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Structural complexity and 'strong positions' in government phonology[1]

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1 The problem with changes of complex segments in strong positions

This paper examines the relationship between the structural complexity of segments and phonologically strong positions with respect to changes involving secondary places of articulation like those in (1) below:

(1a) pre-vocalic labialized velars become plain labials

k^w > p /____V
g^w > b /____V

(1b) some data showing the change

IE *k^w > Ancient Greek *he*[p]*e*- 'follow' (cf. Latin *se*[kw]*i*- 'follow')
IE *g^w > Ancient Greek [b]*ous* 'cow' (cf. Old English [k]*u* 'cow /kaʊ/')

In the framework assumed here, government phonology (Harris & Kaye 1990, Harris & Lindsey 1995, Cyran 1997, Backley & Takahashi 1998, Ségéral & Scheer 1999, Dienes & Szigetvári 1999, etc), there is a direct connection between a phonological event and its phonological environment and this connection rests on the governing and licensing relations obtaining between positions in the string. Thus, for instance, lenition (or weakening) is expected to occur in so-called weak phonological positions such as a "coda" (that is final or pre-consonantal positions), which is an ideal lenition site, where segmental complexity tends to reduce. Strong positions such as "onsets" (that is initial positions before vowels or post-consonantal positions), on the other hand, tend to favour segmental strengthening and the retention of segmental complexity.
Most processes fit neatly into the typology just outlined. For instance, /l/-darkening in English occurs in coda positions and this is a case of vocalic lenition: /l/ becomes more vowel-like, in some varieties a semi-vowel [w]. Some processes are, however, not so straightforward, because they seem at first blush to defy the connection between the phonological position and the process. Such is the case in (1) above where a complex segment with a labial gesture for secondary place of articulation undergoes a change to a structure where the secondary becomes the primary place of articulation and a plain labial consonant emerges. It is crucial to point out that the change occurs in *any* pre-vocalic position: in initial pre-vocalic positions, which is a strong position, as well as in intervocalic pre-vocalic positions, which is a weak position. It will be shown in this paper that this change in strong phonological positions is a genuine case of phonological strengthening and that the change also fits in with weak positions.

1 A version of this paper was presented at the 16th Manchester Phonology Meeting on 24 May 2008. Many thanks for the comments I received then.

The problem with processes like in (1) is twofold. The first problem is that /k^j g^j k^w g^w/ are represented as contour structures in government phonology (see Cyran 1997: 212-222 for representations of /ts/, /ts^j/, /tʃ/ and /k^j/ in Polish), which makes them phonologically more complex than the resulting labials and about just as complex as the palatal affricates.

(2) representations of contour and non-branching structures

```
/kʷ/          /p/           /kʲ/          /tʃ/

C             C             C             C
| \           |             | \           | \
h U           U             h   I         ʔ   I
|             |             |               |
ʔ             h             ʔ               h
              |
               ʔ
```

But then how does a contour segment become a structurally non-branching segment in the initial prevocalic onset position, that is in a strong position where strengthening is expected to occur? It will be proposed that /k^w/ and the other segments with a secondary place of articulation should be represented as non-branching structures using complement tiers (a 3D extention, represented by the right-branching element in (3) below) to enhance the colour tier in the sense of Backley & Takahashi (1998):

(3) proposed representation for /k^w/ and /p/, respectively

```
C                 C
|                 |
[U]               [U]
|   \             |  \
…  [  ]           … [U]
```

The second problem is that even if /k^w/ is represented as a non-branching structure, how is the process /k^w/ > /p/ an instance of strengthening rather than simplification? It will be argued that /p b/ have a more stable structure because they have a more robust presence of U in their structure, which makes them more stable.
After first presenting cases often cited to illustrate the direct connection between an onset (a strong phonological position) and segmental strengthening (segmental complexity), the more controversial case of labialized velars becoming plain labials, cited in (1) above, will be shown to occur in exactly the same strong phonological context. This means that processes where secondary places of articulation become primary places of articulation in strong phonological positions are genuine examples of strengthening.

2 Segmental complexity and phonological strong positions

Harris (1997: 343) uses the example of the segment /p/ to illustrate various cases of consonantal reduction trajectories associated with segmental decomposition, that is the suppression of various primes in their representation . All the processes in (4) below are cases of lenition because they result in structurally simpler segments (the suppressed primes are put between <> parentheses).

(4) lenition trajectories from the segment /p/ = (U, ʔ, h)

a) spirantisation: /p/ > /f/, that is (U, ʔ, h) > (U, <ʔ>, h)

b) stop debuccalisation: /p/ > /ʔ/, that is (U, ʔ, h) > (<U>, ʔ, <h>)

c) spirant debuccalisation: /p/ > /h/, that is (U, ʔ, h) > (<U>, <ʔ>, h)

d) vocalisation: /p/ > /w/, that is (U, ʔ, h) > (U, <ʔ>, <h>)

The changes in (4b-d) are not expected to occur in strong positions. Stop or spirant debuccalization tends to appear in coda-positions, vocalizations occur intervocalically. Although the intervocalic position is a kind of onset position because it is followed by a vocalic position, but since this is a position which is under the influence of both licensing and government, the intervocalic consonantal position cannot exhibit all the complexity a true, initial, onset can. It is a weak position. While spirantization, in (4a) above, is indeed a reduction process, the choice of data cited by Harris (1997) needs to be modified. Spirantization is perhaps better illustrated by Latin /p/ to French /f/ (or /v/ when still intervocalic in Old French) which happened in the same pre-consonantal or intervocalic position as the other processes in (4b-d):

(5) reflexes of Latin /p/ in French illustrating spirantization

Latin		French
ri**p**a	'shore'	ri**v**e
ca**p**u	'head'	che**f** (through Middle French *chief*)
ca**p**ra	'goat'	chè**v**re
ru**p**ta	'road'	route

Harris cites the High German Consonant Shift for the illustration of this spirantisation. But the change was convincingly established by Iverson & Salmons (1995) and Davis, Iverson & Salmons (1999), building on a detailed documentation of the spread of the change, to have passed through a /p/ > /p^f/ > /f/ trajectory rather than directly giving /f/ in weak positions. It is best to separate the two phases of the process. The second, /p^f/ > /f/, phase of the High German shift is indeed a case of reduction in that an affricate becomes a fricative, but contrary to Harris, it is not directly from /p/ > /f/. However, the High German shift had a first phase, /p/ > /p^f/, which occurred in *all* possible positions – worse, it was a gradual process originating in the affrication first of intervocalic plosives after short stressed vowels, according to Iverson et al. 1995, 1999. In initial onset and post-coda position, this first phase, affrication, is a case of strengthening so that Harris's typology in (4) can be expanded to include a fortition trajectory next to the reduction trajectories:

(4') a fortition trajectory from the segment /p/ = (U, ?, h)

e) affrication: /p/ > /p^f/, that is (U, ?, h) > (U, ?, h; U, h)

The reason why this modification to Harris's choice of data needs to be made is because the weak positions, where spirantization can happen, are systematically different from strong positions where fortition (strengthening) can. Ségéral & Scheer (1999: 8) offer the following typology of lenition and fortition sites and give a detailed analysis of strong positions, which they term the "coda-mirror". Underlining marks the site in question:

(6) a) weak positions: coda C, that is <u>C</u>C
final, that is <u>_</u>#

	intervocalic, that is	v_v
b) strong positions:	initial, that is	#_
	post_coda, that is	C<u>C</u>

Coda-mirror, that is strong, positions are favourable for sustaining melodic complexity. This means they either retain melodic structure or favour the gaining of complexity (Ségéral & Scheer 1999: 8). Retention of melodic complexity can be illustrated by the transition from Latin to French where stops did not change in coda-mirror positions, even though they did in intervocalic or coda positions as the following data show (adapted from Ségéral & Scheer 1999: 2, with a few more examples added):

(7) developments of Latin /p/ in French in various strong and weak positions

Latin		French	phonological position of /p/	gloss
strong positions				
porta-	>	**p**orte	initial	'door'
panem	>	**p**ain	initial	'bread'
ves**p**a-[2]	>	guê**p**e	post-consonantal	'wasp'
weak positions				
ru**p**ta-	>	route	pre-consonantal	'road'
ri**p**a-	>	ri**v**e	intervocalic	'shore'
o**p**erare	>	ou**v**rer	intervocalic	'work'

The process where Latin initial and post-coda /j/ went to French /ʒ/ (or /ʃ/, both through Old and Middle French /dʒ/ or /tʃ/), is a clear case of strengthening in strong positions. The data below are adapted from Ségéral & Scheer (1999: 11):

(8) developments of Latin /j/ in French in various strong and weak positions

strong positions

Latin		French	phonological position of /j/	gloss
sap**i**am	>	sa**ch**e	post-coda	'know; subj'
jocu	>	**j**eu	initial	'game'
jejunu	>	(à) **j**eun	initial	'on an empty stomach'
'fasting'				
weak positions				
ma**j**u	>	mai [mɛ]	intervocalic	'May'
ra**j**a	>	rai [rɛ]	intervocalic	'ray(fish)'
je**j**unu	>	(à) jeun	intervocalic	'on an empty stomach'

2 The word was contaminated by Germanic (Frankonian) **waspa* 'wasp'.

Cypriot Greek has also strengthening of /i/ to [k] in post-coda positions (Harris 1996). The change occurs when a post-consonantal /i/ finds itself before a vowel through concatenation. In this morphophonological environment /i/ vocalizes to /j/. This semi-vowel is realized in Cypriot Greek as [k] followed by a vowel. Data come from Harris (1996):

(9) Cypriot Greek /i/ > [k]

teri	'one of a pair'	/teri-azo/	> ter[k]azo	'I match'
vari	'heavy'	/vari-uma/	> var[k]uma	'I am bored'

What is crucial here is that this change also appears in a coda-minor position, after a consonant. Ségéral & Scheer (1999: 8) cite the High German Consonant Shift to further illustrate the difference between weak and strong positions. In this shift, Germanic *****/p/ went to affricate /p^f/ in initial and post-coda position but to fricative /f/ intervocalically and finally, according to the traditional formulation of the rule. (One should specify that pre-consonantally the change did not happen because, due to earlier changes, /p/ could no longer occur in that position monomorphemically – modern words like *Haupt* 'main, head' are later developments.)

(10) High German Consonant Shift

strong positions

English	German
path	**Pf**ad 'path'
pope	**Pf**affe 'priest'
car**p**	Kar**pf**en 'carp'

weak positions

shee**p**	Scha**f** 'sheep'
po**p**e	Pfa**ff**e 'priest'

But there is a problem with these data as presented by the authors. Following the view of Iverson & Salmons (1995) and Davis, Iverson & Salmons (1999) already alluded to, the change from /p/ > /p^f/ occurred eventually in *all* positions, irrespective of whether */p/ had occurred in onset, post-coda or intervocalic position. It was only later that /p^f/ was *kept* in strong positions, as in (10a), while weakening occurred intervocalically, /p^f/ > /f/, as in (10b). In other words, what can be seen in these data is the retention of complexity in strong positions and decomposition in weak positions. Nevertheless, one should first be able to account for the uniform nature of the original change, /p/ > /p^f/ (along with /t/ > /t^s/ and /k/ > /k^x/) since it is only later that the retention of /p^f/ and its reduction to /f/ follow from their respective strong and weak phonological positions. This nuance has implications for the behaviour of intervocalic positions, but I shall postpone this issue until section 4. In this section, it had to be pointed out that there is a close relationship between a phonological event and its phonological environment, namely strong positions favour strengthening or retention of complexity while weak positions favour reductions.

3 How is the /k^w g^w/ > /p b/ change fortition in strong positions?

There is plenty of evidence that /k^w g^w/ > /p b/ changes occur in both strong phonological positions and in weak positions (Huber 2007: 231-262) as the data in (11) show:

(11a) /k^w/ > p /___V
/g^w/ > b /___V

(11b) more data

IE *k^w > Ancient Greek *he*[p]*e*- 'follow' (cf. Latin *se*[kw]*i*-)
IE *k^w > Ancient Greek [p]*oiné*- 'punishment' (cf. Lith. *kainà*)
IE *g^w > Ancient Greek [b]*ous* 'cow' (cf. Germanic [k]*u* 'cow')
IE *g^w > Ancient Greek [b]*aino* 'to come' (cf. Du. [kw]*aam* 'came')
Lat. *a*[kw]*a* > Rumanian /p/ a[p]ă 'water'
Lat. [kw]*attro* > Rumanian /p/ [p]*atru* 'four'
Lat. [kw]*i* > Rumanian /p/ [p]*e* 'that; CONJ'

It is important to point out that the change is not triggered by its melodic or prosodic environment (see Huber 2009).
As already pointed out, /k^w/ is represented as a contour structure and /p/ as non-branching in the received government phonological approach. Under this view, strengthening of /k^w/ to /p/ happens exactly as expected in strong positions, and /p/ is stronger structurally by virtue of having U in the head, while /k^w/ has U in a dependent position.

(12) the representation of /k^w/ and /p/

```
/kʷ/                    /p/

C                       C
|  \                    |
[_] [U]                 [U]
|                       |
…                       ...
```

This approach is rather similar to the proposal made by van der Hulst (1994: 460), where a labialized velar is defined by a dependent structure, C_V, while a labial has the same structure but in head position within the locational gesture:

(13) Labialized velar > Labial

```
Locational              Locational
gesture                 gesture
 |      \                |
 -      C_V    >>>>>     C_V
```

The problem with these representations is that the change /k^w g^w/ > /p b/ produces structurally simpler sounds, /p/ and /b/, in a strong position, where "gaining structure" rather than simplification is expected. It is not obvious how the loss of the branching structure of /k^w/ can be interpreted as "gaining structure" in either government phonology or in the radical CV theory of van der Hulst. The proposal here rests on two assumptions. The first is that velars are supposed to have no place specification so that other place specifications can readily occupy their vacant place slot (Harris & Lindsey 1995, Cyran 1997, van der Hulst 1994, Huber 2007, for the treatment of a similar labial–velar interaction see Huber 2010). The second is that the representation of /k^w/ is not in fact a contour structure, rather it is non-branching with no melody on the "complement tier". Combining these two approaches, /k^w/ > /p/ is a case of strengthening because it happens in strong positions and

because /p/ is structurally more stable by virtue of having U both on the colour and the complement tier, while /k^w/ has U only on the colour tier.
The proposal put forward by Backley & Takahashi (1998) on melodic tiers and complement tiers is then assumed here. It will be argued that the labialized velar stop is not a contour structure. Rather it has a colour tier, which is dominated by the U element, and no filled-in complement tier to reinforce this labiality.

(14a) the representation of /k^w/ using a colour tier and a complement tier

```
/kʷ/

C
|
[U]            < colour tier
|   \
…   [  ]       < complement tier (a 3D enhancement of the colour-tier)
```

A plain labial stop, on the other hand, has both a colour tier dominated by U, and a complement tier dominated by the same U element. The representation below only shows the colour tier and its complement tier, leaving out all other elements:

(14b) the representation of /p/ using a colour tier and a complement tier

```
C
|
[U]            < colour tier
|   \
….  [ U ]      < complement tier (a 3D enhancement of the colour-tier)
```

The changes in (11) then involve the activation of the U complement tier in a pre-vocalic, that is, a licenced position. Activating the complement tier means that the segment becomes both more stable – its labiality is reinforced –, and more complex than it had been before the change (although neither is a contour structure). Therefore, becoming more stable structurally – in this case, gaining melody or primary place specification – is a genuine form of phonological strengthening, which occurs in phonologically strong positions, just as expected. This had to be pointed out.

4 How does the proposed analysis square with the representation of intervocalic lenitions?

It can be observed that in general, changes of /k^w/ all tend to give a more stable structure. Indo-European languages that show simplification of IE *k^w to /k/ (like Slavic or Indic) could be said to prefer having no melody in velars to having a non-reinforced (labial) melody. It would seem that languages can prefer having no melody to keeping some melody as secondary place of articulation, and this results in more stable segments. Other languages have opted for forming a sequence /kw/ out of /k^w/. This seems to be a wide-spread strategy (and it often develops further into /kv/). It is not, however, the purpose of the present paper to go into details about whether there is a meaningful phonological difference between /kw/ and /k^w/ in given language and what these criteria are. Finally, a number of languages had historically opted for extending the U element of /k^w/ to the complement tier, giving a more stable structure, /p/. These trajectories are summarized below:

(15) possible trajectories of /k^w/

(a) /k^w/ > /k/
(b) /k^w/ > /kw/
(c) /k^w/ > /p/

The problem of intervocalic strengthening needs to be addressed here. In government phonology, an intervocalic position is a position which is both licenced and governed, meaning that this position is subject to the impacts of both licensing and government. It was in this sense that Ségéral & Scheer (1999) regarded this position as a weak position. Dienes & Szigetvári (1999: 12) predict lenition of the vocalic type in this environment. This is typically manifest in vocalisations or voicing of intervocalic obstruents.

(16) both licensing and government affecting intervocalic /k/

```
   ______
   |    |
V-C  <=  V-c
| |      |
a  k     a
```

becoming *a***w***a* (vocalisation) or *a***g***a* (intervocalic voicing)

Nevertheless, both affrication of /k/ > /k^x/ (along with /p/ > /p^f/ and /t/ > /t^s/), the first general stage of the High German Consonant Shift (when all voiceless plosives uniformly turned into affricates), and /k^w/ > /p/ can happen in this intervocalic environment. This implies that beyond cases of vocalisation and intervocalic voicing, one must admit affrication and fortitions like /k^w/ > /p/ as occurring in this governed and licensed intervocalic position:

(17) lenition trajectories of /k^w/ – a fuller range

(a) a/k/a	> a[w]a	vocalisation
(b) a/k/a	> a[g]a	intervocalic voicing
(c) a/k/a	> a[k^x]a	affrication
(d) a/k^w/a	> a/p/a	secondary to primary place of articulation

As for the /k^w/ > /p/ change, extending a *melodic*, that is a *par excellence* vocalic, element from the colour tier to the complement tier can be seen as vocalic lenition in the sense that the consonants become even more vowel-like, that is more melodious. The same change, however, was regarded as a consonantal change, that is fortition, in the sense that the structure becomes simpler than a contour structure, as argued in section 3 above.
A similar analogy will hardly work for intervocalic affrications, though. The rule of "breaking" evoked by Harris & Kaye (1990: 262), where the elements split into a contour structure in intervocalic position, to account for the first stage of *t*-lenition does not work for affrication because the resulting contour structure keeps most of the original elements, it is not a simple repartitioning of elements into a contour structure. A detailed exposition is beyond the scope of this paper, though. One can say that affrication is a form of lenition because these segments often tend to be unstable historically precisely because of their contour structure. Changes affecting affricates, such as de-affrication or fricativization, either affect affricates in all positions in a language (Middle French /tʃ dʒ/ > modern French /ʃ ʒ/ across the board) or only those in weak positions (reflexes of the High German Consonant Shift) – but there are no reported cases as far as I am aware where affricates decompose in strong positions but not in weak positions.

5 Conclusions

The paper established that changes where labialized velars become plain labials, /k^{w}/ > /p/ or /g^{w}/ > /b/, are genuine cases of fortition, that is segmental complexification. Data were presented to show that these processes occur in onset, post-coda positions, that is strong, as well as in intervocalic, that is weak positions. A representation for labialized velars was then proposed where they are not a contour structure, but have a non-branching structure like plain labials. This structure has a colour tier and a complement tier. A labialized /k^{w}/ differs from a plain labial /p/ in the presence of the melodic element U on the complement tier in addition to the U element on the colour tier in both structures. Data also reveal that the change occurs in intervocalic positions, which calls for an explanation in terms of vocalic lenition. A proposal was made that extending the colour tier, that is the primary melody, to the complement tier makes the segment more melodious, hence more vocalic in a sense. The reason why /k^{w}/ > /p/ or /g^{w}/ > /b/ can occur in both strong or weak position is because they satisfy some aspects of both phonological contexts.

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