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*Research article*

## **An element-based analysis of nasal-glide assimilation in the Taqbaylit prepositional phrase**

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### **ABSTRACT**

In this paper we aim to describe and analyze the different phonetic realizations resulting from nasal-glide assimilations in some dialects of Taqbaylit Berber. Specifically, we aim to study the assimilation of the nasal-approximant /n-w/ which yield to different labial(ized) realizations [ww, pp, pp<sup>w</sup>, bb<sup>w</sup>, gg<sup>w</sup>], and the nasal-yod /n-j/ that result in palatal segments [jj, kk, gg] depending on the dialect. While these facts are well documented, most works are limited to descriptive accounts and rarer are the attempts to theoretically explain their phonological derivation. Our analysis is couched in Element Theory (KAYE et al. 1985, 1990, HARRIS 1990, 1994, among others) and proposes to analyze the internal structure of the surface segments and their link to the underlying forms and explain their distribution in Taqbaylit dialects. Our analysis also contributes to the theoretical debates on the link between voicing and nasality and their element-representation.

**KEY WORDS:** phonology, nasal-glide assimilation, voicing-nasality, Element Theory, Taqbaylit/Kabyle Berber



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## 1. Introduction

In Taqbaylit Berber, the assimilation of the nasal-approximant /n-w/ and the nasal-yod /n-j/ yields different surface segments depending on the dialect. The first results in geminated labial(ized) consonants [ww, pp, pp<sup>w</sup>, bb<sup>w</sup>, gg<sup>w</sup>], and the second in geminated palatals [jj, kk, gg]. In most cases, but not in all dialects, the surface form resulting from nasal-glide assimilation is the same as the surface form of the geminated glide. Therefore, this process of nasal-glide assimilation can be seen in terms of two different phenomena: fusion of two segments, or compensatory lengthening. Fusion refers to the phenomenon where two or more distinct segments combine to form a new surface segment, also known as 'reciprocal assimilation'. This process occurs precisely by combining the features/elements of the segments in question. Compensatory lengthening, on the other side, can be defined as the lengthening of a segment on the position of another adjacent segment by fully assimilating it (BELTZUNG 2008). In other words, in a sequence of segments /XY/, the segment X can lengthen/spread on the position of Y and surface [XX]. These two phonological processes will be discussed in our article. We will demonstrate that only an analysis in terms of segment-element fusion can satisfactorily account for the empirical data collected from Taqbaylit.

The phenomenon of nasal-glide assimilation which occurs on the left edge of the Taqbaylit noun phrase is well-documented in the literature (ALLAOUA 1994, BENDJABALLAH and HAIDEN 2005, 2013, CHAKER 2015, NAIT-ZERRAD 2001, among others). However, to the best of our knowledge, no phonological studies have analyzed this phenomenon from an element-based perspective. Our study aims to address this gap by providing an analysis within the framework of Element Theory (KAYE et al. 1985, 1990, HARRIS 1990, 1994, BACKLEY 2011, among others) that accounts for the surface forms of this assimilation. Specifically, we seek to examine the phonological patterns that govern the assimilation between the nasal /n/ and glides in Taqbaylit and explore the internal structure (element content) of these segments. By doing so, we hope to contribute to the understanding of the internal structure of segments in Taqbaylit and shed light on some aspects that contribute to phonological theories, in particular the link between nasality and voicing.

The assimilation cases we will analyze occur at the left edge of the noun. These nouns exhibit two morphological states traditionally named 'free state' and 'annexed/construct state' (BADER and KENSTOWICZ 1984, GUERSSEL 1987, OUHALLA 1988, GUERSSEL 1992, METTOUCHI 2008, KOSSMANN 1996, BENDJABALLAH and HAIDEN 2013, EL HANKARI 2014, among others). In general, a noun in singular begins with a vowel /a/, and in plural with a vowel /i/. These vowels alternate with the

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glides /w/ and /j/ between the ‘free state’ (FS) and the ‘construct state’ (CS), also called ‘absolutive/accusative case’ and ‘nominative case’, respectively. This is illustrated with the data in (1).

(1)	FS	CS	Gloss	Alternation
	<i>a-xxam</i>	<i>wə-xxam</i>	‘house’	a → w
	<i>i-xxam-ən</i>	<i>jə-xxam-ən</i>	‘house-pl’	i → j

The genitive preposition /n/, also considered as a case marker by GUERSEL (1987),<sup>1</sup> selects a noun inflected in the construct state, which can be marked by /w-/ or /j-/. The genitive marker assimilates with one of these glides, and the result of this assimilation can vary depending on the dialect. In (2), we provide the results in Taqbaylit of Chemini.

(2)	/θawwurθ	<i>n</i>	<i>wə-xxam/</i>	→	[θappurθ <i>ppə-xxam</i> ]
	door	GEN	CS-house		
	‘Door of house.’				
	/θiwwura	<i>n</i>	<i>jə-xxamən/</i>	→	[θippura <i>kkə-xxamən</i> ]
	door	GEN	CS-house		
	‘Doors of houses.’				

The assimilation of the genitive /n/ with the construct state marker occurs on the left periphery of the noun stem. BENDJABALLAH and HADEN (2005, 2013) argued that this left periphery contains two phonological sites represented by two CV units, spelling out the two syntactic projections K(ase) and D(eterminant) proposed in GUERSEL (1987, 1992). This is illustrated by the representations given in (3). In (3a), the vowel /a/ of the noun in free state (FS) occupies both CV units of K and D, because vowels are phonologically long in Taqbaylit (BENDJABALLAH 2004). In (3b), with the same noun in construct state (CS), the first CV unit of K(ase) is occupied by the genitive marker /n/, and the second one by the construct state marker /w/.<sup>2</sup> The cases of assimilation that we will study occur at both of these CV sites.

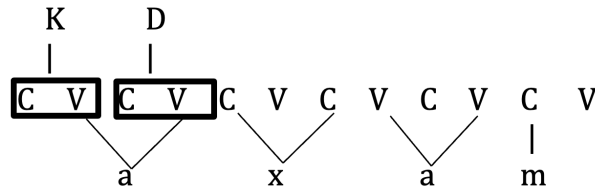
<sup>1</sup> See the author’s discussion on the morphosyntactic status of the genitive /n/ (and other prepositions): preposition *vs* case marker.

<sup>2</sup> In the literature, the status of /w/ lacks consensus, often viewed as a marker of masculine gender, a determiner marker, or a marker of the construct state. Our aim is not to definitively determine its status; rather, we refer to it as a marker of the construct state.

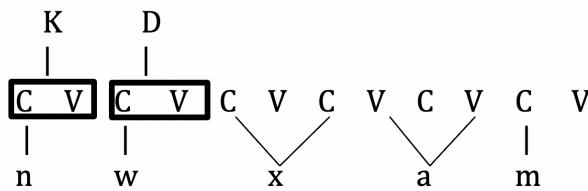
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(3) a. Free state (FS): **axxam** 'house'



b. Construct state (CS): **n wəxxam** 'of house'



Our analysis aims to explain the various surface realizations that result from the assimilation of the genitive /n/ and the marker of the construct state, occurring on the two CV units in the left periphery as in (3b). Specifically, we will try to answer these questions: why do nasal-approximant /nw/ give rise to labial(ized) segments [ww, pp, pp<sup>w</sup>, bb<sup>w</sup>, gg<sup>w</sup>], and why do nasal-yod /nj/ lead to palatal segments [jj, kk, gg]? What are the processes and factors that explain these surface forms in the different dialects of Taqbaylit?

Our paper is organized as follows. In section 2, we will discuss in detail the phenomenon of nasal-glide assimilation and compare it to glide gemination in Taqbaylit dialects. We will present in section 3 the theoretical tools of Government Phonology, specifically the frameworks of *Strict CV* and *Element Theory*. An analysis of the phenomenon of nasal-glide assimilation will be developed in section 4. Finally, in section 5, we will conclude the paper with the results of our analysis.

**2. Nasal-glide assimilation and glide gemination**

To investigate the micro-variation observed among Taqbaylit dialects regarding the phonetic realizations resulting from the nasal-glide assimilation, we conducted data collection with native speakers in three provinces of Kabylia: Bejaia, Bouira, and Tizi-Ouzou. Within these provinces, we selected 18 distinct survey locations indicated in (4), and their corresponding numerical references are plotted on the map presented in Figure 1.

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(4) Province	Survey location
Bejaia	Chemini [1], Akfadou [2], Tazmalt [3], Ighil Ali [4], Bejaia city [5], Tichy [6], Mergha Aboudaou [7], Oued Ghir [8], Tamridjet [9]
Bouira	Selloum [10], Takerboust [11], M'cheddallah [12], Kadiria [13]
Tizi-Ouzou	Tizi Rached [14], Ouaguenoun [15], Aghriv Azefoune [16], Idjeur [17], Michelet (Ain El Hammam) [18]

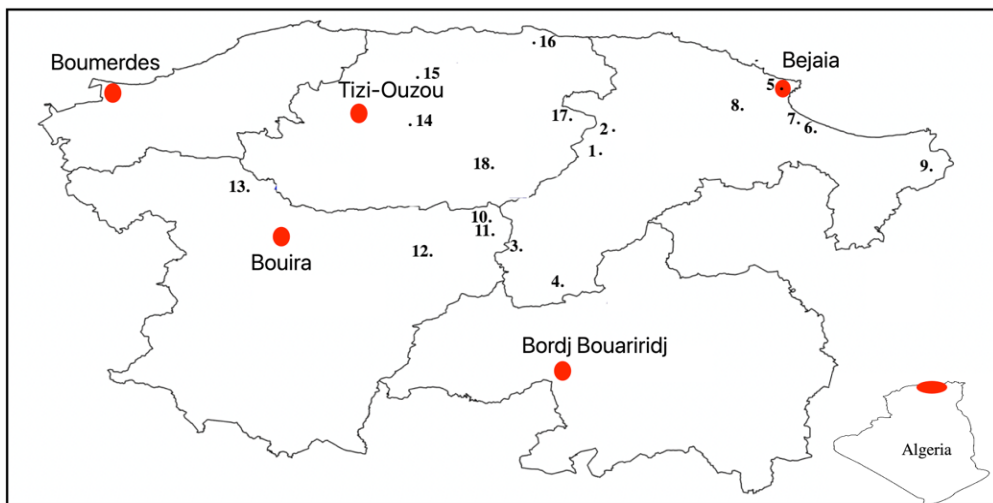


Figure 1 - Map of Taqbaylit provinces and the distribution of survey locations (The map is designed using MapInfo)

In these eighteen survey locations, we observed a variety in surface forms resulting from the nasal-glide assimilation as well as the glide gemination. We will begin by describing cases of nasal-glide assimilation in section 2.1, followed by cases of glide gemination in section 2.2. Finally, we summarize the facts and observations in section 2.3.

**2.1 On the nasal-glide assimilation**

**2.1.1. Nasal-approximant assimilation**

The nasal-approximant sequence /nw/ can have various surface forms depending on the dialect/location. First, it can surface as a geminated approximant [ww], what we consider as a case of compensatory lengthening. Second, it can be realized as a voiceless (labialized) bilabial occlusive [pp, pp<sup>w</sup>]. Third, it results in a voiced bilabial occlusive [bb<sup>w</sup>]. Finally, it can surface as a voiced labiovelar occlusive [gg<sup>w</sup>]. The distribution of these various surface forms

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resulting from the sequence /nw/ is provided with an example in (5), along with the numerical references of the locations where they are attested.

(5)	/afus	<i>n</i>	<i>wə-rgaz/</i>
	FS.hand	GEN	CS-man
	'Hand of man.'		
	[afus <i>wwərgaz</i> ]	[5], [6], [7], [8]	
	[afus <i>ppərgaz</i> ]	[1]	
	[afus <i>pp<sup>w</sup>ərgaz</i> ]	[2], [14], [18]	
	[afus <i>bb<sup>w</sup>ərgaz</i> ]	[9], [12], [13], [15], [16], [17]	
	[afus <i>gg<sup>w</sup>ərgaz</i> ]	[3], [4], [10], [11]	

The crucial point to summarize is that in data in (5), assimilation of the sequence /nw/ can be realized in six different forms in Taqbaylit dialects: [ww, pp, pp<sup>w</sup>, bb<sup>w</sup>, gg<sup>w</sup>]. These realizations can be characterized as labial(ized) segments.

It should be noted that this assimilation occurs due to the contact between the genitive /n/ and the construct state marker /w/. In most Taqbaylit dialects, this assimilation does not occur within the word.

2.1.2 Nasal-yod assimilation

The nasal-yod sequence /nj/ can surface into the following three geminated forms: i) a palatal approximant [jj], ii) a voiceless velar occlusive [kk], and iii) a voiced velar occlusive [gg]. This is illustrated with the data in (6), with the numerical references indicating the location where they are attested.

(6)	/axxam	<i>n</i>	<i>ǰə-sli/</i>
	house	GEN	CS-groom
	'Groom's house.'		
	[axxam <i>jjəsli</i> ]	[5], [6], [7], [8]	
	[axxam <i>kkəsli</i> ]	[1]	
	[axxam <i>ggəsli</i> ]	[2], [3], [4], [10], [11], [12], [13], [14], [15], [16], [17], [18]	

The sequence of the genitive and the construct state marker /nj/ gives rise to three different geminated palatals in Taqbaylit dialects: [jj, kk, gg].

**2.2 Gemination of glides**

The two glides attested in Taqbaylit can be geminated in certain contexts and give rise to surface realizations that are relevant to compare with cases of nasal-glide assimilation. For example, the case of gemination of a median consonant that occurs on the formation of the imperfective stem/aspect from the aorist one.

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The gemination of glides is illustrated in (7.ii) for comparison with other segments in (7.i).

(7)	Aoriste	Imperfective	Gloss
i.	<b>zgər</b>	<b>zəggər</b>	‘to cross’
	<b>frən</b>	<b>fərrən</b>	‘to choose’
ii.	<b>r wəl</b>	<b>rəggəl, rəgg<sup>w</sup>əl</b>	‘to escape’
	<b>ʕju</b>	<b>ʕəjju, ʕəggju</b>	‘to be tired’

We conducted a comparison of glide gemination phenomena using the same survey locations as those studied in the previous case. We will first describe the surface forms of the germination of the approximant /w/, then we will return to the case of the gemination of the yod /j/.

2.2.1 Approximant glide gemination

The gemination of the approximant glide /w/ results in five different surface forms depending on the dialect: i) a geminated approximant [ww], ii-iii) a voiceless bilabial occlusive and its labialized counterpart, [pp, pp<sup>w</sup>], iv) the voiced counterpart of the latter [bb<sup>w</sup>], and v) a voiced labiovelar occlusive [gg<sup>w</sup>]. This is illustrated by the data in (8), which includes numerical references to the locations where they are observed.

(8)	/θa <sup>w</sup> wurθ/ ‘door’	Survey location
	[θa <sup>ww</sup> wurθ]	[5], [6], [7], [8]
	[θa <sup>pp</sup> wurθ]	[1]
	[θa <sup>pp<sup>w</sup></sup> wurθ]	[2], [14], [16]
	[θa <sup>bb<sup>w</sup></sup> wurθ]	[12], [13], [15], [17]
	[θa <sup>gg<sup>w</sup></sup> wurθ]	[3], [4], [10], [11]

Thus, the gemination of the approximant glide /ww/ can surface in the same forms resulting from the assimilation of the nasal-approximant /nw/, albeit not symmetrically in each dialect. In addition, two different forms of this glide gemination can be attested in the same location. For example, in the survey locations [12] and [13], the gemination of this glide results in [bb<sup>w</sup>] in example (8) but in the labialized velar [gg<sup>w</sup>] in the example given in (9).

(9)	Aoriste	Imperfective	Gloss
	/r <sup>w</sup> u/	[rəgg <sup>w</sup> u]	‘to satiate’

It should be noted that there is no one-to-one correspondence in all dialects regarding the two phenomena, namely nasal-glide assimilation and gemination.



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In other words, there are dialects where the phonetic realization resulting from the assimilation of /nw/ is different from that resulting from the gemination of /w/, as in the case of the location [16].

2.2.2 Palatal glide gemination

The gemination of /j/ gives rise to two different surface forms: i) a geminated palatal [jj], and ii) a geminated voiced velar occlusive [gg]. This is illustrated by the data given in (10), with numerical references indicating the locations where they were attested.

(10)	Aoriste	Imperfective	Gloss
	/ɣju/	/ɣəjju/	‘to be tired’
			Survey points
	[ɣju]	[ɣəjju]	[1], [5], [6], [7], [8], [9]
	[ɣju]	[ɣəggju]	[2], [3], [4], [10], [11], [12], [13], [14], [15], [16], [17], [18]

To summarize, the gemination of the glide /jj/ gives rise to two surface forms, [jj] and [gg], depending on the dialect. It should be mentioned that there is no dialect where the gemination of the yod yields the geminated voiceless palatal [kk] resulting from the assimilation of /nj/ in certain locations.

**2.3 Summary**

The possible realizations of nasal-glide assimilation and glide gemination in Taqbaylit dialects are summarized in (11). We observe that the nasal-approximant /nw/ assimilation and the gemination of the approximant glide /ww/ yield nearly identical surface segments, specifically: [ww], [pp], [pp<sup>w</sup>], [gg<sup>w</sup>], [bb<sup>w</sup>]. On the other hand, the nasal-yod assimilation and the gemination of the palatal glide /jj/ also result in same surface forms, namely [jj] and [gg], in addition to which the form [kk] arises only as a result of the nasal-yod assimilation.

(11)	/nw/	/ww/	/nj/	/jj/
	[ww], [pp]	[ww], [pp]	[jj]	[jj]
	[pp <sup>w</sup> ], [bb <sup>w</sup> ]	[pp <sup>w</sup> ], [bb <sup>w</sup> ]	[gg]	[gg]
	[gg <sup>w</sup> ]	[gg <sup>w</sup> ]	[kk]	

It is important to note that there is no one-to-one correspondence in all dialects regarding the two phenomena, namely nasal-glide assimilation and glide gemination. Firstly, there are dialects in which the phonetic realization resulting from the assimilation of /nw/ differs from that resulting from the gemination of

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/w/, as observed in the location [16]. Secondly, there is no dialect where the gemination of the yod results in the geminated voiceless palatal [kk], as occurs from the assimilation of /nj/ in Taqbaylit of Chemini.

Now that we have established generalizations regarding the distribution of our data, let us proceed to discuss the theoretical frameworks. These will be used to analyze the surface forms and their link to underlying forms.

### **3. Theoretical background**

Our study contributes to the theoretical debates on the internal structure of phonological segments, known in phonological literature as *Element Theory* (KAYE et al. 1985, 1990, HARRIS 1990, SCHEER 1996, BACKLEY 2011, among others). This framework focuses on the internal structure and/or the element content of phonetic/phonological segments. Its objective is to investigate the phonological primes of segments, also called ‘elements’, their organization, and their interpretation at the phonetic level. Within the framework of Element Theory, our discussion centers precisely on the interaction between nasality, voicing, and syllabic structure. In previous phonological frameworks, such as SPE (CHOMSKY and HALLE 1968), voicing and nasality are considered as two distinct features (e.g., [+voicing] and [+nasality]) This consideration was followed in the early versions of Element Theory, often representing nasality as |N| and voicing as |L| (KAYE et al. 1985, 1990, SCHEER 1996, among others). In later versions, these features, namely nasality and voicing, are often represented by the same element/prime, following the works of PLOCH (1999) and NASUKAWA (1997, 2000). To distinguish between them, some authors propose that voicing be represented by the head element |L| and nasality by the non-head element |L| (NASUKAWA 2000, BACKLEY 2011, 2012, among others), while others suggest the opposite regarding headedness (BREIT 2013, 2017). More recently, some authors propose that voicing should not be represented by an element/prime but it is considered to be a structural property (PÖCHTRAGER 2006) or a skeletal configuration (SÓSKUTHY 2008). Our aim is to take part in this debate and contribute some new elements by analyzing the nasal-glide assimilation in Taqbaylit.

#### **3.1 Element Theory**

Element Theory is a phonological framework that studies the internal structure of phonological segments based on primitives, also called ‘Elements’ or ‘primes’ (KAYE et al. 1985, 1990, HARRIS 1990, 1994, HARRIS and LINDSEY 1995, SCHEER 1996, PLOCH 1999, NASUKAWA 2000, BACKLEY 2011, among others). The main characteristics of this framework are as follows:

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- (i) Elements are directly perceptible and interpretable.
- (ii) Elements are monovalent.
- (iii) There is a direct relationship between a phonological process and the environment in which it occurs.

Several studies within the framework of Element Theory aim to represent phonological segments in natural languages, using different sets of elements according to various authors. In our analysis, we adopt the version of Element Theory proposed by BACKLEY (2011, 2012), as depicted in (12). This version employs a set of six elements/primes divided into two groups: i) place elements, which are vocalic primes |A|, |I|, and |U|; and ii) manner elements, which are consonantal primes |L|, |H|, and |ʔ|.

**(12) Vowel Elements (Place Elements)**

- |A| pharyngeals, coronals, liquids, non-high vowels
- |U| labials, velars, uvulars, rounded vowels
- |I| palatals, coronals, front vowels

**Consonant Elements (Manner Elements)**

- |L| fully voiced obstruents, low tone vowels
- |H| voiceless obstruents, high tone vowels
- |ʔ| oral/nasal/glottal stops, laryngealized vowels

(BACKLEY 2012: 16)

These elements are categorized into vocalic and consonantal groups, where the vocalic elements - |I|, |A|, and |U| - can be directly interpreted as the vowels [i], [a], and [u] (13a). They can combine with each other to form other vowels (13b), or with consonant elements to form consonants (13c).

- (13) a.                    b.                    c.
- |          |            |              |
|----------|------------|--------------|
| A  = [a] | A U  = [o] | U ʔ  = [p]   |
| U  = [u] | A I  = [e] | U ʔ L  = [b] |
| I  = [i] |            |              |

We use this framework to analyze the internal structure of surface forms arising from nasal-glide assimilation and glide gemination, as well as the relationship between the surface forms and underlying forms, which is not arbitrary.

**3.2 Strict CV**

To analyze the link and interactions between melodic structure and syllabic structure, we utilize the phonological framework called *Strict CV*, also known as

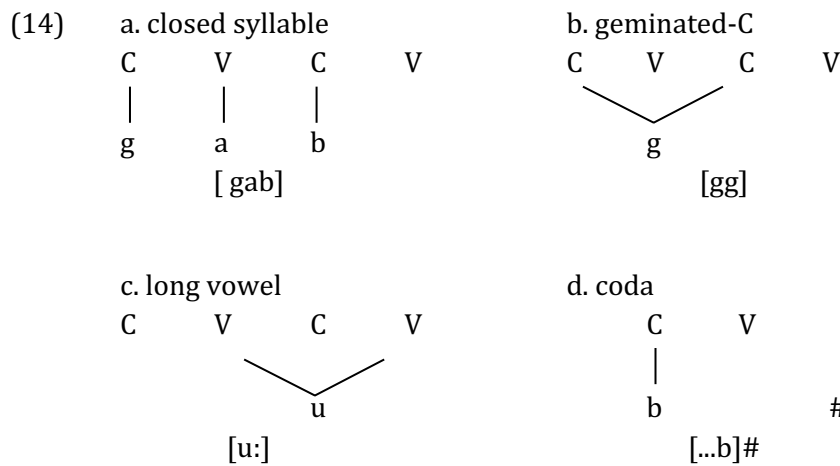
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‘CVCV phonology’ (LOWENSTAMM 1996, 1999, SCHEER 2004). To provide a concise summary of this framework, we can outline the following key points:

- The syllabic structure is reduced to a succession of CV units (CVCVCV...).
- A geminate consonant branches to two C positions separated by an empty V position, and a long vowel branches to two V positions separated by an empty C position.

A summary of the various types of syllabic structures within this framework is provided in (14) below.



We will use this phonological framework to analyze the surface form of geminated segments, as well as assimilated segments that appear as a single geminated segment in two consecutive consonant positions. This will allow us to establish a connection between the syllabic structure of segments and their melodic structure, which pertains to their internal makeup.

**4. Analysis**

In our analysis, we address two key issues arising from the nasal-glide assimilation in Taqbaylit. The first issue pertains to explaining the nature of voicing observed in surface forms resulting from this assimilation in specific dialects, in contrast to its absence in others, as succinctly summarized in (15a). The second issue entails a comprehensive examination of the phenomenon of secondary labialization, which manifests in instances of approximant gemination or its assimilation with the nasal /n/, but remains absent in cases of yod gemination and assimilation, as summarized in (15b).

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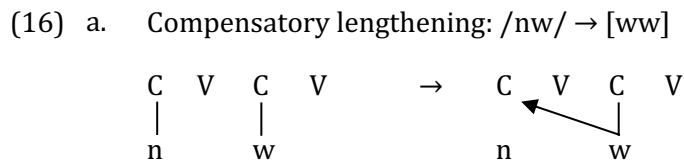
(15) a.	Voiced dialects		Voiceless dialects	
	/nw/	/nj/	/nw/	/nj/
	[bb <sup>w</sup> ]	[gg]	[ww]	[jj]
	[gg <sup>w</sup> ]		[pp]	[kk]
			[pp <sup>w</sup> ]	
b.	Labialized forms		Non-labialized forms	
	/nw/	/ww/	/n j/	/jj/
	[pp <sup>w</sup> ]	[pp <sup>w</sup> ]	[jj]	[jj]
	[bb <sup>w</sup> ]	[bb <sup>w</sup> ]	[kk] * [kk <sup>w</sup> ]	[gg] * [gg <sup>w</sup> ]
	[gg <sup>w</sup> ]	[gg <sup>w</sup> ]	[gg] * [gg <sup>w</sup> ]	

The first question that we address contributes to the debates on the status of voicing in Element Theory (NASUKAWA 1997, 2000, PLOCH 1999, BOTMA 2004, PÖCHTRAGER 2006, SÓSKUTHY 2008, BREIT 2013, 2017, among others). Our data poses a challenge to the representation of voicing with a phonological element [L]. We will attempt to explain whether voicing can be represented using the same primitive as nasality and also elucidate the differences between voiced and voiceless dialects. The second question we address pertains to the status of secondary labialization and its representation in terms of element within the internal structure of a segment. We will endeavor to explain why secondary labialization occurs only with the gemination and assimilation of the approximant /w/, but never with a yod gemination or assimilation.

**4.1 Proposal**

To explain the cases of assimilation observed in the context of the nasal /n/ in contact with a glide, we make the following proposals:

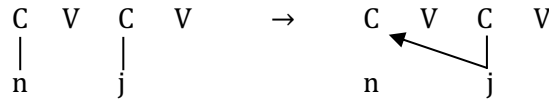
- (i) We propose that cases of regressive assimilation, namely /nw/ → [ww] and /nj/ → [jj], involve compensatory lengthening. From a representational perspective, the nasal /n/ dissociates from its skeletal position, and the glide spreads over this position and surfaces as a geminated consonant. This case is illustrated by the representations in (16a-b).



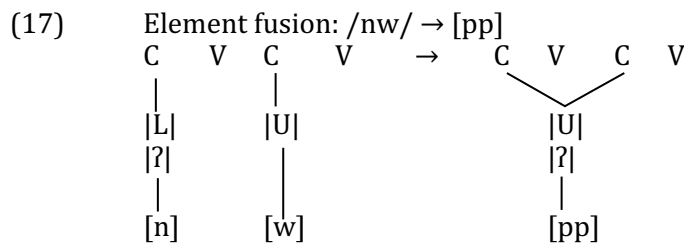
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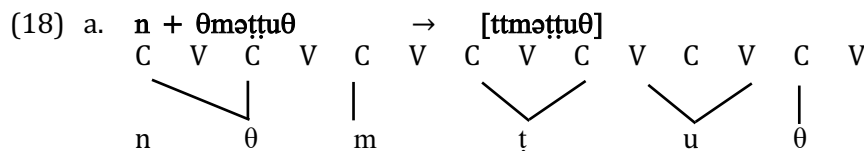
b. Compensatory lengthening: /nj/ → [jj]



(ii) We propose that nasal-glide reciprocal assimilation involves the fusion of elements. From a representational perspective, the elements of the nasal /n/ combine with those of the glide, forming a new segment composed of all or some elements from both. This case is illustrated by the sequence /nw/ surfacing as [pp] in Chemini dialect, where the element |L| is dropped in the derived form.



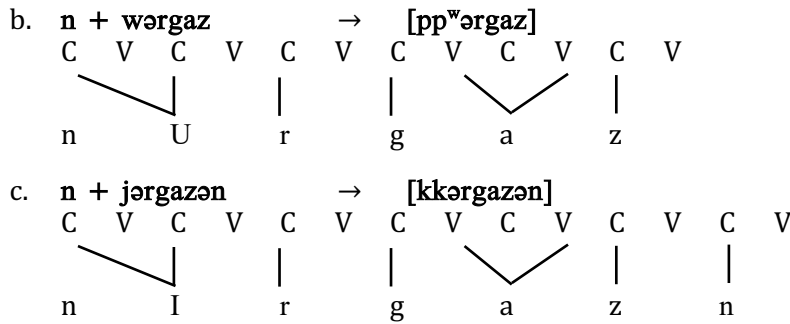
Our proposal is different from the analysis proposed by BENDJABALLAH and HAIDEN (2005), the only one addressing this assimilation phenomenon in Taqbaylit. These authors analyzed the assimilation between the nasal /n/ and the glide as a case of glide gemination. Thus, they proposed that “in Berber Chemini, θ geminates as [tt], w as [pp<sup>w</sup>], and j as [kk]. The assimilations between the preposition n and the following noun must therefore be represented as gemination of the noun-initial consonant” (2005: 14). So, these three geminated forms are equivalent to these three assimilations, /nθ/ → [tt], /nw/ → [pp<sup>w</sup>],<sup>3</sup> and /nj/ → [kk], represented in (18).



<sup>3</sup> In Chemini dialect, the assimilation between /n/ and /w/ results in two variants, [pp] and [pp<sup>w</sup>], but the latter being less attested geographically.

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(BENDJABALLAH and HAIDEN 2005:14)

We believe that this analysis proposed by BENDJABALLAH and HAIDEN (2005) is an untenable one for several reasons. First, there are dialects in which the phonetic realization resulting from the assimilation between the nasal /n/ and the glide /w/ differs from that resulting from the geminated glide /w/, as observed in the location [16] as follows: /nw/ → [bb<sup>w</sup>], but /ww/ → [pp<sup>w</sup>]. Secondly, there is no dialect where the gemination of the glide /j/ results in a geminated voiceless palatal [kk], as occurs from the assimilation of /nj/ in certain dialects. One can consider that is the element |l| of the glide /j/ which is realized on two consonantal positions and is interpreted as [kk]. However, this doesn't explain why in certain dialects it is interpreted as a voiced palatal [gg]. In other words, it does not explain the origin of the voicing feature/element. Thirdly, the same question arises for the voiced labialized segments resulting from the assimilation between /n/ and /w/, which gives rise to [bb<sup>w</sup>]. Moreover, in this latter case, the mechanism (gemination) does not explain the interpretation of the element |U|: is it interpreted once or twice, once in the structure of the labial consonant, and another time as a complement marking labialization?

These issues suggest that the only viable analysis is one that considers the phenomenon of nasal-glide assimilation as a 'fusion' of internal elements of the two segments. Element fusion does not necessarily involve all the elements in every case, as the case of the lack of |L| in (18). Additionally, it should be noted that the role of each element (head or complement) is not always the same in the base form and the derived form, as we will discuss in the next section regarding cases of labialization and voicing that account for the following assimilations: /nw/ → [pp<sup>w</sup>], [bb<sup>w</sup>].

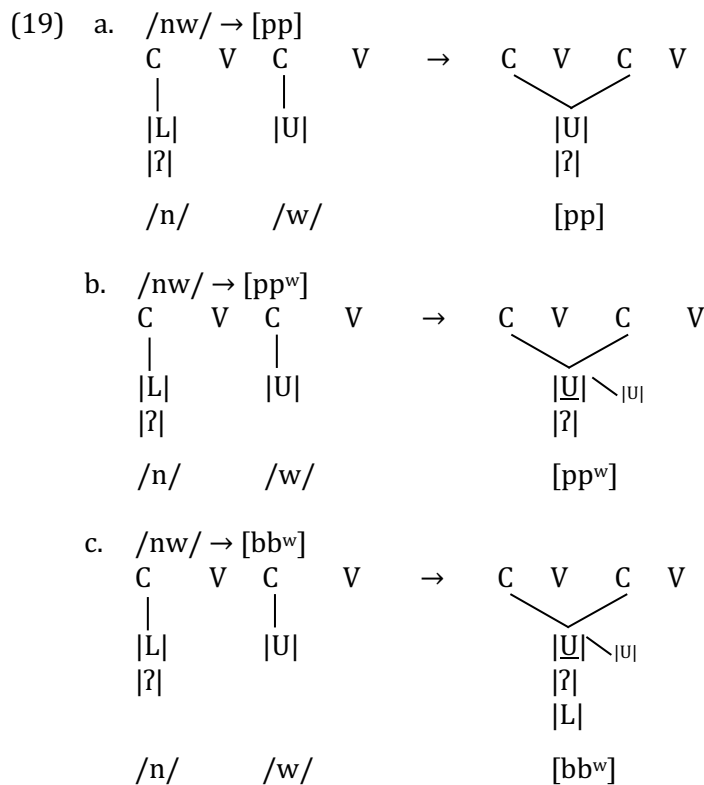
**4.2 Labialization**

Following the hypothesis proposed by HUBER and BÉRCES (2010), based on NASUKAWA and BACKLEY (2005), regarding the representation of aspirated segments with |h| in a complement position, we propose that labialization is

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represented by the element |U| in a complement position. Thus, the difference between the labial [pp] and its labialized counterpart [pp<sup>w</sup>] lies in the additional presence of an element |U| as a complement. This is represented in (19a-b). On the other hand, the voiced counterpart of this segment is characterized by the interpretation of the nasality element |L| of /n/ in the derived form. This element is interpreted as a voicing ‘feature’ in the voiced labial [bb<sup>w</sup>], represented in (19c).



The last point that remains to be explained in the assimilation between the nasal and the approximant /w/ is the case where they surface as a voiced velar stop [gg<sup>w</sup>]. This phenomenon will be explained in the following section after a discussion of nasality and voicing element(s), as well as the content of velars.

**4.3 Nasality-Voicing and velar content**

From a representational standpoint, the difference between the voiceless segments and their voiced counterparts is the presence of the element |L| in the latter. Thus, the pairs /f/ vs /v/ and /p/ vs /b/ are represented in (20), following BACKLEY (2011).



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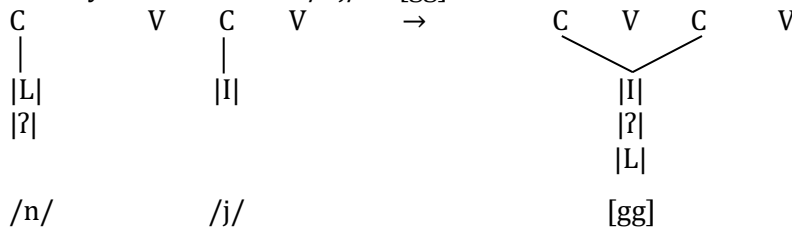
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(20) Voiceless vs voiced segments

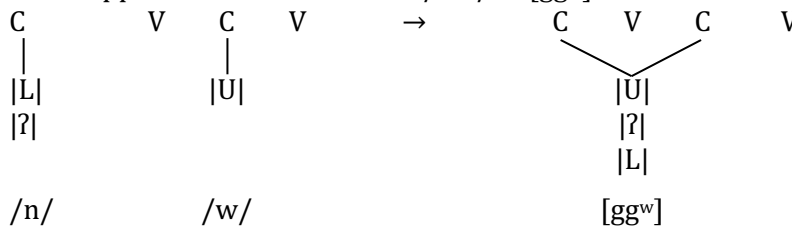


If we consider voicing and nasality can be represented by the same element (|L| or |N|), as proposed by PLOCH (1999), NASUKAWA (1997, 2000), and BREIT (2013, 2017), we could explain the case of voicing resulting from nasal-glide assimilation because of the presence of the nasality element in /n/. The element of nasality in /n/ is interpreted as voicing in the velar stops [gg] and [gg<sup>w</sup>]. This is illustrated by the nasal-yod assimilation in (21) and the nasal-approximant assimilation in (22).

(21) Nasal-yod assimilation: /nj/ → [gg]



(22) Nasal-approximant assimilation: /nw/ → [gg<sup>w</sup>]

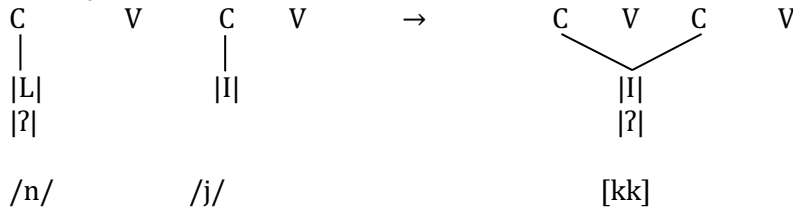


The presence of the occlusion element |ʔ| in the representation of the geminated segments in (21) and (22) is justified by its presence in /n/, as posited by BEDAR and QUELLEC (2020). This is because in Taqbaylit, the nasal /n/ occlusivize fricative segments, for example /θ-aβerrçan-θ/ → [θaβerrçanʔ] 'black.F'. On the other hand, when the nasal-glide assimilation gives rise to voiceless segment, the element |L| of the nasal /n/ is not interpreted in the derived form, as illustrated in (23-24).

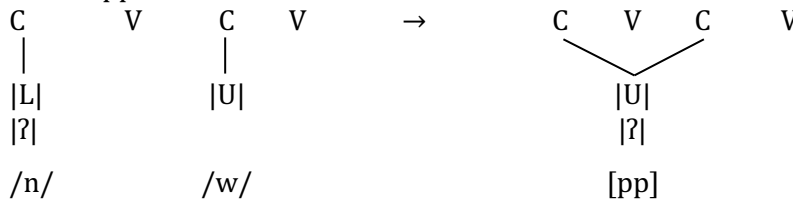
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(23) Nasal-yod assimilation

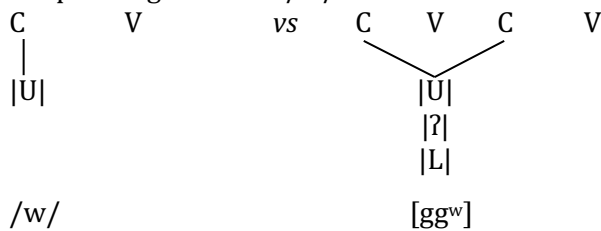


(24) Nasal-approximant assimilation



Considering that the element |L| represents both nasality and voicing provides a complete explanation for the data concerning nasal-glide assimilation, but it raises issues when applied to glide gemination. It is difficult, if not impossible, to justify the presence of the voicing element |L| in the underlying representation in (25) of voiced velar stop resulting from the glide gemination. However, the presence of the occlusion element |ʔ| in the geminated segments can be justified by its length. In other words, since the segments spans two consonantal positions, they acquire the occlusion element |ʔ| (see JENSEN (1994) for a discussion on the link between length and the occlusion element |ʔ|).

(25) Simplex vs geminated /w/

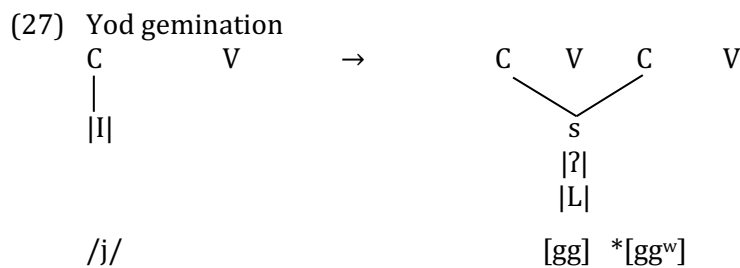
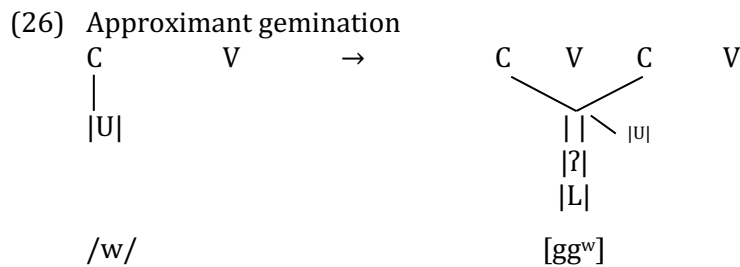


The question arises as to why the two glides /w/ and /j/ can be realized as a voiced velar stop [gg<sup>w</sup>]. The fact that both glides can be realized as a voiced velar suggests either they lack a vocalic element (HARRIS and LINDSEY 1995), or that they may possess the two (|I| and |U|). Several versions of Element Theory assign element |I| to palatalization (BACKLEY 2011) and element |U| to velarity (SCHEER 1999, BACKLEY 2011). The set of dorsals is often represented by the two elements |UI| (BACKLEY 2011, TIFRIT and VOELTZEL 2016, BEDAR 2022). The plausible hypothesis is the one suggesting that velars are empty, for two reasons:

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i) when the approximant /w/ is geminated, the element |U| is interpreted as a complement marking labialization; ii) in all Taqbaylit dialects, when the yod is geminated or assimilated with the nasal, the resulting segment is never labialized and the element |I| can remain uninterpreted. Both cases are respectively illustrated in (26) and (27).



This shows that velars can lack the vocalic element, which explains the case of labialization in segments resulting from the gemination of /w/ or its assimilation. The representations in (26-27) raise some issues that deserve to be explained in further studies, namely: i) the reason why |I| is not interpreted during gemination in (27), and ii) the origin of the voicing element |L| in (26) and (27). Nevertheless, the presence of the occlusion element |?| in the representations is justified by the fact that in Taqbaylit, geminated segments always get an occlusive interpretation (BEDAR 2022, BEDAR and QUELLEC 2022, among others). Thus, our analysis has accounted for some instances of nasal-glide assimilation and cases of labialization. However, there remains some unexplained aspects that will be discussed in the following subsection.

**4.4 Some issues and further research**

Our analysis contributed to theoretical debates on several points, namely the preference for an approach based on element fusion rather than glide gemination, and the confirmation of the validity of the hypothesis proposing the representation of nasality and voicing with the same element. However, it also

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highlighted some theoretical issues that need to be further explored in subsequent studies. Here, we outline some of these issues.

One of the issues lies in cases where nasal-glide assimilation results in labialized labials consonants in some dialects: /nw/ → [pp<sup>w</sup>, bb<sup>w</sup>]. If we consider that labial segments are composed of the element |U|, p{U?} and b{UL?}, how is the labialization derived/represented in [pp<sup>w</sup>] and [bb<sup>w</sup>]? Can we consider that |U| is interpreted twice: once as a labial segment element and another time as a complement to mark labialization? One of the reviewers wondered whether we could consider labialized segments as truly contour segments, similar to classical representations of affricates: an unfused-segments representation sharing a single timing slot/skeleton position. The reviewer also wondered whether the assumption that dependent |U| makes labials, and headed |U| makes labialization may not just work better without the need for the separate dependent/unheaded |U|, as represented in (19b-c)?

Another issue concerns the case of gemination of the approximant glide resulting in voiced palatals in certain dialects: /ww/ → [gg, gg<sup>w</sup>]. If we consider that palatals lack place elements (HARRIS and LINDSEY 1995, BEDAR et al. 2022), we can suggest that |U| is interpreted as an element of secondary labialization in some dialects and not interpreted in others. However, if we consider that the voiced palatal contains |U| and/or |I| in its internal structure, as suggested by BEDAR (2022), it remains to explain how this element is interpreted within the segment as a marker of secondary articulation, namely labialization. Another element that is difficult to justify is the presence of the voicing element |L| in these voiced palatals. In other words, where does the voicing element |L| come from, given that we know nothing appears out of thin air? This question also arises in the case where the gemination of /w/ results in a voiced labial segment: /ww/ → [bb<sup>w</sup>].

The third issue stems from the second and concerns the interpretation or non-interpretation of the voicing element. Below, in (28), we reproduce the data given in (15b) which show a dichotomy between dialects where the result of the nasal-glide assimilation is a voiced segment and dialects where the result of this assimilation is a voiceless segment.

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(28) Voiced dialects		Voiceless dialects	
/nw/	/nj/	/nw/	/nj/
[bb <sup>w</sup> ]	[gg]	[ww]	[jj]
[gg <sup>w</sup> ]		[pp]	[kk]
		[pp <sup>w</sup> ]	

As pointed out by one of the reviewers, this can be explained by a dichotomy in the interpretation or non-interpretation of the voicing element |L| depending on the dialects, but this generalization deserves an explanation within theoretical mechanisms and operations.

### 5. Conclusion

We intend to conclude our article with a concise summary of its main findings. Firstly, based on new empirical data from eighteen variants of Taqbaylit, we presented a description and classification of nasal-glide assimilation phenomena, comparing it to glide gemination to verify if a unified analysis is possible. Then, we have demonstrated that the only previous analysis accounting for nasal-glide assimilation as a case of glide gemination fails to account for some issues, in particular the difference in surface forms resulting from the two phenomena in some dialects. We proposed a new analysis that accounts for the nasal-glide assimilation in terms of element fusion. Finally, we discussed the underlying representation of nasalization as well as the link between nasality and voicing, which can be represented by the same element. Thus, our analysis not only contributes to the theoretical debates on the representation of nasalization and voicing-nasality representation, but also raises several issues and theoretical questions that deserve consideration in further research.

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