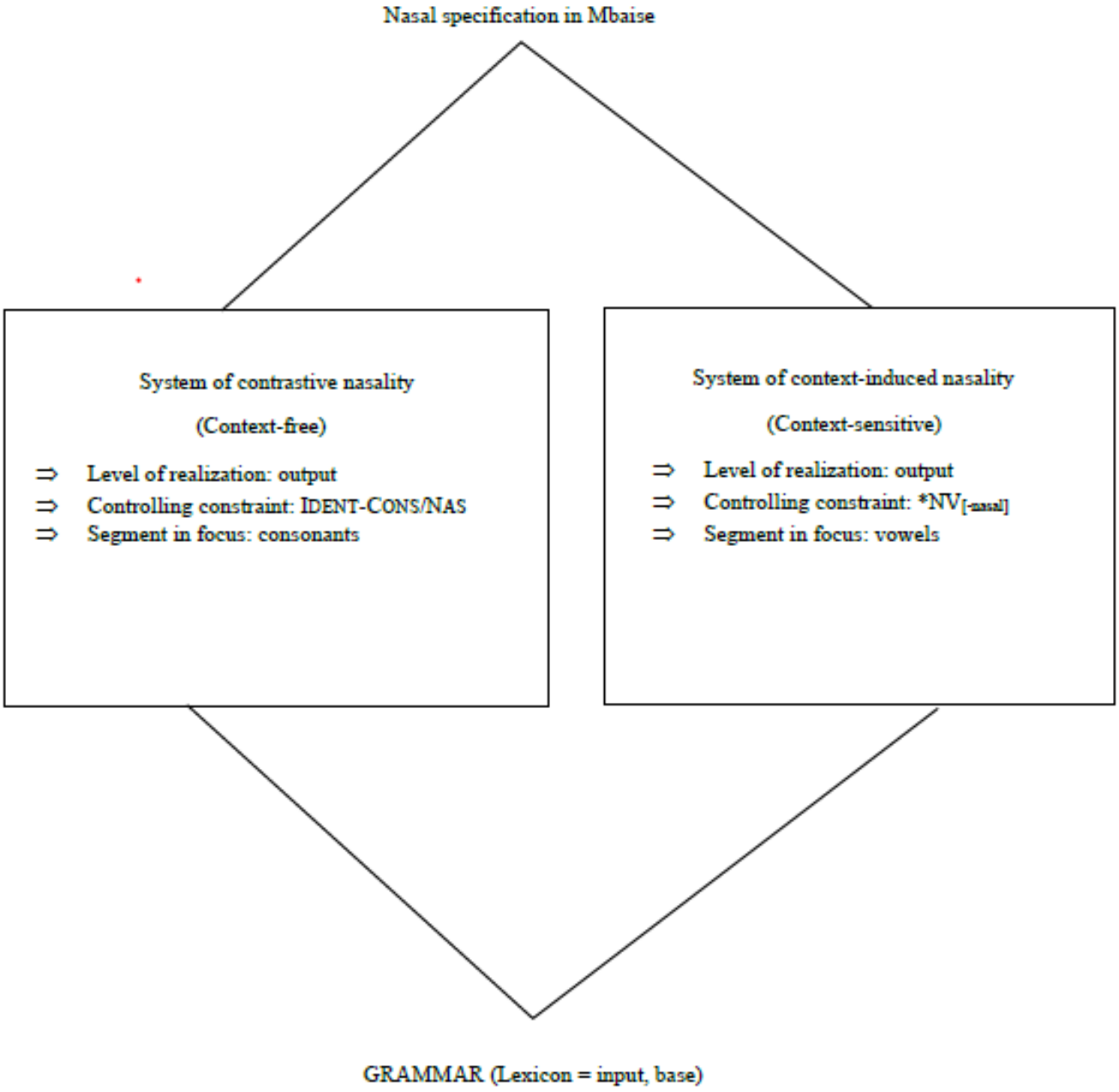

Figure 1: An optimality-theoretic model of two systems of nasal specification in Mbaise

6. Conclusion

This paper has shown that Mbaise, a dialect of Igbo spoken in Imo state, Nigeria, operates two systems of nasalization: the contrastive type affecting consonants and the context-induced type affecting vowels. Though the phonological distribution of the nasalized consonants is restricted to inter-vocalic position, their phonetic form is not context-driven. On the other hand, the phonological distribution of the nasalized vowels is context-sensitive in that they are phonetically realized after nasal(ized) consonants. An opposition holds for their functional status in the dialect: nasalized consonants are phonemic while nasalized vowels are allophonic (they are variants of their oral counterparts). The paper has also argued that nasality is an inherent feature of the nasalized consonants; the feature is only acquired by a succeeding vowel via a process of nasalization. This argument is founded on the fact that Mbaise vowels, all of which are underlyingly oral, generally acquire nasality after either an unmarked nasal consonant or a marked nasalized consonant.

With respect to the surface realization of Mbaise nasalized consonants, this paper has established that the faithfulness constraint IDENT-CONS/NAS is ranked above the context-free markedness constraint *CONS/NAS. With respect to the surface realization of Mbaise nasalized vowels, the context-sensitive markedness constraint *$NV_{[-nasal]}$ outranks the context-free markedness constraint *V/NAS as well as the faithfulness constraint IDENT-IO(nasal). Despite the difference in their phonological distribution and functional status, Mbaise nasalized consonants and nasalized vowels have a structural relationship within the syllable in which they occur, thereby leading to the proposal that a single constraint hierarchy can uniformly capture their well-formedness: IDENT-CONS/NAS, *$NV_{[-nasal]}$ >> *FRIC/NAS, *LIQ/NAS >> *CONS/NAS, *V/NAS >> IDENT-IO(nasal).

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