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## Glide – high vowel alternation at the syntax-phonology interface

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### 1. Introduction

Anyone who has once thumbed through a textbook on Amazigh (Berber) phonology has probably come across one of the most productive processes in the language, namely the alternation of glides and high vowels, some aspects of which still challenge standard phonological theories. In Tashlhiyt, like in many other Amazigh varieties, glides typically appear in the immediate vicinity of a vowel, in complementary distribution with the corresponding high vowels, as the following examples illustrate (the alternating segments are in bold):

(1)

<b>gru</b>	‘pick up’	agraw	‘assembly’
<b>bri</b>	‘crush’	abra <b>j</b>	‘crushed seeds’
<b>nu</b>	‘be cooked’	tin <b>wi</b>	‘cooking’

Standard analyses generally address this issue from a syllabic point of view, claiming that glides and high vowels are phonetic reflexes of two underlying high vocoids I and U. These vocoids surface as high vowels when attached to a nucleus position, and as glides when associated to margin positions (cf. Bensoukas 2001: 35, Boukhris et al. 2008: 23, Dell & Elmedlaoui 2002: 190-198, Iazzi 2018: 429, Lahrouchi 2001, 2010, 2013, Lahrouchi & Ségéral 2010, Lahrouchi & Kern 2018: 504, Ridouane 2014: 214, among others).

The problem with the above generalization arises when considering contexts where the underlying vocoids surface as high vowels when they should normally be realized as glides. Let us consider the dative forms of the verbs *gru* and *bri*, compared to those of *skr* ‘do’ and *fk* ‘give’:

(2)	<i>Verb</i>	<i>Dative</i>
a.	<b>gru</b>	<b>gru</b> -j-as
	<b>bri</b>	<b>bri</b> -j-as
b.	<b>skr</b>	<b>skr</b> -as
	<b>fk</b>	<b>fk</b> -as

From the examples in (2b), one concludes that the phonological form of the dative morpheme is /as/, immediately following the final consonant of the verb base. When attached to verbs like in (2a), the initial vowel of the dative marker should normally allow the verb’s final vocoid to surface as a glide, leading to the forms \**grwas* and *brjas*. Instead, the high vocoids are realized as vowels, resulting in a hiatus context which is then resolved by means of j-epenthesis.

The question then arises as to whether this type of phonological opacity (Kiparsky 1976) can be addressed without having recourse to any specific boundaries, junctures (Trager 1962, Lehiste 1965), phonological cycles (Kiparsky 1982, 1985) or any other morpheme-specific phonology (Pater 2010).

The key to understanding this phenomenon lies, we argue, in the morpho-syntactic structure of the forms at stake. In line with recent works at the syntax – phonology interface (cf. Marvin 2002, Marantz 2007, Newell & Pigott 2014, Samuels 2010, among others), we claim that the behavior of the high vocoids in the forms of the type in (1) and (2) is the result of the application of spell-out and phase impenetrability condition (Chomsky 2001) at different levels in the syntactic structure. In particular, we show that vP corresponds to a phase where I and U are spelled-out as high vowels before the dative enclitic /-as/ is added. The hiatus is then resolved by means of *j*-epenthesis, leading to *grujas* and *brijas*. In *agraw* and *abraj*, U and I surface as glides since they belong to the same phase (nP) as the neighboring vowel /a/.

External evidence in favor of this analysis will be drawn from the phenomenon of emphasis spread. It will be shown that the emphatic coronals spread their feature to the neighboring segments within the vP and nP domains. That is, verbal and nominal bases containing an emphatic consonant will be entirely emphaticized, to the exclusion of their suffixes which will remain unaffected.

The paper is structured as follows. Section 2 presents the data more fully, and illustrates the set of alternations just outlined. It also explains how the standard syllabic approach to these alternations remains valid, provided that extra-phonological information is taken into account. The examples in this paper are all from the Tashlhiyt variety, but the facts are similar in other Amazigh varieties (cf. Destaing 1920, Basset 1952, Appelgate 1970, Guerssel 1986, Kossmann & Stroomer 1997: 467, Iazzi 2018: 429, among others). Section 3 provides the theoretical background necessary to understanding the proposed analysis. Our phase-based analysis is presented in section 4. Section 5 provides another piece of evidence in favor of our analysis: It will be shown that emphasis spreads within the domains of nP and vP, exactly where glides alternate with high vowels. Section 6 concludes the paper.

## **2. Glide vs. high vowels: features, representations and alternations**

### **2.1 Amazigh phonemic system: an outline**

Tashlhiyt, like almost all other Amazigh varieties, has a simple vocalic system with three phonemic vowels /i, a, u/, and a central short vowel, generally referred as to schwa [ə], whose phonological status is highly controversial. According to many scholars (Dell & Elmedlaoui 2002, Ridouane 2008, among others), this short vowel found in certain consonant clusters is a mere transitional vocoid that has no syllabic status (*contra*. Coleman 1996, 1999, 2001, and Puech & Louali 1999).

As to consonants, Tashlhiyt has 35 phonemic units (including the glides /j, w/), each of which has a geminate counterpart. Although the phonemic status of the two glides is clearly established, as they contrast underlyingly with high vowels (e.g. *rwl* ‘escape’ / *ruh* ‘go away’, *r<sup>s</sup>mi* ‘be tired’ / *rwi* ‘soil’) and like any other consonant they undergo imperfective gemination (e.g. *lkkm* ‘arrive.imperf’ / *rwwi* ‘soil.imperf’), they very often appear in complementary distribution with the corresponding high vowels (further discussion and data in section 2.3). This fact has led many linguists to claim that both glides and high vowels are merely phonetic

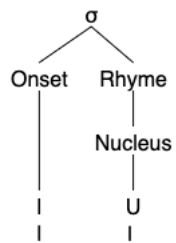
reflexes of the same underlying segments, whose syllabic representations can easily account for their surface realization.

## 2.2 Glides vs. high vowels: features and representations

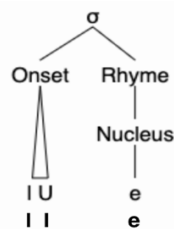
Glides, also termed semi-consonants or semi-vowels, have been largely documented in the literature, from both empirical and theoretical points of view. Their behavior has constantly posed a problem to phonological theory. On the one hand, they closely interact with vowels, alternating with them in various well-defined contexts, not only in the language under scrutiny, but also in many other typologically unrelated languages (see Rosenthal 1994, Padgett 2008, and Levi 2011). On the other hand, they behave as consonants, underlyingly contrasting with vowels.

With the advent of syllable theory, many phonologists have proposed that the difference between vowels and glides can be derived directly from syllable structure (cf. Clements & Keyser, 1983, Kaye & Lowenstamm 1984, Levin, 1985, Selkirk, 1982, 1984), thus making redundant the standard SPE featural distinctions: [ $\pm$ vocalic], [ $\pm$ consonantal], [ $\pm$ syllabic] (Chomsky & Halle 1968: 303, 354), and [ $\pm$ approximant] (Clements 1990: 293). That is, vowels appear in the syllable nucleus, whereas glides attach to coda and onset positions. In this respect, Kaye & Lowenstamm (1984: 130-138) claimed that in French, the high vocoids /U/ and /I/ are realized as vowels in verbs like *loue* ‘rent.IMPERATIVE.SG’ and *lie* ‘tie.IMPERATIVE.SG’, and as glides in the corresponding infinitive forms *louer* and *lier*. This is illustrated in the representations in (3).

(3) a. [lu], [li]



b. [lwe], [lje]



The underlying segments /U, I/ behave as syllabic in (3a), while they form part of a complex onset in (3b). Their position in the syllable structure allows assigning them a phonetic interpretation, without the mediation of any specific feature. The same reasoning underlies the representation of alternating glides and high vowels in Amazigh, as it will be shown in the next section.

## 2.3 Glide – high vowel alternations in Amazigh

This section provides the empirical basis for the generalizations briefly introduced in the previous sections, through a closer, fuller examination of the glide-high vowel alternations in Tashlhiyt.

### 2.3.1 Contexts of alternation

The paradigm in (4) elaborates on (1) above. It shows the structural environments where high vowels alternate with glides.

(4)	<i>Verb</i>		<i>Noun</i>	
a.	gru	‘pick up’	agraw	‘assembly’
	xlu	‘destroy’	amxlaw	‘madman’
	aru	‘give birth to’	arraw	‘child’
	nu	‘be cooked’	tinwi	‘cooking’
b.	bri	‘crush’	abraj	‘crushed seeds’
	sti	‘sort’	astaj	‘sorting’
	fsi	‘untie’	afssaj	‘untying’
	ngi	‘overflow’	angaj	‘overflowing’
	mlilli	‘feel dizzy’	timlillaj	‘dizziness’

Each pair in these examples clearly shows how the verb’s final vowel turns into a glide when for morphological reasons a vowel appears in its immediate vicinity: this is especially the case for the infix -a-, which is inserted after the stem’s second consonant (and which is similarly found in derivations like *sbr* ‘to dry’ > *asbar* ‘wood, tree’, *frs* ‘be sharp’ > *afras* ‘sharpening’). This infix allows [u] to change into [w] (4a) and [i] into [j] (4b). The affixal vowel can also appear after the target segment, like in the nominal form *tinwi* where [i] turns the stem’s final [u] into [w].

Similar alternations are found in plural nouns, as shown in the examples in (5).

(5)	<i>SG</i>	<i>PL</i>	
	iflu	iflwan	‘plank’
	ikru	ikrwan	‘kid’
	amdlu	imdlawn	‘cloud’

The plural suffix -an (also found in forms like *ifrg-an* ‘enclosure’ (< SG *ifrg*) and *ifr-an* ‘caves’ (< SG *ifri*)) is responsible for the semi-vocalization of final [u] of the singular form. Many other formations exhibit similar patterns in Amazigh, including the construct state forms whose vowel marker [u-] alternates with [w-] (e.g. u-frux ‘boy.CS’ vs. w-adgal ‘widower.CS’; cf. Dell & Elmedlaoui 2002, Lahrouchi 2010, 2013, among others) and the perfective forms where the 3MS marker [i-] alternates with [j-] (e.g. i-skr ‘he did’ vs. j-ukr ‘he stole’). The focus on the forms of the type in (4) and (5) will become more evident when analyzing their datives and demonstratives, whose final high vowels resist alternation. The basic rule underlying all of the examples examined so far is the avoidance of any hiatus context: semi-vocalization is one of these strategies that Amazigh utilizes in this respect.<sup>1</sup>

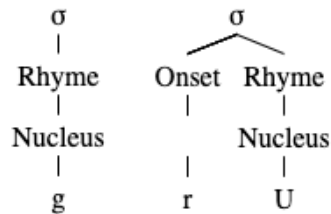
Many Amazigh phonologists have analyzed these alternating segments as variants of the same underlying segments, whose realizations are fully derivable from their position in the syllable structure, (cf. Dell & Elmedlaoui 1985, 2002, Bensouskas 1994, 2001, Lahrouchi 2001, 2013, Lahrouchi & Ségéral 2010, Soutsane 2008, Ridouane 2014, among others). In line with standard approaches to syllable structure (cf. Pike & Pike 1947, Levin 1985, and Blevins 1995; see also Bosch 2011, Goldsmith 2011, and Scheer 2015 for detailed reviews of the relevant

<sup>1</sup> In Amazigh, hiatus may also be resolved by means of j-epenthesis, a fact we will be highlighting in subsequent sections (e.g. *fk-as* ‘give him’ vs. *ini-j-as* ‘tell him’) or by deletion of one of the vowels in contact (e.g. *afus-inu* ‘my hand’ vs. *tasa-nu* ‘my liver, my dear’, *azr<sup>h</sup>u* (SG) vs. *izr<sup>h</sup>-an* (PL) ‘stone’, *itri* (SG) vs. *itr-an* (PL) ‘star’). The reader is referred to Boukous (1979, 2009) and Iazzi (2018: 459) for further details and analysis.

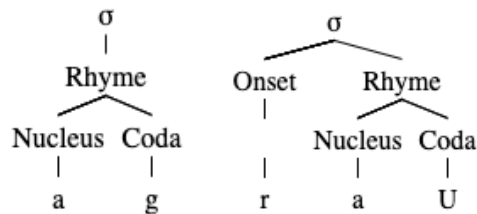
literature), the representation of the verb *gru* ‘pick up’ and its nominal form *agraw* ‘assembly’ is shown in (6).

(6)

a. [gru]



b. [agraw]



A thorough discussion of the above syllabic representations and the ability for any segment to be syllabic in Tashlhiyt would take us beyond the scope of this paper (cf. Dell & Elmedlaoui 1985, 2002, Boukous 1987, and Lahrouchi 2018). We simply draw the reader’s attention to the syllabic positions where the vocoid /U/ appears: When attached to a nucleus position, the vocoid is realized as a high vowel (6a), while it surfaces as a glide when associated to a margin position (6b). Similar representations hold for the vocoid /I/ in words like *bri* ‘crush’ and *abraj* ‘crushed seeds’. The reader is also referred to Dell & Elmedlaoui (2002: 198) for similar syllabic representations of the high vocoids /I/ and /U/ in words like *t-suj* ‘she let pass’ and *t-zwi* ‘she beat down’.

The syllabic approach entirely accounts for the high vowel-glide alternations that occur within a specific domain, which the present study aims to define in a principled way. The following section turns to cases where the so far called ‘alternating high vowels’ cease to undergo alternation.

### 2.3.2 Lack of alternation

One striking context in which the high vowels of the forms in (4) resist alternation arises with the dative and 3<sup>rd</sup> person object suffix /-as/. This is shown in the following examples.

(7) *Verb*

*Dative*

a.	<i>gru</i>	‘pick up’	<i>gru-j-as</i>	‘pick to him/her’
	<i>xlu</i>	‘destroy’	<i>xlu-j-as</i>	‘destroy for him/her’
	<i>kru</i>	‘rent’	<i>kru-j-as</i>	‘rent him/her’
	<i>zru</i>	‘delouse’	<i>zru-j-as</i>	‘delouse him/her’
b.	<i>bri</i>	‘crush’	<i>bri-j-as</i>	‘crush to him/her’
	<i>sti</i>	‘sort’	<i>sti-j-as</i>	‘chose for him/her’
	<i>fsi</i>	‘untie’	<i>fsi-j-as</i>	‘untie him/her’
	<i>z<sup>l</sup>i</i>	‘isolate’	<i>z<sup>l</sup>i-j-as</i>	‘put aside for him/her’

Unlike in (4), the verbs final vowels resist gliding even though they are immediately followed by a vowel initial suffix. In such a context, the high vowels should normally surface as glides, leading to the dative forms *\*grwas* and *\*brjas*, to take but two examples. Instead, a glide [j] is inserted in order to avoid hiatus.

The same phenomenon takes place in the nominal forms of the type in (5). The high vowels of their singular forms resist alternation when immediately preceding the demonstrative enclitic /-ad/, as shown in (8).

(8)	<i>Noun</i>		<i>Noun+Demonstrative</i>	
	iflu	‘plank’	iflu-j-ad	‘this plank’
	ikru	‘kid’	ikru-j-ad	‘this kid’
	amdlu	‘cloud’	amdlu-j-ad	‘this cloud’

Based on similar facts in Tamazight, Guerssel (1986: 03) claimed that the difference observed between non-alternating high vowels as in *t-uri* ‘she wrote’ vs. *t-uri-j-ax* ‘she wrote us’ (not \**turjax*), and *t-essu* ‘she made a bed’ vs. *t-essu-j-ax* ‘she made us a bed’ (not \**tesswax*) and alternating ones like in *i-ru* ‘he cried’ vs. *aha j-ru* ‘then he cried’ receives “a natural explanation if a phonemic distinction between glides and high vowels is established.”

This has been proposed in the case of Tamazight. The data under scrutiny hardly fit into such an analysis for the very simple reason that the final high vowels in (7) and (8) actually undergo alternation within the stem domain, as shown previously in the examples in (4) and (5). They resist alternation only when followed by certain vowel initial suffixes, such as the dative *-as* and the demonstrative *-ad*. While keeping a syllabic approach to these alternations, we will call on those formal mechanisms which integrate extra-phonological information capable of explaining why alternating segments cease to do so beyond a certain domain. Cyclic derivation at the interface between syntax and phonology, nowadays referred as to “phases”, is one such device which better accounts for these paradoxical cases where the same underlying segments may or may not undergo alternation. Before expanding on this issue, we provide some theoretical background necessary to understanding our analysis.

### 3. Boundaries, phases and spell-out: The basics

#### 3.1 Grammatical carriers in phonology

One undeniable property which characterizes the contexts in which alternating high vowels cease to do so is that they contain a boundary between the stem and the enclitic (dative *-as* and demonstrative *-ad*). The question is what the exact nature of these boundaries is and how they affect the phonological interpretation of sound strings. Do they carry any morpho-syntactic information which impacts phonology?

Many studies have long been investigating various phenomena whereby automatic phonological processes fail to occur when they come up against a certain type of boundaries. Back in the 1960’s, structuralist phonologists (cf. Kager 1962, and Lehiste 1965) drew a distinction between phonemes as basic units of phonological analysis and juncture phonemes as carriers of grammatical information in phonology. Generative phonologists resorted to similar objects, including classical SPE types of diacritics (# and the like) and prosodic constituents ( $\omega$ ,  $\phi$  and the like), as means by which phonologically relevant domains are delimited. These so-called representational ways of implementing morphosyntactic information in phonology are distinguished from derivational solutions, successively known as transformational cycles (Chomsky 1966), phonological cycles, levels or strata (Mascaró 1976,

Kiparsky 1982, 1985, Mohanan 1982, Bermúdez-Otero 2011), and phases (Chomsky 2001, 2008). The reader is referred to Scheer (2011) for a thorough review of the relevant literature.

### 3.2 Derivation by phase

Derivation by phase allows for a model of grammar in which pre-specified chunks of syntactic structure are sent to the phonological and semantic components. According to Chomsky (2001, 2008), vP and CP correspond to phases, within which lexical material is inserted and constituents may move up to higher syntactic positions. Generalizing from vP, Marantz (2001, 2007) claims that any category-forming projection uniformly defines a phase within which the phonological and semantic properties of words are interpreted.

Relying on these proposals, many studies have addressed various non-automatic phonological processes that standard analyses fail to capture in a satisfactory manner. In her fundamental work, Marvin (2002) addressed among other phenomena the opacity characterizing schwa-insertion in words like *meter* [mi:tər], *metering* [mi:təriŋ], and *metric* [mɛtrɪk]. She argued that the adjectival suffix *-ic* which prevents schwa from appearing in *metric* is spelled out in the same phase as /metr/, as opposed to the gerund suffix *-ing* which is added later in the syntactic structure, once /metr/ is spelled out along with its schwa (see also Marvin 2013 for a phase-based account of stress assignment in English). The Phase Impenetrability Condition (Chomsky 2001) allows explaining why a previously spelled-out schwa resists deletion. Various phenomena in languages like German (Kratzer & Selkirk 2007), Basque (Samuels 2010), Ojibwe (Newell & Piggott 2014), Abruzzese (D’Alessandro & Scheer 2015), and Kiowa (Miller 2018), have since been analyzed in a comparable manner, despite differences in the versions of phase theory and the direct vs. indirect reference to morphosyntactic categories (cf. Scheer 2008, 2011). The common denominator of these studies is that morpho-syntactic chunks which correspond to phases locally determine the domain of application of certain phonological processes.

Unlike phonological cycles which may appear as *ad hoc* stipulations and which lack any external evidence, phases have independent morpho-syntactic motivation, outside the realm of phonology. Moreover, derivation by phase allows specific chunks to be spelled-out, thus leading to a grammar whose computation is much simpler in terms of memory load and processing.

In the following section, we return to glide-high vowel alternations. We argue that phasal spell-out better explains why high vowels fail to alternate with glides when followed by certain vowel-initial suffixes.

### 4. Phasal spell-out of the high vocoids I, U

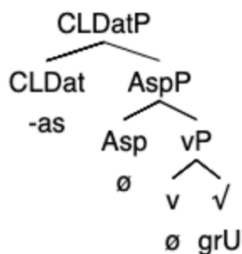
The crux of the matter lies, as we have seen in section 1.3, in the non-alternation of final high vowels with glides in verbs like *bri* ‘crush’ and *gru* ‘pick up’. When adjacent to the vowel-initial dative enclitic /-as/, [i] and [u] should normally surface as glides, especially since they do so in the corresponding nominal forms *abraj* ‘crushed seeds’ and *agraw* ‘assembly’. Instead, a glide [j] is inserted between the verb’s final vowel and the enclitic in order to resolve hiatus, leading to *brijas* ‘crush him/her’ and *grujas* ‘pick for him/her’. Similarly, the final high vowels of singular nouns like *iflu* ‘plank’ and *ikru* ‘kid’, which surface as glides in the corresponding



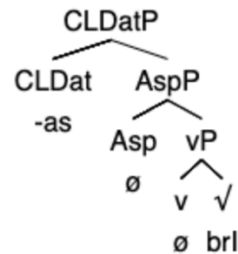
plural forms *iflw-an* and *ikrw-an*, paradoxically remain unchanged when followed by the demonstrative suffix */-ad/*.

The key to understanding these opaque cases lies in the syntactic structure of the dative and demonstrative forms. The failure of the high vowels to change into glides in the dative forms receives a natural explanation once we assume that the verbal projection (vP) constitutes a phase, within which the phonological and semantic features of the verb base are fully interpreted. More specifically, the high vocoids of verbs like *gru* and *bri* are spelled out inside the vP phase as vowels before the dative enclitic */-as/* is added. The phase domain within which these verbs are interpreted is rendered opaque to further operations, including the suffixation of the dative enclitic, whose initial vowel cannot recover the phonological identity of the verb's final segment, hence j-epenthesis. This is illustrated in the structures in (9a) and (9b), as opposed to the ones in (9c) and (9d) where the same vocoids undergo semi-vocalization in the corresponding nominal forms.

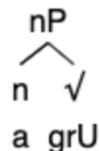
(9) a. *gru-j-as* ‘pick up for him!’



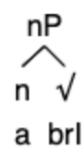
b. *bri-j-as* ‘crush for him!’



c. *agraw* ‘assembly’



d. *abraj* ‘crushed seeds’



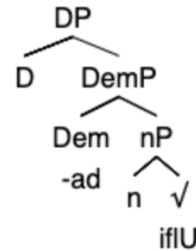
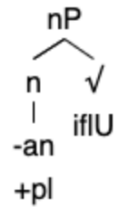
These structures are simplified for expository reasons. The reader is referred to Ouhalla (1988), Ouali (2011), Achab (2012), among others, for a thorough treatment of verb and clause structure in Amazigh. Of immediate concern is that the dative clitic is base-generated outside the vP domain, as the structures in (9a, b) illustrate (cf. Boukhris 1998, Ouali 2005, 2011, and Omari 2012 on this issue). Under the assumption that Phase Impenetrability condition holds in phonology, the phonological string spelled-out within the vP domain becomes inaccessible to subsequent operations, leading to a situation where the high vocoids I and U are realized as vowels before the dative clitic is added. The resulting hiatus is then resolved by means of j-epenthesis. In other words, the rule regulating glide-high vowel alternations holds only within the same domain/phase: The high vocoids I and U surface as glides when adjacent to a vowel, as in the forms represented in (9c, d), and as vowels elsewhere.

The same reasoning holds for nouns like *iflu* ‘plank’ and *ikru* ‘kid’, previously introduced in (5) and (8): Their high vowel turns into a glide when followed by the plural suffix *-an*, while it remains unchanged when followed by the demonstrative clitic *-ad*. The reason, we

argue, is that the high vocoid U is spelled-out along with the plural suffix within the same phase (nP). Conversely, the demonstrative marker is generated higher in the structure, once the high vocoid is spelled-out as a vowel. The representations in (10) illustrate both situations.

(10) a. *iflw-an* ‘plank.pl’

b. *iflu-j-ad* ‘this plank’



Two observations are in order. First, number and plurality are assumed to be realized as a feature under the head of noun phrase, as shown in (10a) (see Lowenstamm 2008, Acquaviva 2008, and Kramer 2012). Second, the demonstrative marker *-ad* heads its own projection below DP, as shown in (10b). The linear order (postposed to the noun) is derived through movement of N to the D position. The reader is referred to Belkadi (2017: 117) for further details and references, and to El Moujahid (1997: 223) for an alternative analysis according to which the demonstrative acts as a complement of N.

The crucial point about the above structures is that the high vocoid U surfaces as a glide in (10a) since it is spelled out along with the plural marker within the same phase nP. Conversely, it surfaces as a vowel in (10b) because it is spelled out before the vowel-initial suffix /-ad/ is added. The resulting hiatus is then resolved by means of j-epenthesis, exactly like in (9a) and (9b).

External evidence in favor of this analysis is drawn from emphasis spread. In the next section, we show that phasal spell-out better explains how the verbal and nominal bases containing an emphatic consonant are entirely pharyngealized, to the exclusion of any segmental material generated outside the domains of vP and nP.

## 5. Emphasis spread in verbs and nouns: acoustic data

Emphasis, also called dorsopharyngealization, refers to a secondary articulation whereby a specific set of Tashlhiyt consonants is produced with a backward movement of the tongue towards the posterior pharyngeal wall, while the anterior part of the tongue is lowered (Ridouane 2009). At the phonemic level, emphasis is a property of individual segments. Tashlhiyt includes the following set of emphatic consonants, all of which are coronal: /tʰ, tʰˤ, dʰ, dʰˤ, sʰ, sʰˤ, zʰ, zʰˤ, ʒʰ, ʒʰˤ, rʰ, rʰˤ, lʰ, lʰˤ/ (Elmoujahid 1979, Elmedlaoui 1985, 1995, Boukous 1987, 1990, Lasri 1991, Dell and Elmedlaoui 2002).

At the surface level, dorsopharyngealization is a property that can be displayed by any segment; an instance of emphasis spread by which underlying pharyngealized coronals spread their secondary articulation on neighboring sounds. For instance, the form /matʰija/ ‘tomato’ contains one underlying emphatic coronal /tʰ/, but all the segments contained in the word can

be phonetically dorsopharyngealized [m<sup>ʕ</sup>a<sup>tʕ</sup>i<sup>ʕ</sup>f<sup>ʕ</sup>a<sup>ʕ</sup>]. Pharyngealized words may be composed of emphatic coronals only (e.g. [s<sup>ʕ</sup>r<sup>ʕ</sup>d<sup>ʕ</sup>] ‘to file a complaint’). In such items there is no principled way of determining whether only one or more coronals are underlyingly dorsopharyngealized.

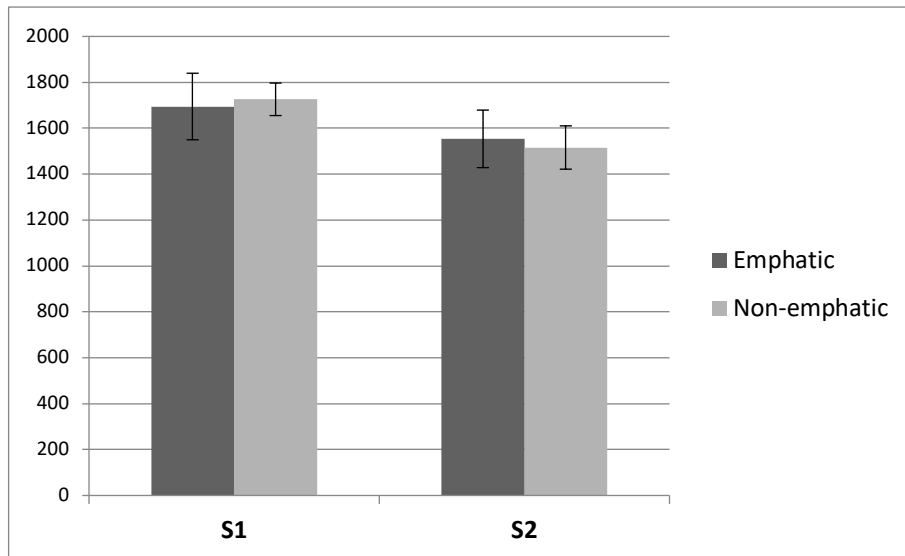
The exact delimitation of the propagation of dorsopharyngealization is not clearly established. The segments in a CV sequence must be both plain or both emphatic. This requirement must be satisfied regardless of the morpho-syntactic relationship between C and V (Dell & Elmedlaoui 2002). But it is generally considered that the domain of this propagation may be larger than the word (Elmedlaoui 1985, 1995, Boukous 1990, Lasri 1991). There are important acoustic differences between pharyngealized coronals and their plain counterparts, which induce highly salient auditory differences between items containing emphatic consonants and items containing plain ones. The most important and consistent difference is manifested by a lowering of F2 of the vowels contained in the emphatic items. This pattern has been extensively shown in different Arabic varieties, including Moroccan Arabic (Yeou 1997, Zeroual 2000, Lahrouchi & Ridouane 2016). The same pattern has been observed in Tashlhiyt. Ridouane (2003), based on vowel productions in the context of /t<sup>ʕ</sup>/ and its plain counterpart /t/ (e.g. [at<sup>ʕ</sup>a] vs. [ata]) by 5 Tashlhiyt speakers, showed that emphasis lowers F2 of the adjacent vowels in a systematic way. In this context the realization of the vowel /a/ is close to back [ɑ].

We conducted a pilot acoustic study in order to determine whether the vowel /a/ in the dative enclitic /-as/ and the demonstrative /-ad/ is affected by the presence of emphatic consonants within the same words. The acoustic data were recorded by two subjects producing 6 pairs of words contrasting emphatic to plain consonants in verbal and nominal forms. Each pair was repeated 3 times by each speaker. The data set is presented in (11) below. We measured F2 values at the midpoint of the vowel /a/ (bolded in the data below).

(11) List of items used in the acoustic experiment

<u>Verbs</u>			
bdu-j-as	‘begin’	bd <sup>ʕ</sup> u-j-as	‘divide’
ndu-j-as	‘demolish’	nd <sup>ʕ</sup> u-j-as	‘jump’
mdi-j-as	‘trap, intercept’	md <sup>ʕ</sup> i-j-as	‘taste’
<u>Nouns</u>			
ssif-ad	‘sword’	ss <sup>ʕ</sup> if-ad	‘summer’
adan-ad	‘bowls’	ad <sup>ʕ</sup> an-ad	‘nights’
izri-j-ad	‘mugwort’	iz <sup>ʕ</sup> r <sup>ʕ</sup> i-j-ad	‘sight’

From our perspective, segmental material generated outside the domains of vP and nP will not be affected by emphasis spread. According to this view, the vowel /a/ in /-as/ and /-ad/ will have similar F2 values whether the base contains an emphatic consonant or not. That is, the vowel /a/ in the words /bdu-j-as/ and /bd<sup>ʕ</sup>u-j-as/, for example, will display similar F2 values although the latter word has an emphatic consonant. This is exactly what the results of our study show. The vowel /a/ displays virtually identical F2 values in both the emphatic and non-emphatic contexts. This pattern is illustrated in Figure 1.



**Figure 1.** F2 values (Hz) of the vowel /a/ in emphatic and non-emphatic contexts for the two subjects S1 and S2.

The reason why the vowel of the dative and demonstrative suffixes resist emphasis is the same which, from our point of view, prevents the stem final vowel from surfacing as a glide, as previously discussed in section 4. In other words, vP and nP demarcate a phase, wherein emphasis spreads and glides alternate with the corresponding high vowels.

## 6. Conclusion

In this study, we have accounted for glide-high vowel alternations in Amazigh at the interface between syntax and phonology. This phenomenon which has long resisted exclusively phonological analyses, has been argued to occur within specific syntactic domains, corresponding to phases (vP and nP) wherein I and U in words like *bri* ‘scratch’ and *iflu* ‘plank’ are spelled out as high vowels. Interestingly, these vowels remain unchanged when followed by vowel-initial suffixes generated outside the phasal domain, including the dative /-as/ and the demonstrative /-ad/. Emphasis spread was used as evidence in support of our analysis of glide-high vowel alternation. Based on acoustic data from two subjects, we showed that the dative and demonstrative suffixes, which are generated outside vP and nP domains, remain unaffected by emphasis spread, whether their base contains an emphatic consonant or not.

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