A Typology of Morphological Segment Zero Alternations

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1   Modularity and Decompositionality

1.1   Architecture

Language, in generative terms, is the pairing of meaning and form through the generative engine of syntax (Chomsky 2005).

(1)   Strong Minimalist Thesis

Merge   +   Interfaces (SM and CI)

Distributed morphology (Halle & Marantz 1993) proposes a strictly modular feed-forward architecture. Information is shipped in a universal manner across the components of the grammar.

(2)   Feed-forward modular architecture
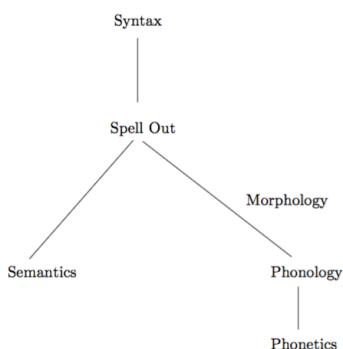
Moving between components means a mapping between symbolic representations written in the alphabet of each module.

Each module has its own vocabulary of features (Scheer 2015) and, being modular, each component of the grammar only has access to its own information.

There can be no look-ahead, or *looking back*, *tampering* (going back). This has been formulated as the Strict cycle condition (Chomsky 1973) and Strict Cyclicity (Kiparsky 1985, Kenstowicz 1994). For another variant Kaye (1995), a parallel in syntax: *Phase Impenetrability Condition* (Chomsky 1999, 2001) and recently: (Samuels 2010; Scheer 2012; D'Alessandro & Scheer 2015).

1.2   Different modules different alphabet different rules

The first major assumption of Distributed Morphology is that the syntax is the sole driver of composition in the grammar (cf. *Merge* in the SMT in (1)).

(3)   **Syntax-all-the-way-down**: *The primary mode of meaningful composition in the grammar, both above and below the word-level are the syntax. Syntax operates on sub-word units and thus (some) word-formation is syntactic.* (Bobaljik 2015)

The second major assumption is consistent with the observation that the features in grammars belong to different modules. Evidently [+fem] belongs to the syntax, while [+high] belongs to the phonology, therefore, the most economic proposition1 is to say that the features of the modules stay in their own module. Therefore, there is no phonological content in the syntax, no words or affixes. This assumption is stated in (4).

(4)   **Late Realisation**: *…pieces manipulated by the syntax (functional morphemes) are abstract lacking in phonological content. The pairing of phonological features with the terminals of the syntax (vocabulary items, exponence) happens post-syntactically… mapping from syntax to the phonological form.* (Bobaljik 2015).

This assumption is harmonious with a model where all words are built from lexical roots, merged with categorial features and other heads/syntactic features (Borer 2003).

1.3   Class features do not fit in the architecture

(5)   "[…] an optimal solution to legibility conditions" (Chomsky 2000)

The vocabulary of each component should be, not only module specific, but also module appropriate.

(6)   Class features do not fit in this architecture because they are not features of:

(a)	Meaning (CI):	Encyclopedic, number, person, gender, animacy, definiteness...
(b)	External interpretation (SM):	+high, -back, H, heavy syllable, handshape x...
(c)	Nor of pure syntax (driving movement, agreement etc...):	EPP, diacritics...

Class features are just there to teleogically get the right pairings between exponents, they exist only 'to get the answer right'.

2   Morphological and Phonological ingredients in an analysis

2.1   Bilbao Spanish (joint work with F. Torres Tamarit)[1]

(7)   a.   /d/ deletion (cf. voiced stops become approximants post-vocalically *abogado*)

i.	kort-a-d-o	kortau	'cut-A-PCL-M.SG'
ii.	pesk-a-d-o	peskau	'fish-A-PCL-M.SG'

   b.   Only the /d/ of the participle

i.	dad-o	daðo	*dau	'dice.SG'
	cf. d-a-d-o	dau		'give-A-PCL-M.SG'
ii.	sad-o	saðo	*sau	'sad-ist/ic'
	cf. pensado	pensau		'think-A-PCL-M.SG'
iii.	pesc-a-dor	pescaðór	*peskaúr	'fish-A-NOMLZ'

   c.   Only in A-stems

i.	kom-i-d-o	comiðo	*komiu	'eat-I-PCL-M.SG'
ii.	ker-i-d-o	keriðo	*keriu	'want-I-PCL-M.SG'

   d.   Only before M/o

i.	pesk-a-d-a	peskaða	*peska:	'fish-A-PCL-F.SG'
ii.	kort-a-d-a	kortaða	*korta:	'cut-A-PCL-F.SG'

   e.   Really is before M (not M.SG)

   i.   han s-i-d-o *[siu] kort-a-d-o-s [kortaus]   'cut-A-PCL-M.PL'
          'they have been cut'

   f.   Fully productive (in the appropriate register)

i.	sórado	[sóraðo]	(can't be a participle)
ii.	sorado	[soráu]	(a participle of unknown verb)

   f.   Stress is a factor

   i.   kort-a-d-ít-o   [kortadíto]   'cut-A-PCL-DIM-M.SG'

---

(8)   High frequency, clearly lexicalized

i.	/lau/	al + lau	[al:au]	'on the corner'
ii.	/lado/	el + lado de...	[el:aðoðe]	'the side of...'

2.2   Morphology or phonology?

This could be written in purely morphological terms:

(9)   PCL → Ø / Class I (A) _ + M

This makes the rule entirely arbitrary. There is no morpho-syntactic reason to operate this way. It makes a concidence of raising of /o/ to [u].

This leaves a rule which mixes morphological and phonological information, anti-modular.

A phonological analysis is *a priori* preferable because...

(10)   a.   We are manipulating phonological features so we're in the phonology already.
        b.   We might suppose that there's a connection between the structural change
                and the structural description of the rule.
        c.   /o/ to [u] raising happens only if there is /d/ deletion, never independently
        d.   Spanish lexicon has [au] diphthongs + but no *[iu] diphthongs or hiatuses.

A purely phonological rule looks like it can't be formulated *only* because the target of the rule is morphologically specified (PCL).

Hold the phone!   We can make this a fully phonological process by somehow marking the 'd' of the PCL defective in some way.

Morpheme/vocabulary item/exponent/item-specific phonology does **not** necessitate lexically-indexed constraints (Pater 2007), item-specific phonology or strata if you can locate its special behaviour representationally.

Whenever phonological processes are item-specific it is *a priori* possible to encode this in the item itself.

This keeps all the unpredictable information in the lexical item where it belongs (cf. 'Borer conjecture' (Borer 1981, 1984) (dubbed the 'Borer-Chomsky conjecture' by Baker (2008)).

However, this should **not** be encoded operationally (there are no rules inside lexical items).

2.3   What are representations made of?

(11)   Shapes of exponents (Bendjaballah & Haiden 2008; Faust et al. 2018)

a.   Fixed   b.   Floating   c.   Empty   d.   Unfixed

```
C     V                                C     V                C     V
|     |                                                       |     |
α     β               α                                       α     β
```

e.   Derivation with floating segments (cf. Fathi & Lowenstamm 2016)

   i. UR of √pti<t> [peti] 'small.M'

```
C     V     C     V
|           |     |
p           t     i     t
```

   ii. √pti<t> + CV F [petit] 'small.F'

```
C     V     C     V              +     C     V
|           |     |                _____/
p           t     i     t
```
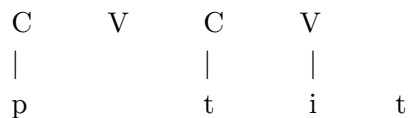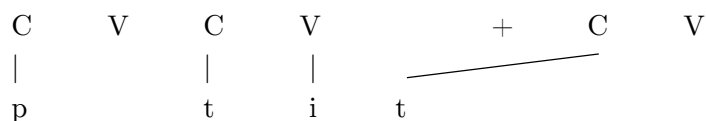
   iii. √peti<t> + vowel initial word = [petit**a**mi] 'small friend.M'

```
C     V     C     V              +     C     V     C     V
|           |     |                _____/          |     |     |
p           t     i     t                          a     m     i
```
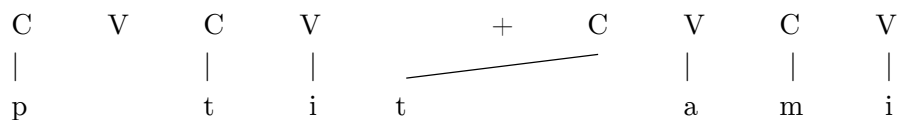
Zimmermann (2017) uses similar concepts in her representations. Notice, any autosegmetnal framework makes this prediction and the configurations above will have a translation in it. Free combination of the two independent tiers predicts these combinations, to exclude them you have to make UG more complex (cf. Chomsky on Merge).

2.4   Preliminary analysis of Bilbao Spanish /d-/ deletion

(12)   Analysis of Bilbao Spanish /d-/ deletion

a.   Fixed /d/   Floating /<d>/

```
C    V    C    V                    C     V
|    |    |    |
d    a    d    o                    d
```
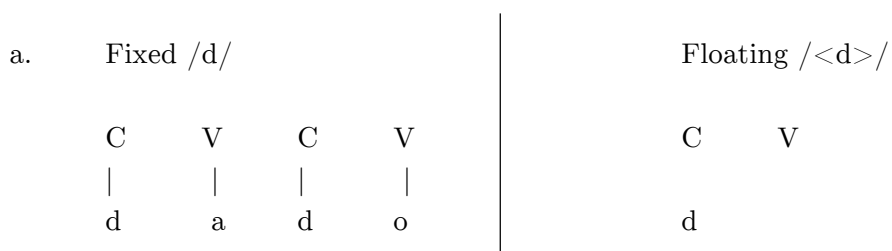
b.   Derivation of /d/ deletion

i. UR of A-stem + PCL + M.SG

```
...C    V        +      C      V
   |    |
   t    a               d      o
```
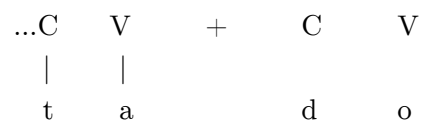
ii. Computed form (/o/ in C so it glides)

```
...C    V        +      C      V
   |    |                ⟍
   t    a               d      o
```
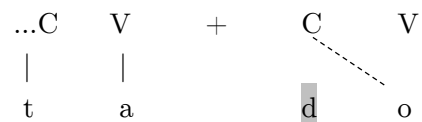
c.   Non-alternating /d/

i. UR /dad + o/ 'dice + M.SG'

```
C    V    C    V      +
|    |    |      ⟍
s    a    d            o
```
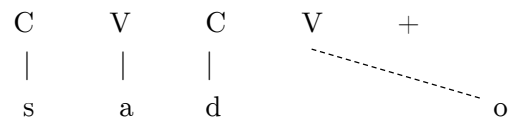
ii. Computed form [daðo] *[dau] (/o/ is in V so no raising)

```
C    V    C    V      +
|    |    |      ⟍
d    a    d            o
```
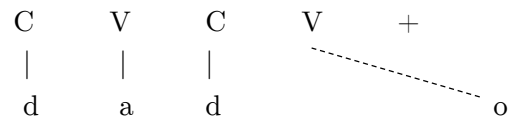
3   Galician determiner allomorphy

3.1   Summary

Galician presents an intriguing case of opaque phonologically-conditioned definite article allomorphy (PCA). Though Galician features in the general literature on PCA (Nevins 2011), there is a surprising lack of synchronic theoretical discussion of this specific pattern. The data appears to require allomorph selection arranged in a system of PRIORITY (Mascaró 2005; Bonet et al. 2003, 2007). The pattern involves opaque segment 'deletion' and resyllabification, where segment deletion counterbleeds allomorph insertion along with morphologically-specific segmental changes. A Strict CV representational reanalysis is proposed in which there is no true allomorphy (no selection between competing underlying morphemes). All the forms are generated form a single underlying form, thereby undercutting PRIORITY.

3.2   The pattern

(13)   Galician article allomorphy (Álvarez & Xove 2002; Dubert-García 2014)

	First form	Second form	Third form
(F)eminine	a	la	na
(F.Pl)ural	as	las	nas
(M)asculine	o	lo	no
(M.Pl)ural	os	los	nos

(14)   Contexts for Galician allomorphy (Álvarez Blanco 1983, Dubert-García 2001; Kikuchi 2006; Dubert-García 2014)

        a.   After vowel-final stems

                i.   vexo [os] primos   'see the cousins'
                      see.1SG the cousins

                ii.   para [o] campo   'for the field'
                      for the field

                iii.   chegou [o] momento   'the moment has come'
                      take.3PS the moment

        b.   Absolute initial position

                i.   a nena   'the girl'   ii.   os falantes   'the speakers'

        c.   After consonant initial stems

                i.   [poɾ]   [po-**l**o-maɾ]   'for the sea'
                ii.   [todas]   [toda-**l**as-muʎɛɾes]   'all the women'
                iii.   [beŋ]   [be-**n**as-muʎɛɾes]   'they see the women'

3.3 Opacity

Consonant-final words predict the occurrence of second and third-allomorphs, the final consonants also delete (14c). This produces a synchronically active case of 'counterbled' allomorph insertion:

(15)   UR   /poɾ+_+maɾ/

       Allomorph insertion   poɾ-lo-maɾ

       C-deletion   polomaɾ

       Output   [polomaɾ]

                                             'for the sea'

3.4 Morphological not phonological?

In an affront to modularity, these segmental changes do not occur within morphemes.

(16)   [buɾla]   'mockery'
            [meɾlu]   'blackbird'

            [penla]   'handle'
            [kanle]   'canal'

            [esluiɾ]   'dilute'
            [leʃislaðoɾ]   'legislator'

3.5 Alternative Analysis

(17)   PRIORITY (Bonet et al. 2007)

       Respect lexical priority of allomorphs (e.g. {A > B})

(18)   DEF.MASC.SG.   {o > lo}   DEF.MASC.PL.   {os > los}

       DEF.FEM.SG.   {a > la}   DEF.FEM.PL.   {as > las}

3.6 Some Strict CV basics

(19)   Silencing of empty positions

       a.   Domain-Final Parameter (DFP) (based on Kaye 1990)

              Domain-final empty V slots are silenced (receive no phonetic interpretation)

              C   V   C   <u>V</u>
              | | |
              x y z

b.   Gov(ernment) (Charette 1991)

An empty V-slot can be silenced *iff* it is followed by a V-slot that is **not** itself silenced.

C   V̲   C   V   vs.   C   V̲   C   V̲
       ✓   x   ✗
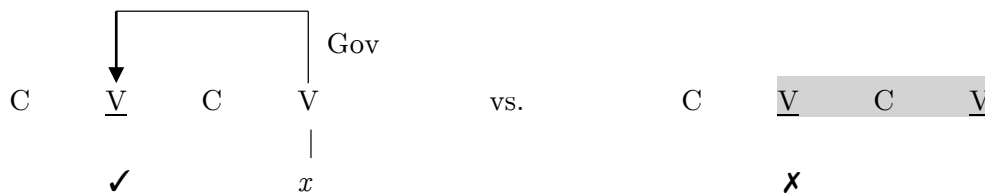
Crucial: Floating segments will not link to Silenced positions.

3.7   Strict CV analysis

3.7.1   The pieces

(20)   Galician DP structure and exponents
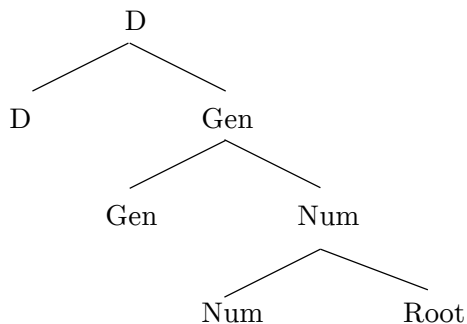
a.   D(eterminer)   b.   Gen(der)

| [+definite] | ⇔ | <l> |
| [-definite] | ⇔ | un |

| [+fem] | ⇔ | a |
| [-fem] | ⇔ | o |

c.   Num(ber)

| [+plural] | ⇔ | s |
| [-plural] | ⇔ | Ø |

3.7.2   The representations

The shape of Galician determiners as they enter phonological derivation

a.   Feminine singular definite   b.   Masculine plural definite
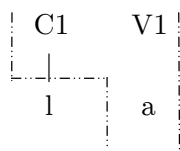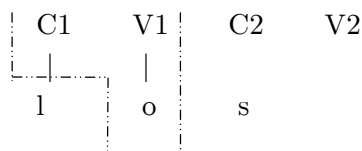
(c)   Cf. Masculine plural indefinite

```
        C1      V1 ┆ ┆ C2      V2 ┆   C3      V3
               |  ┆ └─┐ |  ┄┆   |  ┆    |
                ┆└┄┄┄┄┘       |  ┆    |
                u      n┆      o ┆    s
```
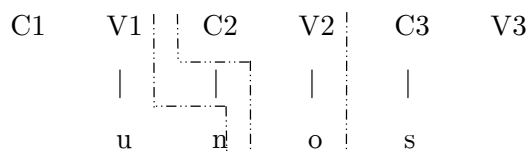
3.7.3   Segment-zero alternations

(22)   Definite article after a vowel-final exponent

    a.   URs /para <l>o kampo/ 'for the field (M.SG)'

```
    ...C    V       C       V       C       V       C       V       C       V
       |    |               |       |       |       |               |       |
       ɾ    a       l       o       k       a       m               p       o
```

    b.   Computed form [paɾaokámpo] 'for the field'

```
                        ┌──────┐ Gov                        ┌────────────┐ Gov
                        ↓      |                            ↓            |
    ...C    V       C    V       C       V       C       V       C       V
       |    |               |       |       |       |               |       |
       ɾ    a       l       o       k       a       m               p       o
```
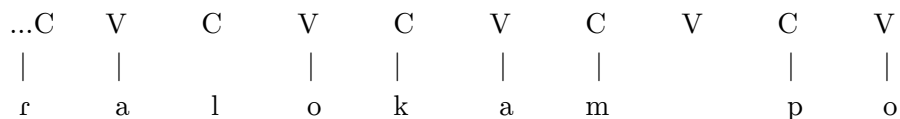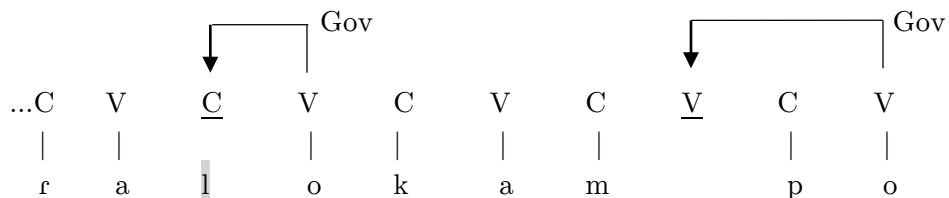
(23)   Definite article in absolute-initial position

    a.   URs /<l>a + nena/ 'the girl (F.SG)'

```
    C       V       C       V       C       V
            |       |       |       |       |
    l       a       n       e       n       a
```
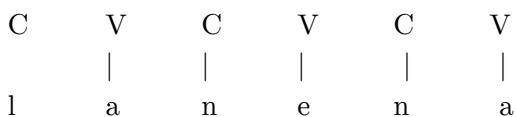
    b.   Computed form [anena] 'the girl'

```
    ┌──── Gov
    ↓      |
    C       V       C       V       C       V
            |       |       |       |       |
    l       a       n       e       n       a
```

(24)   Definite article after C-final stem (partial structure)

     a.   UR /vir + la + ʃente/ 'see the people'

...	V0	+	C1	V1	+	C2	V2	C3	V3	C4	V4
			l	a		ʃ	e	n		t	e

     b. [vilaʃente] 'see the people'

Gov   Gov

...	V	+	C1	V1	+	C2	V2	C3	V3	C4	V4
			l	a		ʃ	e	n		t	e

(25)   UR of stems in Galician

     a.   UR of /pɔlβo/ 'octopus' & /toɾðo/ 'thrush'[2]

C	V	C	V	C	V
p	ɔ	l		β	o
t	o	ɾ		ð	o

     b.   UR of /todos/ 'all' & /maɾ/ 'sea'

C	V	C	V	C	V
t	o	ð	o	s	
		m	a	ɾ	

(26)   Definite article after C-final stem

     a.   UR /poɾ + lo + maɾ/ 'by the sea' (morpheme affiliation shown)

C1	V1	C2	V2	C3	V3	C4	V4	C5	V5
p	o	ɾ		l	o	m	a	ɾ	

---

[2] Here and elsewhere in the paper, I show the voiced fricatives in the underlying forms, although they may be surface allophones. This is a matter of analysis and I do not pronounce on it here.

b. Phonological computation

Gov   DFP

| C1 | V1 | C2 | V2 | C3 | V3 | C4 | V4 | C5 | V5 |
| p | o | ɾ | | l | o | m | a | ɾ | |
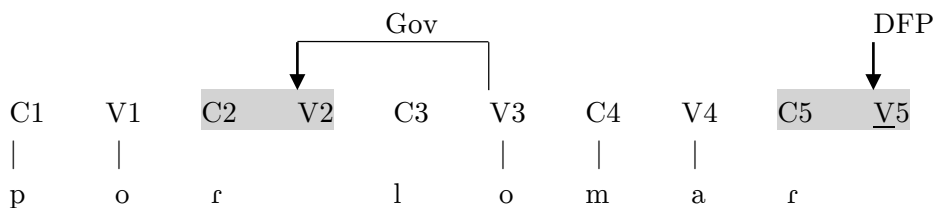
c. Floating melody cannot link to C2 but it can link to C3

Gov

| C1 | V1 | C2 | V2 | C3 | V3 | C4 | V4 | C5 | V5 |
| p | o | ɾ | | l | o | m | a | ɾ | |

d. [polomaɾ] 'by the sea'

Gov

| C1 | V1 | C2 | V2 | C3 | V3 | C4 | V4 | C5 | V5 |
| p | o | ɾ | | l | o | m | a | ɾ | |
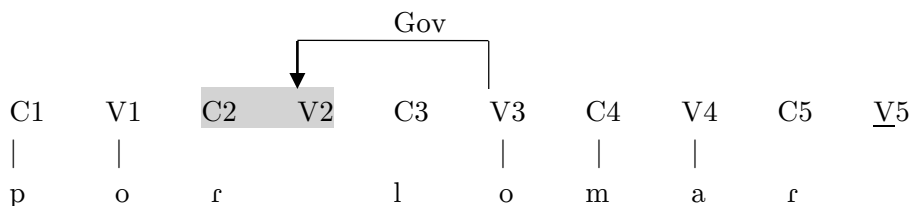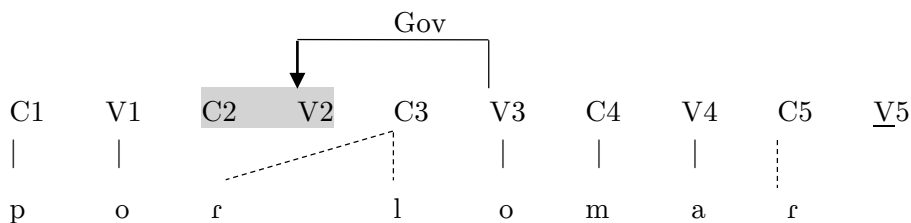
3.7.4 Feature changes (coalescence)

There are competing analyses for the segmental changes, one based in coalescence the other in deletion.

(27) a. r + l > l   b. s + l > l   c. l + n > n

(28) *If* $|X,Y| \Leftrightarrow [\alpha]$ *Then* $|X+X,Y| = |X,X,Y| = |X,Y| \Leftrightarrow [\alpha]$

Coalescence correctly predicts that <n> and <l> ought to fuse (crucially) in C3.

(29) Definite article after C-final stem (full structure)

a. UR /bɛ<n> + <l>a + rosa/ 'they see the rose'

<n> cannot link to C2 (Gov) but it can link to C3

Gov

| C1 | V1 | C2 | V2 | C3 | V3 | C4 | V4 | C5 | V5 |
| b | ɛ | n | | l | a | r | o | s | a |

b. [bɛ**n**arosa] 'they see the rose'

```
                              Gov
                    ┌─────────────┐
                    ↓             │
C1      V1    [C2        V2]   C3      V3      C4      V4      C5      V5
|       |                      ⟋                |       |       |       |       |
b       ɛ     n            l        a       r       o       s       a
```
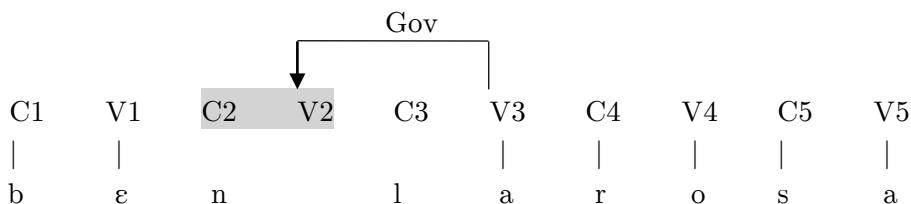
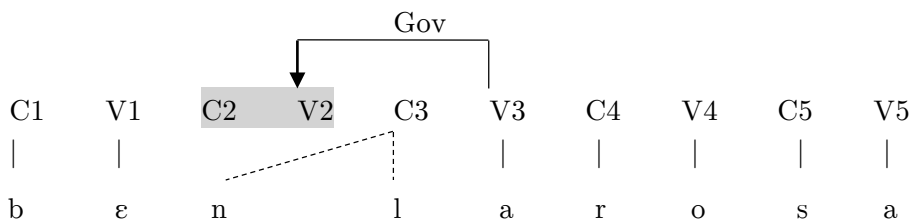<n+l> should > [n]. In keeping with standard Element Theory (Backley 2011) assumptions, /l/ |R,ʔ| is a proper subset of /n/ |R,ʔ,L|.

Therefore, we expect: /n+l/ = |R,ʔ,L+R,ʔ| = |R,R,ʔ,ʔ,L| = |R,ʔ,L| ⇔ [n], because |R,ʔ,L| ⇔ [n] (producing effectively 'no change').
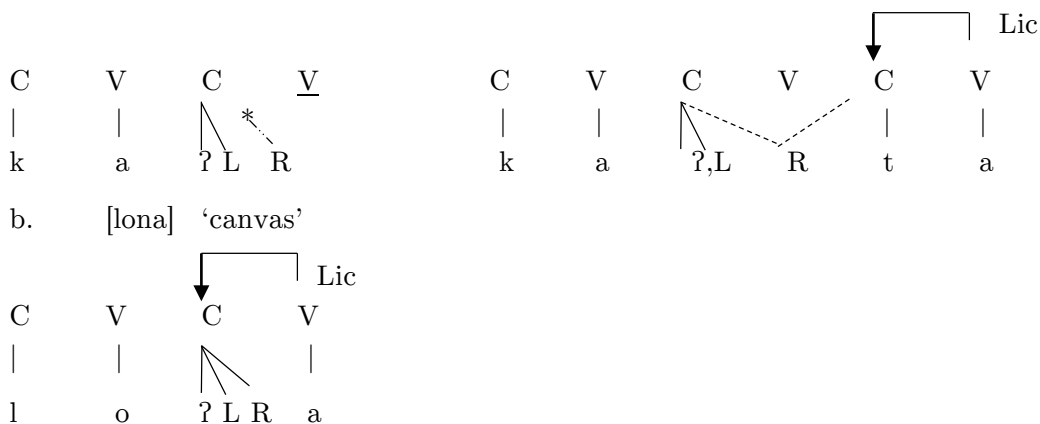
The competing deletion-analysis would probably expect the nasal to remain under C2. But /n/ must move from C2 <n+l> to C3.

In Galician the velar nasal is an allophone of /n/. Morpheme-internally and word-finally, a nasal is always velarized in 'closed syllables' (Lipsky 1975).

This is defined in Strict CV as: before an empty V.[3] The coronal nasal needs to have its place feature (|R|) licensed by a filled V position, lest it become placeless ([ŋ]): |R| of |R,ʔ,L| must be Licensed (Lic).

This condition means that the coronal feature of the nasal *cannot* be found in a singleton C position *unless* that C comes before a filled V position that can Lic it.

(30)   a.   [kaŋ]   'dog'   c. [kanta] 'he/she sings'

```
                                                                        ┌──────┐ Lic
                                                                        ↓      │
C       V       C       V̲               C       V       C       V       C       V
|       |      ⟍*                       |       |      ⟍  ⟍               |       |
k       a      ʔ L   R                  k       a      ʔ,L  R       t       a
```

b.   [lona] 'canvas'

```
                ┌──────┐ Lic
                ↓      │
C       V       C       V
|       |      ⟍⟍       |
l       o      ʔ L R   a
```

─────────────────────

[3] Or via spreading from a C which is licensed by a filled V: [kam**p**o] 'field', [kan**t**a] 'he/she sings'.

(31)   *[bɛŋarosa] 'they see the rose'

(32)   [bɛnarosa] 'they see the rose'

4   Basque Participle classes

4.1   Basque participle

The participle of Basque is also the citation form of verbs and their basic non-finite form
(Hualde & Ortiz de Urbina 2003; Haddican 2009).

Verbal roots are made into participles by suffixing either: -tu, -i (-n, or Ø)

(33)   sar-tu   'enter'   Class I
        jantz-i   'dress'   Class II
        ja(-)n   'lay'   Class III
        jo-Ø   'hit'   Class IV

(34)   All /-tu/ /-i/ /(-)n/ behave the same way with 'A suffixes'

aska-tu	aska-pen	isur-i	isur-pen	eroa-n	eroa-pen
labur-tu	labur-pen	erabil-i	erabil-pen	irau-n	irau-pen
barka-tu	barka-pen	igor-i	igor-pen	itxaro-n	itxaro-pen

(35)   /-tu/ and /-i/ pattern together by deleting with 'B suffixes' but /(-)n/ stays

| alda-tu | alda-kor | egos-i | egos-kor | irau-n | irau-n-kor |
| neka-tu | neka-garri | ikus-i | ikus-garri | jasa-n | jasa-n-garri |

(36)   Compounding also treats /-tu/ and /-i/ separately from /(-)n/

sal-du	sal-erosi	ibil-i	ibil-toki	ego-n	ego-n-gela

4.2   Do Basque participles contain affixes?

4.2.1   no

Only the –tu participle-forming strategy is productive.

It is the only strategy for forming verbs from nouns and adjectives:

(37)   *gorri* 'red'   >   *gorri-tu* 'redden'   (Hualde & Ortiz de Urbina 2003:197)

Asymmetry in productivity might suggest that both the participle classes –n and –i have been reanalysed (or are part of) the verbal root. However, this analysis (considered in Ortiz de Urbina 1986) is resisted for two main reasons.

4.2.2   yes

The (A) affixes in (31) take no participle marker at all (not even /-n/). This suggests all the participle suffixes are affixes.

There is a radical form of verbs and this does not include the /–i/ participle, suggesting it is an affix.

(38)   ken-du   >   ken
         eror-i   >   eror
         eda(-)n   >   edan

If /n/ and /i/ where not affixes, they would require phonological /n/ and /i/ deletion.
This is not phonologically predictable. 'Real root-final /n/' does not delete:

(39)   /ipin-tze/   *ipi-tze   (Ortiz de Urbina 1986:215)

Synthetic verbs take neither –i or –n. Strongly suggesting they are affixes.

(40)   ibil-i   >   n-a-bil*(i)
         ego-n   >   d-a-go*(n)

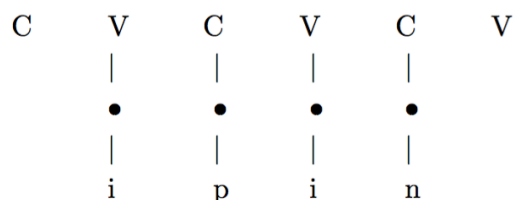## 4.3   Strict CV reanalysis without Classes

I will challenge the common sense argument that the radical or synthetic forms are 'obviously' equivalent to root/basic/UR of the verb.

It does not follow from anything, except "common sense", that the smallest alternant of related morpho-phonological forms represents all and only the segmental material of the root. (cf. peti<t>/
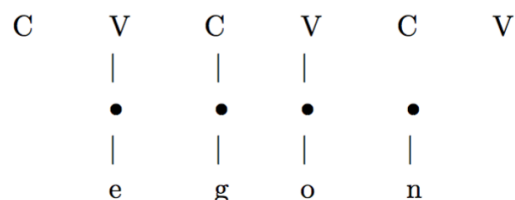
I will also challenge the apparently obvious fact that /-n/ and /-i/ have different *morphological* behaviour.
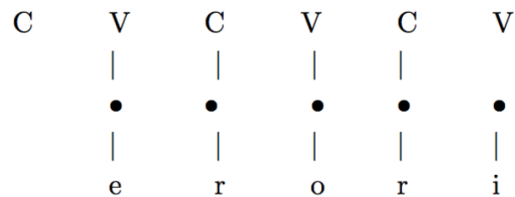
(41)   Some Basque root shapes

Fixed-final segment   Floating Final 'n'

```
C    V    C    V    C    V          C    V    C    V    C    V
     |    |    |    |                    |    |    |
     •    •    •    •                    •    •    •         •
     |    |    |    |                    |    |    |         |
     i    p    i    n                    e    g    o         n
```

                                                    Floating Final 'i'

```
                                        C    V    C    V    C    V
                                             |    |    |
                                             •    •    •    •    •
                                             |    |    |    |    |
                                             e    r    o    r    i
```

Any shared behaviour between /<n>/ and /<i>/ can be put down to the phonological and representational fact that: **they're both floating.**
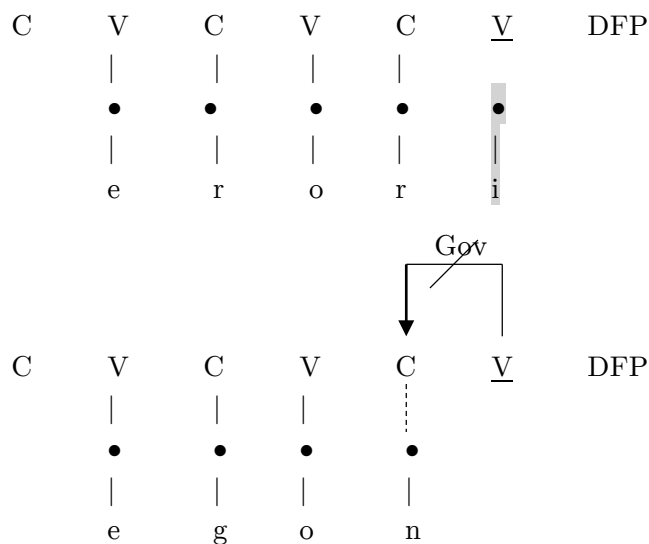
(42)   Synthetic verb and A affixes: Do not linking floating material

Then, any differences in the behaviour of /<n>/ and /<i>/ can be put down to the fact that they are a consonant and a vowel. Therefore, in domain-final position (utterance-finally i.e. the radical form and before some affixes) the floating segments will be final.

In these cases, vowel-final roots which have one empty category will lose their final floating segment. But consonant-final roots which end in two empty categories will preserve their final consonant.

(43)   V-final deletion, C-final retention

```
     C      V      C      V      C      V      DFP
     |      |      |      |
     •      •      •      •             •
     |      |      |      |             |
     e      r      o      r             i

                          Gov
                       ┌────╱────┐
                       │         │
                       ▼         │

     C      V      C      V      C      V      DFP
     |      |      |             |
     •      •      •             •
     |      |      |             |
     e      g      o             n
```

This reduces the Classes of Basque to the following:

(44)   a.   Previously

sar-tu	'enter'	Class I
jantz-i	'dress'	Class II
ja(-)n	'lay'	Class III
jo-Ø	'hit'	Class IV

        b.   Now

Regular   –tu

Irregular   - Ø

        Some are fixed consonant final /ipin/
        Some are fixed vowel final /jo/
        Some end in floating i /kus<i>/
        Some end in floating n /jasa<n>/

5   Take home messages

Modularity is an important precept. It could be wrong, but we should push it as far as it can go.

Decompositionality and phonological derivations should be pushed as far as possible – because otherwise it's absolutely unclear when to stop! The only truly respectable alternative is to be a hard-core lexicalist.

If your theory of representations can't do this for you phonologically, then get a better theory of representations.

Class features are often superfluous once you have a theory of floating segments which can give you lexically-specific/item-specific segment-zero alternations.

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