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**PROCEEDINGS OF THE ICGL12**  
**ΠΡΑΚΤΙΚΑ ΤΟΥ ICGL12**



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CONFERENCE ON GREEK LINGUISTICS**

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# FEATURES AND ASYMMETRIES OF EDGE GEMINATES

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## Περίληψη

Τα διπλά σύμφωνα στα άκρα της λέξης (ακραία διπλά), αν και σπανιότερα συγκριτικά με τα μεσοφωνηεντικά, απαντώνται σε αρκετές γλώσσες. Η παρούσα τυπολογική μελέτη εξετάζει τα ακραία διπλά ως προς το συλλαβικό βάρος (δηλ. αν είναι μοραϊκά ή μη μοραϊκά) και αποκαλύπτει την κατανομή τους αλλά και τους δυνατούς συνδυασμούς αυτών με ακραία συμφωνικά συμπλέγματα. Διατυπώνει επίσης ενδιαφέρουσες γενικεύσεις και ασυμμετρίες για την προέλευση των οποίων παρουσιάζονται κάποιες πρωταρχικές σκέψεις. Πιο συγκεκριμένα, προκρίνονται παραλληλισμοί μεταξύ των ακραίων και των μεσοφωνηεντικών διπλών, ενώ αναδεικνύονται και δομικοί παράγοντες, όπως η φωνολογική αναπαράσταση των διπλών συμφώνων εντός της λέξης και στα άκρα αυτής.

*Keywords: edge geminates, syllable weight, clusters, typology, asymmetries*

## 1. Introduction

It is well known that the most commonly attested geminates are those that are found intervocalically. Much rarer, but still well represented are edge geminates (EGs), that is, geminates that appear at the beginning or the end of the word. The bulk of the typo-

logical literature on geminates has focused on the former type of geminates (Thurgood 1993; Ladefoged and Maddieson 1996; Morén 1999; Kawahara 2007; Pajak 2010; Davis 2011; Kraehenmann 2011; Dmitrieva 2012). A central finding, relevant to the present paper, relates to the weight properties of *intervocalic* geminates.

Moraic theory (Hayes 1989) distinguishes between heavy and light syllables. The former bear two moras – where mora is an abstract unit of syllable weight – and the latter just one. The heaviness of syllables can be identified through a host of phenomena, such as stress, compensatory lengthening, or word minimality effects, among others. For instance, in many languages, heavy, but not light, syllables attract stress on them and away from the default position. See Morén (1999), Gordon (2006) and Topintzi (2010) for a review of relevant facts and Section 2 for cases involving edge geminates. In fact, geminates are typically moraic and thus render the syllable they are hosted in heavy (Hayes 1989; Davis 1999, 2003; Topintzi 2008, 2010).

Cross-linguistically, four patterns emerge. Commonly, both intervocalic geminates and singleton codas are moraic, as in Latin and Lake Miwok; the opposite, where both are non-moraic, is found too, as in Selkup and Tübatulabal. In these two patterns, the behaviour of geminate and non-geminate codas is completely symmetric, a feature that Tranel (1991) has called the Principle of Equal Weight for Codas. Asymmetric patterns do occur too though, as later research has revealed. In Koya, Seto or Cahuilla (Davis 2003, 2011 and references cited therein), intervocalic geminates are weight-bearing, but other codas are not. Exceedingly rare is the case where geminates are weightless, but other codas are weight-bearing. The best example of this sort is Ngalakgan (Baker 1997).

In the current paper, we shift our attention to EGs and their weight properties. Using data from Muller (2001) and Ham (2001) on initial and final geminates, respectively, we compare the weight behaviour of EGs to their singleton counterparts, as well as to CC-clusters. The former comparison enables us to form a more complete picture about the weight profile of geminates vs. non-geminates in all main positions within the word. The latter comparison is inspired by accounts that bring geminates and CC-clusters on a par, under the assumption that both can be analysed as two C-slots on the consonantal tier (Ringen and Vago 2011). While we do not share this view ourselves, such comparison permits an all-embracing account of the weight properties of geminates that considers different, often competing, analytical components.

The remainder of the paper is structured as follows. Section 2 lays out the Patterns identified for final and initial geminates. It also provides representative languages for each Pattern and offers the corresponding data that support it. Section 3 clusters the

typological generalizations and gaps that arise from our survey. Two main implicational universals are produced as a result. Some discussion is also supplied to explain the resulting typology. Section 4 offers some concluding remarks.

## 2. EG Patterns

For the purposes of this study, we have consulted several publications on geminates and especially typological work on EGs, primarily the studies by Muller (2001) and Ham (2001). While we contend our sample of languages with EGs is large and representative enough, it is by no means exhaustive. In this section, we present instantiation charts for geminates at the right and left edges of the word that summarize the weight status of the geminates (heavy vs. light), whether they can co-occur with a cluster and if so, what type of cluster in terms of weight. Patterns attested are indicated through YES vs. unattested ones, through NO. The charts also mention representative languages that exemplify the patterns in question. However, due to reasons of space, only some of the patterns are briefly illustrated through examples. For further examples and discussion, see Topintzi and Davis (2017).

### 2.1. Instantiation charts

We begin with the instantiation chart of final geminates. Weight-bearing final geminates may combine with any type of final cluster, moraic or not, or no cluster at all (Patterns I-III). In contrast, the combinatorial possibilities for weightless final geminates are severely limited, only exhibiting the co-existence of non-moraic final geminates and non-moraic final clusters (Pattern VI).

| <i>Final geminate (FG)</i> | <i>Final Cluster (F.Cl.)</i> |              |                  |                                       |
|----------------------------|------------------------------|--------------|------------------|---------------------------------------|
|                            | NO F.CL.                     | MORAIC F.CL. | NON-MORAIC F.CL. | Representative Language               |
| MORAIC FG                  | (I) YES                      |              |                  | <i>Baghdadi &amp; Hadhrami Arabic</i> |



|               |          |  |
|---------------|----------|--|
| MORAIC FG     | (II) YES | <i>Swiss German,<br/>Cairene Arabic,<br/>Ponapean, Wolof</i> |
| MORAIC FG     |          | (III) YES <i>Amharic, Sañani<br/>Arabic</i>                  |
| NON-MORAIC FG | (IV) NO  | <i>No language found</i>                                     |
| NON-MORAIC FG | (V) NO   | <i>No language found</i>                                     |
| NON-MORAIC FG |          | (VI) YES <i>Hungarian, Tashl-<br/>hiyt Berber</i>            |

Table 1 | Instantiation chart: final geminates

Somewhat remarkably, an identical picture is drawn for initial geminates and clusters, mutatis mutandis. Initial moraic geminates display all combinatorial possibilities (Patterns VII-IX), but weightless initial geminates may only co-exist with weightless initial clusters.

| <b>Initial geminate (IG)</b> |           | <b>Initial Cluster (I.Cl.)</b> |                  |  |
|------------------------------|-----------|--------------------------------|------------------|--|
|                              | NO I.CL.  | MORAIC I.CL.                   | NON-MORAIC I.CL. | Representative Language  |
| MORAIC IG                    | (VII) YES |                                |                  | <i>Pattani Malay,<br/>Trukese, Woleaian,<br/>Luganda</i>           |
| MORAIC IG                    |           | (VIII) YES                     |                  | <i>Cypriot Greek,<br/>Ponapean</i>                                 |
| MORAIC IG                    |           |                                | (IX) YES         | <i>Shuri Okinawan</i>  |
| NON-MORAIC IG                | (X) NO    |                                |                  | <i>No language found</i>   |
| NON-MORAIC IG                |           | (XI) NO                        |                  | <i>No language found</i>   |
| NON-MORAIC IG                |           |                                | (XII) YES        | <i>Leti, Sw. German,<br/>Baghdadi Arabic,<br/>Tashlhiyt Berber</i> |

Table 2 | Instantiation chart: initial geminates

In Section 3 we return to these generalizations and offer some tentative thoughts that may explain the observed asymmetries. Before doing so, let us briefly examine some of these patterns in more detail.

## 2.2. Illustrative examples

We start by examining final moraic geminates and the three possible combinations they present with final clusters, all of which are attested. Interestingly, while a handful of languages reflect Patterns I-III, here we choose to exemplify each of these patterns by means of three different Arabic dialects.

Pattern I, with moraic final geminates (**FG**) and lack of final clusters (**F.Cl.**), is represented by languages such as Hadhrami Arabic (Bamakhramah 2009) and Baghdadi Arabic (Blanc 1964, Youssef 2013). Hadhrami possesses a bimoraic word minimum that CVG words satisfy indicating that final geminates bear weight (1b). Words with potential final clusters however do not exist, but must undergo epenthesis, as shown in (1a). When the cluster can be syllabified as a coda-onset sequence, i.e. medially, there is no longer any impetus for epenthesis. Note that FGs do not undergo any epenthesis. Moreover, stress – normally assigned on the penult – shifts to the final when a geminate appears in the coda, since the syllable in question is appropriately heavy.

(1) *Hadhrami Arabic Minimality*

- |           |          |                    |                            |
|-----------|----------|--------------------|----------------------------|
| a. /gird/ | [gírid]  | ‘monkey’           | (cf. [gírd-i] ‘my monkey’) |
| /bint/    | [bínit]  | ‘girl’             | (cf. [bínt-i] ‘my girl’)   |
| b. [rább] |          | ‘Lord’             |                            |
|           | [ʔaxáff] | ‘lighter/lightest’ |                            |

In another dialect of Arabic, namely Cairene, final clusters are permitted and in fact behave in a manner comparable to FGs, in being moraic (Davis and Ragheb 2014), i.e. Pattern II. This can be shown by examining word minimality (where both CVCC and CVG words satisfy the minimality criterion, as opposed to plain CVCs), loanword adaptation and stress. We focus on the latter. As in other Arabic dialects, stress is normally on the penult (2a), even in the presence of a final CVC. When the final syllable contains a geminate or a cluster though, stress shifts there (2b). This suggests that final singleton codas are weightless, whereas FGs and F.Cls not only are moraic, but behave in the same way.



ler 2001). With regard to Luganda allomorphy selection for the present perfect suffix, Muller observes that verbal stems ending in /l/ take [-ze] if the stem is two moras, but [-dde] if the stem contains more moras. Since stems with two vowels (i.e. two vocalic moras) and an IG take [-dde], this must mean that the initial geminate contributes a mora rendering the stem trimoraic.

A good candidate language for Pattern VIII (moraic IGs and moraic I.Cls) is Cypriot Greek, at least given Armosti's (2011) analysis.<sup>1</sup> Cypriot possesses both initial and medial geminates, as well as a variety of initial clusters. Armosti's arguments in favour of the moraicity of geminates are both phonetic and phonological. IGs display more durational stability across different places of articulation (POA) than singletons, exactly as predicted for geminates by the typological and phonetic study of Ham (2001). For Armosti then, Cypriot geminates fulfil the phonetic criterion of moraicity.

Phonologically speaking, Cypriot lacks moraicity evidence from phenomena such as stress or allomorphy, i.e. the hallmarks for the identification of syllable weight, but still there are the processes of /n/-deletion and of /i/-epenthesis that can be analysed in terms of weight. We focus on the former. Specifically, the final nasal of the article *tin* 'the-SG.ACC.FEM' and of the particle *en* 'not', may delete when IGs and I.Cls follow, but not when singletons do. Singletons instead cause nasal place assimilation. Stated as a result of syllable weight (Armosti 2011: 278), nasal deletion occurs if a heavy syllable follows, i.e. one that contains a geminate or a cluster.<sup>2</sup>

(3) *Cypriot Greek Initial Gs and Clusters vs. singletons* (Armosti 2011: 273)

|                   | UR           | /n/-assimilation | /n/-deletion  | gloss          |
|-------------------|--------------|------------------|---------------|----------------|
| <i>singletons</i> | /ɛn 'pɛz:ɔ/  | ['ɛ' mbɛz:ɔ]     | N/A           | 'I don't play' |
| <i>clusters</i>   | /ɛn 'psin:ɔ/ | N/A              | ['ɛ' psin:ɔ]  | 'I don't bake' |
| <i>geminates</i>  | /ɛn 'p:ɛftɔ/ | N/A              | ['ɛ' ph:ɛftɔ] | 'I don't fall' |

Shuri Okinawan (Shimoji 2012), demonstrates Pattern IX with moraic IGs and weightless initial clusters, which all begin with a glottal stop. Moraicity can be diagnosed through bimoraic word minimality which is satisfied by CCV words that begin with a geminate, but not with clusters.

1 The analysis of geminates in Cypriot is a matter of debate. See Topintzi & Davis (2017) for details.

2 Following Topintzi (2010), Armosti analyses these as moraic onsets, but this is tangential to the point at hand.

- (4) *Shuri Okinawan Word Minimum*  
 GV words: [ccu] ‘person’ [kkwa] ‘child’  
 CCV words: \*[ʔwa] but [ʔwaa] ‘pig’

Non-moraic IGs, like their counterparts in final position, have only been found in our survey to combine with non-moraic initial clusters in several languages (Pattern XII), including Leti (Hume et al. 1997) and Swiss German (Kraehenmann 2001, Ringen & Vago 2011), among others. Both languages support a bimoraic minimal word constraint, but no GV or CCV words are allowed. On the other hand, our preliminary survey has not revealed any cases of non-moraic IGs and moraic initial clusters (Pattern XI) or no clusters (Pattern X) whatsoever.

Finally, note the independence between the behaviour of geminates and the word edge. What we mean by that is that there exist a few languages with geminates at both edges of the word, but where their behaviour in terms of weight may differ. For instance, Swiss German (Muller 2001) presents *moraic* final geminates (in fact, medial intervocalic too), but non-moraic initial ones. Ponapean on the other hand possesses moraic EGs at both edges (Goodman 1995, Kennedy 2003).

### 3. Typological Asymmetries and Generalizations

In this section we summarize our main findings and draw attention to the typological gaps detected. Moraicity or lack thereof is signalled through  $\mu$  and  $\neg\mu$ , respectively.

| FINAL           | FINAL CLUSTERS   |            |           |
|-----------------|------------------|------------|-----------|
| GEMINATES       | NONE             | $\mu$      | $\neg\mu$ |
| $G_{\mu}$ #     | (I) YES          | (II) YES   | (III) YES |
| $G_{\neg\mu}$ # | (IV) NO          | (V) NO     | (VI) YES  |
| INITIAL         | INITIAL CLUSTERS |            |           |
| GEMINATES       | NONE             | $\mu$      | $\neg\mu$ |
| # $G_{\mu}$     | (VII) YES        | (VIII) YES | (IX) YES  |
| # $G_{\neg\mu}$ | (X) NO           | (XI) NO    | (XII) YES |

Table 3 | Summary of EGs and edge clusters

Table 3 reveals that overall, moraic EGs are more common than non-moraic EGs. The distribution of non-moraic edge geminates is much more restricted; in particular, they only occur in languages which also possess clusters at the same edge and these need to be non-moraic too.

Since our survey is far from complete, we cannot be at this point certain whether the typological gaps identified are random or not. However, if the picture outlined is on the right track, we may express the generalizations above in terms of two implicational universals, as follows:

(5) IMPLICATIONAL UNIVERSAL 1

If a language has EGs but no edge consonant clusters, then EGs are moraic

(6) IMPLICATIONAL UNIVERSAL 2

If a language has nonmoraic EGs, then it should also have nonmoraic edge clusters too

A reasonable issue to ponder on is the source of these generalizations, if any. Space considerations do not allow us to fully explore this issue, but the interested reader may wish to consult Topintzi and Davis (2017) for a lengthier discussion. Here, we summarize their ideas.

Topintzi and Davis (2017) suggest that many of the attested distributional patterns of edge geminates (and clusters) mirror those of intervocalic geminates. Intervocalically, the parallel is between coda geminates and coda singletons (rather than clusters), but the analogy seems to hold true with edge geminates and clusters, as Table 4 illustrates. Uniform (non-)moracity, as found in patterns II, VI, VIII, XII, resembles languages like Latin (II, VIII) and Malayalam (VI, XII). In the former, intervocalic geminates and singleton codas are uniformly moraic. In the latter, intervocalic geminates and singleton codas are both non-moraic. The asymmetrical situation, whereby geminates bear weight but singletons do not, comes up intervocalically in Cahuilla and in patterns III and IX at word edges.<sup>3</sup>

---

3 There is one more, extremely rare, pattern that arises intervocalically, namely that of non-moraic geminates and moraic singletons, as in Ngalagkan (Baker 1997). While we have not found a comparable pattern at word edges, we cannot dismiss the possibility of its existence.

| <i>Pattern</i>                                       | <i>Environment where G is found</i> |                           |                                |
|--|-------------------------------------|---------------------------|--------------------------------|
|  | VGv                                 | VG#                       | #GV                            |
| $G_{\mu}$ & SINGLETON $_{\mu}$ / CLUSTER $_{\mu}$    | Latin                               | Pat. II<br>(Cair. Arabic) | Pat. VIII<br>(Cypr. Greek)     |
| $G_{-\mu}$ & SINGLETON $_{-\mu}$ / CLUSTER $_{-\mu}$ | Malayalam                           | Pat. VI<br>(Hungarian)    | Pat. XII (Leti)                |
| $G_{\mu}$ & SINGLETON $_{-\mu}$ / CLUSTER $_{-\mu}$  | Cahuilla                            | Pat. III<br>(San. Arabic) | Pat. IX<br>(Shuri<br>Okinawan) |

Table 4 | Parallels between geminates intervocalically and at edges

This captures six of the eight attested patterns. The remaining ones, i.e. patterns I and VII, describe languages with moraic EGs but no clusters whatsoever. One conceivable understanding of these patterns, but not one devoid of complications (see Topintzi and Davis 2017), relies on structural issues and in particular, the possibility that moraic geminates are to be represented differently from weightless ones. In this view, moraic edge geminates would be largely representationally identical to singletons, the difference being that they would bear an underlying mora. Clusters, on the other hand, would require a wholly different representation, e.g. double linking to an onset or coda, and thus could co-exist or not with *moraic* EGs. Indeed, all combinations of moraic EGs and clusters arise, including those of patterns I and VII.

That would then bring our attention to the purported gaps of languages with weightless geminates and no clusters (IV, X), as well as languages with weightless geminates and weightful clusters (V, XI). If weightless geminates are a different species from weightful ones,<sup>4</sup> then the former might involve double-linking to two root nodes (Selkirk 1990) or to two timing slots (Tranel 1991) under the onset or coda nodes. In turn, that would render weightless geminates representationally similar to (tautosyllabic) consonant clusters. A result of that would be that these two classes of consonants should either co-exist or be both banned, thus the existence of a language with weight-

<sup>4</sup> Using the Containment model of OT, Topintzi and Zimmermann (2014) provide a solution that simultaneously allow weightful and weightless geminates to be treated as a single species, but to also behave differently, when needed. The basic idea is that representationally all geminates start life the same way, i.e. they are underlyingly moraic, but end up having somewhat different structures depending on whether they are weight-bearing or not.

less geminates and no clusters is correctly predicted to be impossible (Patterns IV and X). In a similar vein, no language with moraic clusters and weightless geminates (Patterns V and XI) could emerge, since weight assignment, should equally apply to both.

#### **4. Conclusion**

Most studies on geminates typically concentrate on geminates in intervocalic position. Geminates at word edges, while rarer, are well-represented cross-linguistically. Based on a preliminary survey of languages with such geminates, we have attempted to better understand the weight patterns of EGs and see whether they correlate with the existence and weight behaviour of consonantal clusters. A number of interesting generalizations and asymmetries resulted.

One robust finding has been that moraic EGs are more common than non-moraic EGs. Moreover we found that in languages with EGs, but no clusters at the same word edge, then the EG is moraic. Furthermore, languages with non-moraic edge geminates also possess non-moraic clusters at the same edge. We have also observed that a few languages demonstrate geminates at both edges of the word, but their behaviour does not have to be uniform in terms of weight, i.e. weightful geminates at one edge may co-occur with weightful geminates at the other edge (e.g. Ponapean), but do not have to, as in Swiss German. Finally, we offered some speculative remarks as to why the weight typology of EGs is shaped the way it is. In future research and through the enrichment of our database with additional languages, we hope to be able to determine how sturdy the present findings are cross-linguistically.



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