Licensing saturation and co-occurrence restrictions in structure: on Meinhof's Law in Bantu

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1. Introduction

Phonological co-occurrence restrictions as seen in Bantu Meinhof's Law raise interesting questions for the nature of phonological domains and in particular, what restrictions apply in the definition of such phonological domains.

Government Phonology is one framework that has gone some way in defining the boundaries of phonological domains by utilising the notion of licensing. A phonological domain thus has the formal definition under the licensing principle of Kaye [29] given in (1).

(1) *Licensing Principle*: all positions within a phonological domain are licensed save one, the head.

This paper will focus on Meinhof's Law (ML) which has been described both as a voicing dissimilation (Meinhof [40]) and (nasal) assimilation (Herbert [21], Katamba and Hyman [28]) process.[1] It is akin in nature to Japanese *Rendaku* (Itô and Mester [25]) where the initial consonant in the second element of a compound is voiced, but this voicing is barred if another voiced segment is already present in the phonological domain. Whereas there is no restriction on the adjacency of the segments involved in *Rendaku* some notion of adjacency is called for in ML where only obstruents in a sequence of nasal+consonant clusters (henceforth NC's or NC clusters) are affected by the rule.[2] In its most general form, ML can be characterised as a process that disallows a sequence of two voiced obstruents within NC clusters, i.e. *NCvNC where both C's are voiced.

The goal of looking at ML in this paper is to more generally gain insights into the nature of phonological domains and to investigate whether, under the auspices of Government Phonology, we can relate the failure to sustain two voiced segments in ML, to a failure of licensing in a general way. For this purpose I will first present a characterisation of ML in Bantu and thereafter see what these data demand of the principle in (1), and the ramifications this has for licensing as a principle defining phonological domains in Government Phonology.

2. Meinhof's Law the process

ML has been described in Meinhof [40], Meeussen [39], Schadeberg [52] and has been subject to some analysis in for example Herbert [20], Piggott [45], Kula and Marten [35]. The process is traditionally described as a dissimilation process involving NC clusters occurring in a sequence. The rule changes the first or second NC cluster, depending on the language, to a simple homorganic nasal or to a nasal geminate.[3] Consider the Luganda (Cole [10]), Lamba (Doke [11]), Bemba (van

[1] The process is named after Carl Meinhof who gives the earliest description of the process in Meinhof [40]. A revised version is given in Meinhof [41].

[2] The use of *NC clusters* here reflects a theoretic position on the representation of prenasalised segments. I discuss this issue in section 2.

[3] We will see later, according to the description of Schadeberg [52], that an obstruent, as opposed to a nasal, may also result from ML in languages of the South-Western Bantu area. Meeussen [39] suggests

Sambeek [50]) and Kikuyu (Armstrong [3]) data in (2). *N* represents the 1st person singular subject marker and *iN* the Class 9/10 noun class marker.

(2)	a. N-genda	→	ŋŋenda	'I go'	*ngenda	(Luganda)
	b. iN-lembo	→	inembo	'tattoo'	*indembo	(Lamba)
	c. N-tampa	→	ntampa	'I begin'	*nampa	(Bemba)
	d. N-reme	→	neme	'tongues'	*ndeme	(Kikuyu)

Thus, in Luganda two surface voiced NC clusters are barred in (2a) resulting in a nasal geminate that is note, homorganic to the deleted [g]. Similarly in Lamba, where /l/ becomes [d] in the context following a nasal, the first NC deletes the possible resulting [d] to give a simplex homorganic coronal nasal (2b). The Bemba data in (2c) shows that the rule does not affect voiceless NC's.[4] (2d) shows that in some languages the rule can in addition apply when a simple nasal follows. In Kikuyu (2d) /r/ becomes [d] following a nasal and would yield **ndeme* in the absence of ML.

Thus, at least in the examples in (2), the trigger of ML is the second NC or nasal while the first NC is the undergoer or target of the process. In all cases the target NC is one that is created by the addition of a nasal prefix such as the 1st person singular subject marker or the class 9/10 noun class marker. We will now have a look at this prefixation process to further investigate the phonological and licensing processes involved and show why a cluster representation of nasal+consonant sequences best captures the phonological phenomena at stake.

2.1 Phonological domains in prefixation

In talking about the representation of NC clusters I will also introduce the basic assumptions of GP relevant for the remainder of this paper. I adopt the strict CV version of GP as proposed in Lowenstamm [37] and further developed in among others Scheer [54], in which it is assumed that all constituents are non-branching. For the interaction of phonology and morphology in GP I follow proposals in Kaye [31] and revisions thereof in Kula [34].

GP views phonology as a function that is applied to an input string for the purpose of parsing and to act as a lexical addressing system i.e. to define phonological domains. Morphological structure is thus regarded as consisting of units relevant to phonology in its function as a parsing device. The interaction of phonology and morphology is therefore restricted to the ability of phonology to access phonological domains internal to morphology. In GP this is subsumed under either analytic or non-analytic morphology, where the former consists of internal phonological domains and the latter does not. Prefixation can be of either type with examples such as English *irrational*, where total assimilation between the prefix and the stem applies, illustrating non-analytic morphology and the non-interacting English *un-* in *unkind* [unkind], *unmake* [unmake] as illustrating analytic morphology. What Kaye [31] does

that the rule was operative in Proto-Bantu, at least in the eastern half of the Bantu area. This coincides with the synchronic distribution of the rule in the Bantu zones E, F, G and M of Guthrie [14].

[4] There seems to be contradicting data to this effect as Hoch [22] presents Bemba *N-umfwe* → *ɲuumfwe* 'let me hear' (and also Sims [55] gives Bemba *ca-N-ansha* → *ca-ɲ/ŋaansha* 'its too much for me') as data reflecting ML involving voiceless NC's (here underlined). These data are also noted by Peng [44]. In my own ilicitations I have noticed that both forms (with and without ML) seem to be possible in varying degrees among speakers. A full characterisation of their distribution still remains to be made. If these data are consistent the rule will have to be a bar on voiced NC's following any NC (or a simplex nasal) and future analyses will have to incorporate these facts. Needless to say these data support a cluster rather than a unit analysis of NC's. I leave this to my ongoing research.

not provide for and what is argued for in Kula [34] is a partial relation between the prefix and the stem where the prefix does not form its own domain but is also not part of the stem's domain. All phonological domains end in a vocalic position following *'coda'-licensing* in Kaye [29]. Consider now in (3) the enriched structures for prefixation processes.

(3) Domains in prefixation

a.	Analytic (i)	((prefix)$_1$(stem)$_2$)$_3$	3 phonological domains
b.	Analytic (ii)	(prefix(stem)$_1$)$_2$	2 phonological domains
c.	Non-analytic	(prefix-stem)$_1$	1 phonological domain
d.	Unattested:	((affix)$_1$stem)$_2$	2 phonological domains

The reason for assuming (3b) rather than (3a) for Bantu is that phonological domains may not end in a consonant in Bantu or in GP terms domain final empty nuclei, i.e. nuclei that evade phonetic interpretation, are not permitted in Bantu. Empty nuclei are sanctioned under the empty category principle of GP.[5] In Bantu every phonological domain must end in a realised vowel, the so-called Bantu *final vowel*. In addition, I treat the phonological domains as themselves being in head-dependent relations where the stem acts as head and the affix as its dependent. Thus in prefixation the head forms its own phonological domain while its dependent prefix does not. We will see the salience of this in the discussion of government in NC's. Consider in (4a) what the result of assuming (3a) would be for the Kikuyu example *nreme* 'tongues/languages'.

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(4)  a. [[ C  V]1[C V  C  V]2]3          b. [  C  V  [C V  C  V]1]2
          |  |   |  |  |  |                    |  |   |  |  |  |
          x  x   x  x  x  x                    x  x   x  x  x  x
          |      |  |  |  |                    |      |  |  |  |
          n      r  e  m  e                    n      r  e  m  e
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The phonological domains given in (4a) define independent phonological domains that are retrievable from the lexicon. (4a) implies that the prefix [n] is a well-formed word of Kikuyu, even though it violates a basic phonotactic principle of Kikuyu. (4b) on the other hand, avoids this by not having a phonological domain boundary after the prefix, with the nucleus following the nasal prefix sanctioned by C-to-C government (or inter-onset government) of the Empty Category Principle (ECP). We come to the C-to-C government relation involved presently.

2.2 Representation of NC clusters

There are several arguments that are traditionally presented in favour of the treatment of NC clusters as unit prenasalised segments (Clements [9], Herbert [20], [21], Sagey [49], van de Weijer [60], Downing [13]). The most frequent argument is that the syllable structure of Bantu is strictly CV and an assumption of NC's as simplex

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[5] The ECP is defined and presented in Kaye [30: 305]. I follow the version presented in Kula [34]:
A p-licensed empty category receives no phonetic interpretation.
An empty category is p-licensed if it is:

(i) domain final (parameter)
(ii) properly governed
(iii) a nucleus within an inter-onset government domain
(iv) magically p-licensed
(v) domain initial (parameter)
(vi) an onset within an inter-nuclear domain

segments would fall in line with this syllable structure type. Also high on the list is that the nasal and consonant are always homorganic and must thus be said to share the same place node (Archangeli and Pulleyblank [2], Clements [9], Sagey [49]), resulting in a singly articulated single segment with an initial nasal outburst.[6] But perhaps the most compelling argument is that the vowel preceding NC's is always long and this must result from compensatory lengthening after the shift of the nasal from its position to that of the following segment with which it forms a unit prenasalised segment. Thus even in analysis such as Herbert [21] where it is admitted that NC's are sequences underlyingly, the assumption is that the nasal vacates its position (skeletal slot in our terms) at some point in the derivation, resulting in the lengthened vowel in the output.

There are, however, arguments that favour treating NC clusters as sequences rather than units. I here consider two. The first is the notable fact that NC clusters in Bantu have a restricted distribution in morpheme and word initial position. This would be a surprising distribution if NC clusters were unit segments, since all segments contrast in word-initial position. As already seen, NC clusters only occur in word-initial position if they are part of morphologically complex structure involving prefixation. This suggests that their structure cannot be identical to that of single segments.[7] Conversely, in one of the very few Bantu languages with word final consonants, Ewondo (A.72, Abega [1]), NC clusters are not allowed in final position. Again they fail to pattern with other single consonants. This asymmetry follows if we consider NC clusters to have a more marked structure than simple unitary segments.

The second is that in the nasalisation of recessive liquids following a nasal in Bantu (Greenberg [14]), we encounter the blocking effect of NC clusters, which is best explained by a sequence analysis. Consider the Herero perfective suffix *-ire* that is changed to *-ine* only after simplex nasals (5a-b) and not after NC clusters (5c-d).

(5) a. mba mun-ine 'I had seen'
b. mba man-ene 'I had finished'
c. mba hing-ire 'I had chased'
d. mba jend-ere 'I had walked'

Under a simple spreading analysis where some feature [nasal] spreads from the stem final nasal to the following onset, the distribution in (5) would be odd if NC clusters are treated as unit segments that would as such have the triggering feature [nasal]. In such an analysis we would have to impose restrictions on the spreading conditions of [nasal] within the feature configuration of the prenasalised segment. Concretely, this would entail a binary specification for the feature [nasal] where [- nasal] is ordered following [+ nasal] (Sagey [49]). In this case [+ nasal] would be the spreading feature that would be blocked by [- nasal]. This strict ordering of features mirrors the sequencing analysis effects but has the cost of losing privativity in feature specification. Needless to say [- nasal] does not define a natural class of segments.

Based on these arguments, I will consider NC's to be sequences and now go on to show how a sequence representation can capture the phonological processes relevant

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[6] This is not strictly true; in Nyanja [n] assimilates but [m] does not. Thus: *n+bale* → *mbale* 'plate' but *m+seru* → *mseru* 'cleared path', *m+zere* → *mzere* 'line' and *m+kazi* → *mkazi* 'woman'.

[7] What is referred to here as a single segment is a representation with a single root-node regardless of the possibility of having binary feature specifications. In this sense, affricates with a single node, but with a binary specification for continuant as in Sagey [49], are single segments. Notice that affricates, as opposed to NC's, occur word initially monomorphemically.

to ML, i.e. homorganicity, consonant hardening and consonant epenthesis.[8] In order to do this, we will need to introduce the relevant GP mechanism for this enterprise.

2.3 Segment representations, Government and Licensing

The representation of segments in GP utilises monovalent elements of which an exhaustive list of 10 can be posited.[9] For our current purposes I will use the restricted set of six elements (I, U, R, h, L ʔ) representing palatality, labiality, coronality, noise, voicing or nasality and stopness respectively. For expository purposes I will here use Bemba with the consonantal inventory in (6). Similar consonantal representations can be ascertained for other Bantu languages after thorough analysis of the phonological processes therein.

(6) Consonantal Inventory of Bemba

stops:	p (ʔ.U)	t (ʔ.R)				k (ʔ)
	[b (ʔ.U.L)]	[d (ʔ.R.L)]				[g (ʔ.L)]
fricatives:	β (U)	f (h.U)	s (h.R)	ʃ (h.I)		
affricates:				tʃ(ʔ.I)	[dʒ (ʔ.L.I)]	
nasals:	m (L.U)	n (L.R)		ɲ (L.I)		ŋ (L)
liquid:		l (R)				
glides:	w (U)			y (I)		

The combination of elements to produce phonological expressions that describe segments is regulated by sets of Licensing Constraints, which, based on the phonological processes in a language, determine what elements may combine.[10] Complex phonological expressions have a head element indicating the most salient feature of the expression. The leftmost element of the expressions in (6) is the head. Between the voiced bilabial fricative /β/ and the glide /w/, the fricative is headed. As will be seen, the bilabial fricative is like a sonorant in behaviour and therefore gets no (L) element for voice on a par with other sonorants. Based on discussion in Nasukawa [42], Kula and Marten [35] and Ploch [46] I use the (L) element as denoting nasality when it is head and as voice when it is a non-head or operator. There are no underlyingly voiced obstruents in Bemba, but voiced stops do occur in post-nasal position, so I also give a representation of these segments in (6) above. (They appear in square brackets).

Two other notions central to any GP analysis are Government and Licensing. As already stated, every position within a phonological domain must be licensed. Licensing is in this respect the mechanism by which positions are sanctioned as licit entities. The source of licensing for a phonological domain is the most dominant nucleus (hosted in a V position) of that domain and which, by so being, acquires the status of head of the domain. Being head and the source of all licensing, it can remain

[8] These issues are also discussed in Kula and Marten [35], Kula [33]. See Kula [35] for a fuller exposition.
[9] See Harris [17] and Harris and Lindsey [19] for the description and characterisation of elements.
[10] See Charette and Göksel [8] and Kula and Marten [36] for the notion of Licensing Constraints.

unlicensed within the phonological domain.[11] The head V-position licenses all other V-positions in the domain, which in turn license the C-positions in their CV pairs. Government is, on the other hand, a kind of asymmetric licensing that holds between two positions, where the governed position is impoverished (as presented in Szigetvári and Dienes [57] and Szigetvári [56]). This impoverishment is mostly reflected by the governee not being more complex than (or just as complex as) the governor,[12] but also by diminished licensing abilities. Thus Szigetvári and Dienes [57] and Szigetvári [56] also show (for consonantal positions) that governed positions cannot be governors.[13] Government and licensing can thus be regarded as the *glue* that holds the phonological word together, by defining syntagmatic relations between segments (dominated by C's and V's) in a surface linear order.

Let us now move onto a representation of homorganicity in GP.

2.3.1 Homorganic nasals

As already pointed out, the nasal prefix is usually homorganic to the segment of the stem it attaches to in many Bantu languages. Thus in the Bemba data in (7a-d), the place of articulation of the nasal prefix is homorganic to that of the following segment. When the stem begins with a nasal no nasal geminate is created but a homorganic simplex nasal (or virtual geminate) surfaces. The examples given here illustrate the four nasal types of Bemba.[14]

(7)	stem			N+stem	
a.	pata	'hate'	→	mpata	'I hate'
b.	tana	'refuse'	→	ntana	'I refuse'
c.	ɲyunga	'sieve'	→	ɲyunga	'I sieve'
d.	kúla	'grow'	→	ŋkúla	'I grow'

Having argued for the treatment of NC's as sequences in a C-to-C government relation in section 2.1, we can regard homorganicity as strengthening the argument for some relation between the two segments and also as clarifying which of the two segments in the NC is the governor. Since the stem-initial consonant imposes its place of articulation on the nasal it will be regarded as the governor.[15] Thus the nasal loses its ability to specify its own place of articulation.[16] This implies that if the nasal were the governor we would expect the stop to assimilate to the nasal, which is not the case (*np → nt). The empty nuclear position between the NC in a governing relation is licensed to remain inaudible by the governing domain. The process is shown in (8).

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[11] I take it that it is licensed from outside the domain by higher prosodic structure. I am currently working on the implementation of such structure in GP.

[12] This is stated as the complexity condition in Harris [17]. The same principle is also seen at play in the infrasegmental licensing of Scheer [53].

[13] This is the corollary to proper-government where a properly governed nuclear position cannot be a proper governor (Charette [7]). Positions that are subject to proper government are silenced, i.e. phonetically inaudible.

[14] I assume the underlying or default nasal type of the prefix to be coronal /n/ because it is the coronal nasal that surfaces before vowel-initial tense morphemes of the perfective and present tenses.

[15] This also follows from the head versus dependent relation of the stem and the prefix alluded to in section 2.1, which itself follows from the prefix domain structure adopted.

[16] From a perceptual point of view, Ohalla [43] argues that the non-nasal consonant in an NC cluster is perceptually more salient than the nasal because it is released into a realised vowel as opposed to the nasal. The perceptually less salient segment then assimilates to the more salient one.

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(8)  a.  tana → ntana  'I deny'                 b.  pata → mpata      'I hate'

     ↓‾‾‾‾‾|           C-to-C government          ↓‾‾‾‾‾|
     C  V  C  V  C  V                             C  V  C  V  C  V
     |  |  |  |  |  |                             |  |  |  |  |  |
     x  x  x  x  x  x                             x  x  x  x  x  x
     |     |  |  |  |                             |     |  |  |  |
     n     t  a  n  a                             n     p  a  t  a
     L     ʔ                                      L     ʔ
     R  ←  R               place sharing          U  ←  U
                                                 «R»

     /n    t  a  n  a/                           /m     p  a  t  a/
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In both (8a) and (8b) the place element of the governing head is imposed on the governee by a spreading operation. Spreading the coronal element (R) in (8a) achieves the same objective as doing nothing, since the place of the nasal is already coronal. In (8b), on the other hand, spreading of labial place results in suppression of coronal.[17] Thus homorganicity is achieved by the sharing of a place element under government.

2.3.2 Consonant hardening and epenthesis

As already pointed out, voiced obstruents only occur in Bemba in post-nasal position. There are two sources of these voiced obstruents. One is from a hardening process that hardens the voiced bilabial fricative /β/ and the liquid /l/ to the stops [b] and [d],[18] and the other is from consonant epenthesis that inserts [dʒ] before front vowels and [g] before back vowels, in vowel initial stems. Glide initial stems are also subject to epenthesis, with /y/ initial stems having epenthetic /dʒ/ and /w/ initial stems taking epenthetic /g/. These cases may also be treated as sonorant hardening, depending on the status of the glides in the language in question.[19] Bemba data are as shown in (9).

(9)	stem			N+ stem	
a.	βila	'sew'	→	mbila	'I sew'
b.	leka	'stop'	→	ndeka	'I stop'
c.	olola	'straighten'	→	ŋgolola	'I straighten'
d.	isula	'open'	→	ndʒisula	'I open'
e.	wa	'fall'	→	ŋgwa	'I fall'
f.	ya	'go'	→	ndʒa	'I go'

Hardening will be treated as a change in the elemental configuration of the hardened segments and epenthesis as a response to filling an available empty onset.

Consonant hardening results from a situation where the potential governor is less complex than the governee, i.e. the non-nasal consonant is less complex than the nasal. In this case, the governor improves its complexity by acquiring additional

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[17] Suppression is a process that allows elements to *not* be submitted to the speech signal in the course of phonological processing Harris and Lindsey [18]. Suppressed elements will be presented in angled brackets.

[18] This is akin to the widespread process that turns voiced continuants into non-continuants in many Bantu languages as in for example Kwanyama (Tirronen [58]); *londa* → *ondodo* 'ascend', *vevela* → *ombelela* 'dip into food', and Kikuyu (Armstrong [3]); *reheete* → *ndeheete* 'I have paid', *ɣoreete* → *ŋgoreete* 'I have bought', *βora* → *mbureete* 'lop off'.

[19] I have argued elsewhere Kula [34] that glides are in the nuclear position in Bemba. See also glide hardening in Swahili (Ashton [4]) (*wati* → *mbati* 'hut poles') and Ndali (Vail [59]) (*yuki* → *ɲjuki* 'bee'. And epenthetic consonants in Kwanyama (Tirronen [58]) and Luganda (Ashton et al. [5]).

elements from the governee. The acquisition of additional elements results in the strengthening of the governors /l/ and /β/ that only have one element each, as shown in (10). In (10) /l/ and /β/ acquire the (L) element from the nasal, which is interpreted as voicing in non-nasal consonants, hence hardening.

(10) a. leka → ndeka 'I stop' b. βila → mbila 'I sew'

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  ┌────┐                                   ┌────┐
  ↓    │       C-to-C government           ↓    │
  C  V  C  V  C  V                         C  V  C  V  C  V
  |  |  |  |  |  |                         |  |  |  |  |  |
  x  x  x  x  x  x                         x  x  x  x  x  x
  |     |  |  |  |                         |     |  |  |  |
  n     l  e  k  a                         n     β  i  l  a
  L  →  L              L-sharing = hardening  L  →  L
  R  ←  R                                  U  ←  U
                                          «R»
  /n    d  e  k  a/                        /m    b  i  l  a/
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(10a) shows the spread of (L) from the nasal to the segment that contains a single element. The resulting elemental configurations would be identical if the (L) from the nasal retained its headedness in the stop. I therefore assume (L) to spread under switching, following earlier work in Kula and Marten [35]. Switching of heads, which here just refers to the fact that (L) fails to retain its head position in the target, must take place; otherwise we would predict a nasal geminate.[20] (In fact, this is exactly the desired output for Meinhof's Law.) In this way we avoid a violation of the OCP, which might result from two adjacent identical representations. Similarly, in (10b), (L) spreads under switching to result in /b/. In both of these cases the strongest stricture element (ʔ) is assumed.[21]

Hardening can thus more generally be viewed as resulting from the sharing of an (L) element between the governor and governee. This seems to be the more basic principle, rather than complexity even though the sonority scale in GP is derived from more complex to less complex expressions, i.e. the least sonorous are the most complex and the most sonorous are the least complex, pending the representation of velarity. (But see Scheer [54] for an opposing GP view).

Coming now to cases involving consonant epenthesis, the expected resulting structure before epenthesis, in such cases, would be as in (11a). Compare this structure to (11b) with a vowel-final prefix. (Brackets indicate morpheme boundaries).

(11)

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a. [C1 V1 [C2 V2 C3 V3 ]]        b. [C  V1 [C  V2 [C  V3 C  V4 ]]
    |  |   |  |  |  |                |  |   |  |   |  |  |  |
    x  x   x  x  x  x                x  x   x  x   x  x  x  x
    |         |  |  |                   |   |  |      |  |  |
    N         e  b  a                   a   l  a      e  b  a

   [ndʒeba] 'tell'                      [a leeba]   'he/she tells (habitual)'
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[20] Switching of heads follows from more general principles based on the geometry developed in Kula [34] following assumptions in van der Hulst [23], [24], which space precludes discussion here.

[21] Naturally, it would be desirable, as pointed out by an anonymous reviewer, to derive (ʔ) from more general principles, in these instances. A possible option, that is pursued in Kula and Marten [35], is to not have the glottal element at all and derive stopness from elemental configuration in terms of headedness where, for example, (L.R) and (L.U) would be the nasals /n/ and /m/ but (L.R) and (L.U) the stops /d/ and /b/. This is formally equivalent to saying that voicing implies stopness. This forms part of a larger enterprise (see Jensen [27], Bachmaier, Kaye and Pöchtrager [6]) to get rid of the glottal element, in GP in order to reduce the number of elements and thus the number of possible consonantal contrasts expressible, in line with attestations in natural language.

Given the output with vowel fusion (V_2 and V_3) in (11b) we could expect compensatory lengthening of the stem vowel to give **neeba* in (11a).[22] However, it turns out there is no active rule of vowel lengthening in Bemba, rather 'lengthening', which is really fusion of vowels, only results from hiatus contexts as in (11b). The only option to save the structure in (11a), where V_1 and C_2 cannot be licensed under the principles of GP, is epenthesis.

Epenthetic [g] is a direct result of (L) spreading from the nasal to the empty C-position (12b). The sharing of (L) implies hardening and since there is no place element, the resulting segment is velar; [g].[23] In (12a), epenthetic /g/ is palatalised to /dʒ/ by a palatalisation process that changes /k, g → tʃ, dʒ/ before front vowels.[24]

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(12)  a.  eba → ndʒeba    'I tell'            b.  uβula → ŋguβula    'I peel'

          [C1V  [C2V  C  V]]                      [C1V  [C  V  C  V  C  V]]
           |  |   |  |  |  |                        |  |   |  |  |  |  |  |
           x  x   x  x  x  x                        x  x   x  x  x  x  x  x
           |         |  |  |                        |         |  |  |  |  |
           N         e  b  a                        N         u  β  u  l  a
           L  →   L                                 L  →   L
                  I←I  (palatalisation)             «R»
           R  →   R
                  ↓                                 ↓      ↓
                  /dʒ/                              /ŋ/    /g/
          /n      dʒ e  b  a/                       /ŋ     g  u  b  u  l  a/
```

In both (12a) and (12b) (L) spreads to increase the complexity of the empty governing C-position. In (12b), the governee C_1 suppresses its coronal place because it must share place with its governor, which being empty, results in the velar nasal /ŋ/. The idea is not to postulate an actual empty element that represents velar, but rather that if a phonological expression consists of a simplex non-place element it is interpreted with velar place. The same process of (L) spread is seen in (12a) but in addition, a palatalising (I) element spreads from the following front vowel. The complexity scale being satisfied, C_1 retains its default coronal place. (12a) thus illustrates the inability of velar place to surface in the presence of more than one element. Note that with the addition of (I), C_2 already satisfies its complexity requirements as a governor - it is as complex as C_1. The spreading or sharing of (R) therefore merely takes place to ensure that the stop has a place of articulation. The glide initial stems are treated in a similar manner.

We have thus far seen how under a C-to-C government relation, we are able to account for homorganicity, hardening and consonant epenthesis in Bemba NC clusters that are central to the discussion of Meinhof's Law that follows. Homorganicity has been treated as the sharing of the place element of the obstruent; hardening as the effect of switching under the spread of (L); and epenthesis as the insertion of elemental material (rightward spread of L) into an empty onset that would otherwise

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[22] A possibility in (11a) would be to delete the sequence of empty V and C in (11a), V_1-C_2, resulting in *neba* with short /e/. This is however, counter to GP's *Projection Principle* Kaye [29], which demands that licensing relations must be kept constant at every level of projection. Deleting C_2 would mean that V_2 would license C_1, when it formerly licensed C_2.

[23] The intricacies of elemental interaction in consonants go far beyond the scope of this paper. Readers are referred to Kula [34] for a full exposition. One of the basic assumptions I make on consonantal representations is that every inventory defines a fixed set of positions (each defined by a signature or elemental representation which is in turn defined by Licensing Constraints) in the acoustic signal so that every phonological expression produced by phonological processes is also confined to one of these positions.

[24] This process is almost fossilized and occurs only in stem-initial position. Thus while *ki/*ke may not be found word-initially, these sequences occur between the root and following suffixes; *se<u>k</u>-esh-a* 'make laugh'.

fail to be licensed. I assume that these analyses also apply to word internal NC's (i.e. those not resulting from prefixation) and moreover that the analyses are more generally extendable to other Bantu languages exhibiting similar processes. We return now to ML.

3. Representing Meinhof's Law

The problem we have set out to characterise is aptly described in Schadeberg [52] who in a survey of Meinhof's Law recognises four variants as given in (13) with presentational modifications.

(13) Variants of Meinhof's Law

a. Ganda variant						
NCvNv	→	NNvNv	en-limi	→	ennimi	'languages'
NCvNC	→	NNvNCv	n-genda	→	ŋŋenda	'I go'
b. Lamba variant						
NCvNCv	→	NvNCv	in-lembo	→	inembo	'tattoo'
*NCvNv	→	NvNv	in-guma	→	iŋguma	'head injuries'
c. UMbundu variant						
NCvNv	→	NvNv	n-lima	→	nima	'farm'
*NCvNC	→	NvNCv	n-landa	→	ndanda	'buy'
d. Kwanyama variant						
NCvNC	→	NCvCv	n-gombe	→	oŋgobe	'cattle'
*NvNC	→	NvCv	n-angala	→	naŋgala	'lie down'
*NCvN	→	NvNv	n-goma	→	oŋgoma	'drum'

In the Ganda variant (13a) ML is triggered both by a following NC and a simplex nasal to produce a nasal geminate. In the Lamba variant (13b), ML is triggered by a following NC to produce a simplex nasal. Bemba falls into this variant. The UMbundu variant (13c) is never triggered by an NC but only by a simplex nasal and produces a simplex rather than a geminate nasal.[25] The Kwanyama variant (13c) is a mirror image of the other variants with the first NC acting as the trigger and the second as the undergoer. In addition, the rule deletes the nasal part of the NC rather than the oral consonant. A simplex nasal does not trigger the rule in either first or second position as (13d) shows. (The triggers and targets in the inputs and outputs of example (13) are underlined.)

To have ML only applying before a nasal as in the UMbundu variant, where it is the only type found does not sit well with the general idea that the law in its most general form results from two adjacent NC's. A possibility would be to treat these data in line with a general obstruent deletion (or assimilation) rule that bars voiceless NC's in the language. Consider the following alternations with the 1st person subject marker *N*- taken from Schadeberg [51: 111 ff].

(14) *voiceless NC clusters

a.	N - pópya	→	mópya	'I speak'
b.	N - tuma	→	numa	'I send'
c.	N - tʃiɺa	→	ɲiɺa	'I dance'
d.	N - kwátá	→	ŋwátà	'I take'

(14a-d) show obstruent deletion after assimilation has taken take. Thus in examples such as the UMbundu *n-lima* → *nina* 'farm' (13c) we could view this as more in line

[25] UMbundu from central Angola is to be differentiated from Kimbundu in Mozambique.

with the deletion rule rather than ML. The situation is however not aided by the fact that there is a regular hardening process in the language as in (15).

(15) UMbundu hardening

a.	N - vànjá	→	mbànja	'I look'
b.	N - làndá	→	ndànda	'I buy'
c.	N - yéva	→	njéva	'I hear'
d.	N - ènda	→	ŋgènda	'I go'

Given the outputs in (15), there seems to be no surface constraint against hardening nor against the /l/ → [d] alternation. The challenge of incorporating these data as well as the fact that NC's never trigger the rule in this variant therefore remains if a complete typological analysis is to be attained. I give in (16) a list of the main characteristics and properties of ML that any analysis must account for.[26]

(16) Basic characteristics of ML

- triggered by an NC or a nasal (or both depending on the language).
- a trigger NC must be voiced.
- targets voiced NC's.
- the NC's (or NC-N sequence) must be strictly adjacent C positions i.e. only separated by a vowel.

Supporting evidence for these characteristics has already been seen in the foregoing and is here illustrated by the Bemba perfective data in (17).

(17)	a.	n-βó:mbele	→	mó:mbel-e	*mbó:mbele	'I have worked'
	b.	n-la:ndile	→	na:ndil-e	*nda:ndile	'I have spoken'
	c.	n-tampile	→	nta:mpile	*na:mpile	'I have started'
	d.	n-pá:ŋgile	→	mpá:ŋgil-e	*má:ŋgile	'I have made'
	e.	n-lu:ntwiile	→	ndu:ntwiile	*nu:ntwiile	'I have bumped'
	f.	n-βéle:ŋgele	→	mbéle:ŋgel-e	*méle:ŋgele	'I have read'

(17a-b) show the regular application of ML. (17c) shows that ML does not apply with voiceless NC's. (17d) shows that the target NC must be voiced, thus no ML applies here despite the presence of a voiced trigger. The requirement for a voiced trigger is illustrated by (17e) where the initial voiced NC fails to undergo the rule. (17f) illustrates the adjacency requirement.

I briefly consider some previous analyses of the ML facts in the next section.

3.1 Previous analyses

Many analyses have been concerned with Luganda, where ML was first noted, because it has the additional interesting aspect of having ML also apply before a simplex nasal. This fact has prompted assimilation oriented analyses which view ML as triggered when a consonant is surrounded by nasals. One such analysis is given in Herbert [20], where it is argued that ML is the nasalisation of a consonant in an environment characterised by extreme nasality. Assuming that vowels preceding

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[26] There is wide variation in the degree of productivity of ML. In some languages it is restricted to particular series of NC clusters, e.g. Nilamba (F.31), where the rule applies only to /mb/ and /nd/. In Lamba (M.54) it is subject to grammatical information so that only nominals, as opposed to verb forms, attest the rule (Doke [12: 20]).

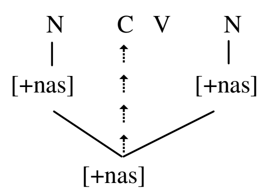
nasals are always slightly nasalised then the target of ML is in the context - $NC_1\tilde{V}N$- where C_1 becomes nasalised to produce the effects of ML. This analysis is good both for a following NC and a simplex nasal. Notice that this analysis also (perhaps inadvertently) supports the representation of NC clusters as sequences. This analysis however still leaves us with the problem of characterising ML as only affecting voiced NC's since this nasalisation process fails to nasalise voiceless stops and fricatives which occur in the same environment.[27] In addition, from a more cross-Bantu point of view, we cannot extend this analysis to the other variants where ML is not triggered by a simplex nasal (the Lamba and Kwanyama variants).

In the same vein, Katamba and Hyman [28] view Meinhof's Law as an assimilation process triggered by well-formedness constraints. They argue that only one specification for the feature [nasal] is allowed in a stem in Luganda, so that only identical nasals doubly linked to one feature specification are allowed. In line with this reasoning, ML is motivated by a constraint on the feature [nasal] in stems. Katamba and Hyman [28: 181] formulate the constraint as in (18).

(18) In an NDVN(C) string, no potential nasality bearing units should be wedged as D between nasals within the stem

Vowels are considered to be non-nasality bearing units, while voiced oral consonants are (potentially) nasality-bearing units. Since only voiced NC's are subject to ML, Katamba and Hyman [28] consider the nasalisation of D in (18) to only take place after hardening and homorganic nasal assimilation have made the segments in the ML target NC very similar to each other. As shown in (19) ML results from the fusion of the nasal nodes (motivated by the OCP), after which nasality spreads to the potential nasal bearing unit. The process as shown in (19) is adapted from Katamba and Hyman [28: 199].

(19)



There is no ML with voiceless stops or fricatives because they are not potential nasality bearing units. The nasality bearing units derive from what Katamba and Hyman [28] term *archiphonemes* represented as /B L J G/, surfacing as the voiced segments /b d j g/ after nasals and as /β l y Ø/ elsewhere, respectively. This parallels the hardening cases discussed for Bemba. Consider now that Luganda unlike Bemba also has underlying voiced obstruents in its consonantal inventory. The question is whether these will also trigger ML. It turns out that they do not. (The Luganda 1st person singular subject nasal prefix in (20) is syllabic and tone bearing).

(20)	a.	Ǹ-bàmà	→	m̩̀bámá	'I rush'
	b.	Ǹ-dùmà	→	ǹ̩dúmá	'I bawl'
	c.	Ǹ-jéémá	→	ɲ̩̀jéémá	'I rebel'
	d.	Ǹ-gèmèlà	→	ŋ̩̀gémúlá	'I bring a gift'

These data assert the fact that ML only affects derived voiced segments. Katamba and Hyman [28] implement this by treating non-derived voiced obstruents (as in (20)) as lexically specified as [- sonorant] and therefore unable to trigger the nasal spread rule. Derived voiced obstruents are, on the other hand, specified as [o sonorant], i.e. have no specification for sonorancy, and are as such able to trigger the nasal spread rule.

[27] This can be solved by having different representations for voiced versus voiceless stops as proposed in for example Piggott [45].

The desired outcome therefore seems to be able to differentiate two identical surface segments with respect to ML. We can thus reformulate the characteristic of ML with respect to the targets of the rule to not simply refer to voiced obstruents but rather to voiced obstruents resulting from hardening.

Within the framework of Optimality Theory, Prince and Smolensky [47] and Peng [44] treat ML as reflecting a crucial ranking between a constraint requiring uniformity between inputs and outputs and a constraint specific to ML as depicted with the constraints and rankings in (21).[28]

(21) (i) Constraints

ML

UNIFORMITY IO (UNIF IO): No element of the output has multiple correspondents in the input (McCarthy and Prince [38])

NOGEMINATE (NOGEM) (Itô and Mester [26])

(ii) Rankings

Ganda variant:	UNIF IO » ML » NOGEM
Lamba variant:	NOGEM » ML » UNIF IO

UNIF IO favours gemination because it demands that output segments that correspond to the NC undergoing ML must correspond to unique entities in the input i.e. have a one-to-one relation between output and input. This results in gemination under ML (Ganda variant). A violation of this constraint implies no gemination where an input NC surfaces as a simplex nasal that is a correspondent of both segments in the input NC. This is reflected in lower ranked UNIF IO in the Lamba variant (21, ii). We would accordingly have to have different ML constraints to express the Kwanyama and the UMbundu variants. Thus while an OT account may derive the facts of ML, it requires four different constraints to characterise the variants of ML.

Of importance though is the underlying basic assumption of Peng's [44] analysis: ML is the nasalisation of the [- continuant] segments /β, l, r, y, ɣ/. We thus again see here that these segments (which undergo hardening) are the main targets of ML whether we regard them to become obstruents that then undergo ML (Herbert [20], Katamba and Hyman [28], Piggott [45]) or as merely themselves being nasalised (Peng [43]). I will now cast ML under a licensing GP analysis in the following section, and show that the facts can be derived under one underlying principle.

4. Domain licensing and ML

As already pointed out, a crucial aspect of ML is the fact that only a hardened (voiced) NC undergoes the rule when followed by another voiced NC. Hardening has been characterised in section 2 as occurring under the influence of the rightward spread of (L) from the nasal to the stem-initial segment. Hardening results from the head switching of (L) from its origin to its target, i.e. an (L) head spreads from a nasal to assume a non-head position in the stem-initial segment. Consider an illustration of this in the partial structure in (22) where the lateral /l/ becomes /d/ as in Bemba for example.

[28] Naturally, there are other constraints at play to, for example, prevent deletion or de-nasalisation of the nasal triggers being used as strategies to circumvent ML violations. The ML constraint also has two variants (ML1 & ML2) to differentiate between cases where the rule only applies before NC's and those where it also applies before a simplex nasal.

(22)

input				output 1			output 2		
C_1	V	C_2…	→	C_1	V	C_3…	C_1	V	C_4…
x	x	x		x	x	x	x	x	x
|		|		|		|	|		|
$\underline{L}$				$\underline{L}$	⟶	L	$\underline{L}$	⟶	$\underline{L}$
R		R		R		$\underline{R}$	R		R
/N/		/l/		/n/		/d/	/n/		/n/

In (22), headed (L) in C_1 (headedness is here indicated by underlining) spreads from the nasal to /l/ in C_2 where it assumes operator position (C_3). This change in headship from source to target phonological expression is what has been referred to as switching. Switching of heads in output 1 results in (R) assuming head position in C_3 and thereby hardening /l/ to [d].

Output 2 shows the result of the failure of switching; (L) retains its head position in C_4, no hardening takes place and /l/ is interpreted as [n]. This then results in a geminate nasal, which depending on the language may be licensed or not. The rightward spreading of (L) in combination with the failure of switching thus explains the effects of ML. The question is of course why switching should fail to take place. In Kula and Marten [35], it is speculated that switching may require external licensing that fails to take place in this configuration. I believe this idea is essentially correct (Kula [34]) and here investigate the implications of such as assumption.

Since licensing defines phonological domains we may regard ML as indicating some restriction on phonological domains in terms of structure or size. Since the NC's in ML involve a change from lexical to derived segments and generally applies within the root of Bantu stems one possibility would be to regard it as a response to the retention of lexical contrast in the root, where the retention of lexical contrast is to be understood here as the retention of non-derived segments. [29] (23) gives, at least for Bemba, the possible root structures from the most unmarked to the most marked.[30]

(23)

	root	C_1	C_2	
a.	C_1VC_2-	voiceless	voiceless	most unmarked
b.	C_1VNC_2-	voiceless	voiceless	↓
c.	C_1VNC_2-	voiceless	voiced	↓
d.	NC_1VNC_2-	voiceless	voiceless	↓
e.	NC_1VNC_2-	voiceless	voiced	↓
f.	NC_1VNC_2-	voiced	voiceless	↓
*g.	NC_1VNC_2-	voiced	voiced	most marked

(23g) is the only form where both consonants within the root are non-lexical and would presumably create problems for lexical retrieval. The vowel is however lexical and should be able to aid the tracking process. If (23g) is problematic for lexical retrieval it would also imply that outputs of phonology are not stored in the lexicon, which is a matter of some debate.

I will rather pursue the idea that switching fails to be licensed under specific conditions and for which we will need to extend our understanding of licensing within a phonological domain.

[29] This is not an absurd assumption, since we know from derived environment effects, that derived segments may function differently from non-derived ones, as also seen in Luganda in section 3.1.

[30] The canonical structure of the Bantu verb is [prefixes [root] suffixes]. The root is predominantly of CVC- shape. In Kula [34] I argue that the root provides the most salient information for the lexical access and retrieval of morphologically complex verbs. I here (23) include the initial N that is technically not part of the root but is in a C-to-C government relation with the root initial consonant. The data in (23d-g) thus refer to the second phonological domain that contains the prefix and the root.

4.1 Microscopic view on licensing

In the basic mechanism of GP, all positions within a phonological domain must be licensed. The precise manner in which such licensing applies is exemplified in the Licensing Inheritance Principle of Harris [16] given here in (24).

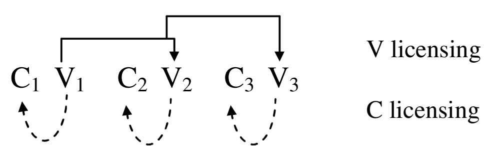
(24) *Licensing Inheritance Principle*
A licensing position inherits its autosegmental licensing potential from its licensor.

Prosodic licensing and autosegmental licensing
prosodic-licensing sanctions the presence of positions at different levels of projection from the skeletal tier upwards.

autosegmental-licensing determines the melodic content of a particular position.

The Licensing Inheritance Principle (LIP) implies that all licensing within a domain is sanctioned by inheritance from one position to another. LIP sanctions the presence of positions and then the segments that may occupy these positions. The head (unlicensed position) of a phonological domain is always a V-position. Thus licensing emanates from the head V-position that licenses the other V-positions in the domain. V-positions then license the C-positions in their CV pairs. Consider for illustration the flow of licensing in the phonological domain in (25) where the head V-position is V_1.

(25)



The domain head V_1 licenses V_2, which then licenses V_3. The V-positions are now licensed to host autosegmental content but they are also licensed to license other constituents. Thus in (25) V_1 licenses C_1, V_2 licenses C_2 and V_3 licenses C_3. Every position in the domain is (apart from the head) now licensed.

As already illustrated by (25), it is necessary to perceive of different kinds of licensing functions. Thus in (25) we have the licensing of positions, as well as the idea of a position acquiring licensing potential so that it can itself be a licensor. I will develop the idea that every process and action within a phonological domain must be licensed in some way. This, I think, is already implied in Government Phonology's *Non-arbitrariness* fundamental principle (Kaye, Lowenstamm and Vergnaud [32: 194]), which demands that there must be some non-arbitrary relation between a phonological process and the context in which it takes place. We can interpret this to mean that phonological processes must be licensed to take place in the contexts that they do. This brings us to the idea of licensing potential. How much licensing potential does a position have, and can we in some way, think of this potential as deteriorating as more licensing tasks are performed, so that a saturation point when no more licensing can be done is reached? Let us first go further into the different types of licensing and their relation to each other.

Licensing within a domain can be characterised as being of three different types that range from the most basic, and hence universal, to more language specific licensing. The most basic kind of licensing will consist of licensing that sanctions skeletal positions in which C's and V's are hosted. By this kind of licensing we get sequences of CV's and surface non-empty CV sequences. The second type of licensing will introduce government licensing and p-licensing. Government licensing is a kind of licensing developed in Charette [7] where it is argued that for a position to be a governor, it must be specifically licensed for this task. I will claim that in essence or by extension of the LIP, this means that a position that sanctions government licensing must itself be licensed for this task. Government licensing gives the possibility of having consonant clusters, which are mostly of the increasing sonority type referred to here as TR clusters. P-licensing introduces another possibility of sanctioning empty positions other than C-to-C government. This introduces consonant clusters of decreasing sonority (RT clusters) and also allows for more than two consonant clusters. The third and least basic type of licensing will involve language specific licensing of processes such as the licensing of changes in melodic structure in hardening processes. This type of licensing is language specific and represents the diverse phonologies of languages. The three licensing types are illustrated in (26).

(26) a.

type I	»	type II	»	type III
Basic (universal)		*Less basic*		*Language specific*
position licensing		government licensing		licensing processes
V-positions		licensing gov. licensors		licensing changes in melodic structure
C-positions		p-licensing		

b. CV » CC (TR) » CC (RT) » processes

(26a) expresses an implicational relation between the different types of licensing, so that having licensing type II implies having licensing type I. Important though is that licensing type II is parametric as are the licensing processes within it since we still want to express the fact that CV languages have processes (type III licensing) and also within type II licensing, that languages that have TR clusters do not necessarily also have RT clusters (26b). Thus in a more general sense prosodic licensing in the LIP is prior to autosegmental licensing.

In V-positions (licensing type I), which are central to the whole licensing enterprise, we can also think of two types of licensing involving licensing within the V-domain and licensing outside this domain. I will term these two types of licensing as local and non-local respectively, with the view that local licensing is prior to non-local licensing as depicted in (27).

(27)

a. V-licensing <
- within its domain (nuclear projection) - local licensing
- outside its domain (CV level) - non-local licensing

b. local licensing » non-local licensing

We can thus trace a licensing path in some language (x) with positive parameter settings as yielding the licensing hierarchy in (28):

(28) Hierarchy of licensing functions in a domain

local licensing » non-local licensing » licensing government licensors » government licensing » p-licensing » licensing processes {$p^1 \ldots p^n$}

I now return to the problem of ML, which will be dealt with firstly in its general form when it is triggered by an NC, and secondly when it is triggered by a nasal.

4.2 ML and syllable structure

With respect to syllable structure or phonotactic constraints, the question is why does ML apply in the sequence NCvNCv and not in NCvCvNCv? There seems to be a cross-linguistic restriction in having the same kind of cluster in a sequence. Consider that in

(29) a sequence of the same cluster is barred while a combination in either order is permissible.

(29) *TRvTRv   TRvRT (=TRT)
     *RTvRTv   RTvTR (= RTR)

I will interpret (29) as reflecting a restriction on proper governors and government licensors since TR clusters require government and RT clusters require proper government. Thus a sequence of two TR clusters fails to be supported because the intervening V-position cannot have the dual role of being a government licensor for the TR cluster on its left as well as (indirectly) for that on its right. This is shown in (30). (*gl* stands for 'government licensing' and *lgl* for 'licensing government licensing').

(30)

```
     gl           *lgl
 ┌───────────┐┌───────────┐
 ↓                        ↓          (non-local » local)
 C1 V1 C2 V2 C3 V3 C4 V4…
 |  |  |  |  |  |  |  |
 x  x  x  x  x  x  x  x
 |     |  |  |     |  |
 T     R  v  T     R  v…
```

In (30) V_2 (government) licenses C_1 to be a governor so that it can govern C_2, a relation that makes V_1 inaudible. To license two TR clusters V_2 would in addition have to license V_4 to be a government licensor so that it can in turn (government) license C_3 to be a governor for C_4. That this fails to take place shows that a V-position that is a government licensor can itself not license another V-position to be a government licensor. I take this restricted potential to follow from the fact that a nucleus that acts as a government licensor has itself only inherited this property from the domain head through the licensing path. The same applies to the proper governor in RT clusters where the intervening V-position in a sequence of two RT clusters cannot act both as a proper governor and as a licensor of proper government. I express this as a form of licensing saturation where a licensor is in some way limited with respect to its licensing potential.

(31) Licensing Saturation (I)

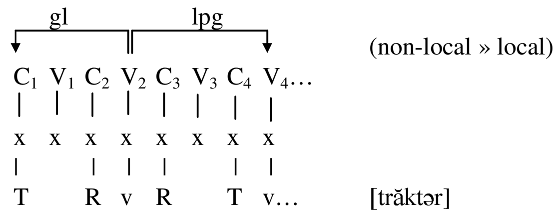
Government licensors may not license other V-positions to be government licensors.
Proper governors may not license other V-positions to be proper governors.

Licensing restrictions have been expressed in GP with respect to undergoers being unable to be triggers. Thus governed positions may not themselves govern (Sigetvári and Dienes [57]) and properly governed positions may not themselves be proper governors (Charette [7]). (31) on the other hand, expresses that triggers may not be multiple triggers. In this respect governors and proper governors may not be multiple governors and proper governors, respectively.[31]

The possibility of having a sequence of two different clusters follows because different kinds of licensing are involved. The intervening nucleus may act as a government licensor and a licensor of proper government.

[31] In earlier versions of GP this was, for government, expressed at the constituent level by having binary branching structures so that a governor could only govern one dependent.

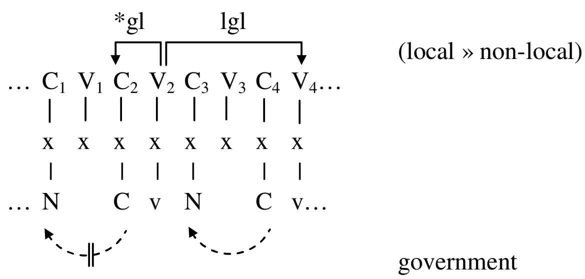
(32)



In (32) V_2 acts as a government licensor to C_1 and licenses V_4 to be a proper governor so that it can proper govern V_3 to remain inaudible, hence licit words like English [trăktər]. The reverse relation is also possible to give RTvTR sequences in Slavic languages (Scheer [53]) for example. An interesting aspect in the licensing of sequences of clusters in (30) and (32) is that non-local licensing precedes local licensing as opposed to the earlier description in (27). Notice however, that at this point we are dealing with type II licensing. So the relation *local* » *non-local* only strictly holds in type I licensing.

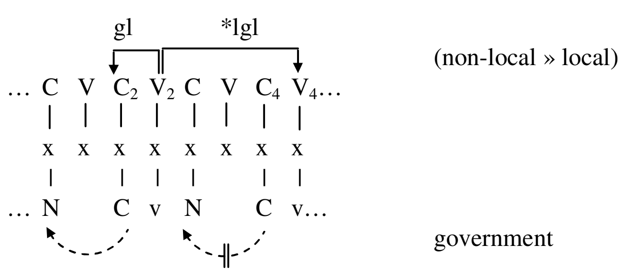
Returning now to the ML cases we can view the general version of the rule as resulting from licensing saturation as shown in (33). For the licensing relations in the Bantu verb, I take the head nucleus to be located in the root (CVC) because the root acts as the head of the phonological domain structure.

(33) *NCvNCv…



V_2 licenses V_4 to be a government licensor so that it can license C_4 to be a governor for C_3. By so doing, it is unable to also license C_2 to be a governor for C_1. Government between C_2 and C_1 therefore fails to take place. This reflects the Lamba variant of the rule where local licensing takes precedence over non-local licensing. The opposite of this is illustrated by the Kwanyama variant where the second NC undergoes ML.

(34) *Kwanyama variant*: ŋgombe → oŋgobe ‘cattle’



In (34) non-local licensing has precedence over local licensing, resulting in the second NC undergoing ML.

We can thus, by licensing saturation as given in (31), account for ML as the failure of government to take place because the potential governing head fails to be licensed to be a governor. More specifically this must be interpreted as the failure of switching under (L) spreading from the nasal to the stem-initial position. Under this view we can then account for why voiceless NC's never undergo ML; switching never has to be licensed in these clusters. Under the same reasoning, a sequence of voiced and voiceless NC's is also possible because switching is only licensed once in the voiced NC. Thus failure of government is really being used as a cover term for failure of switching. This explains why assimilation is still seen to apply.

Consider now that we have UMbundu where the sequence NCvNC is possible in for example *ndanda* 'I speak'. Pending further investigation of this language and variant of ML, two avenues are possible. The first is to view the UMbundu variant as reflecting the parametric lack of application of ML. In this case we would have to give a different treatment to the simplification of voiced NC's before nasals. This is appealing but would cost us the licensing saturation generalisation that nicely extends to RT and TR cluster distribution cross-linguistically. The second is to view the lack of ML as a reflection of the presence of prenasalised segments rather than clusters in the language. This would indeed be a useful test to differentiate between prenasalised segments and NC clusters.

I leave these matters to future research and rather consider a second version of licensing saturation that seeks to explain the application of ML before simplex nasals and more generally relates this issue to phonological domain size.

4.3 Licensing saturation II

If we consider that the failure of government under licensing saturation is a reflection of the fact that government fails because switching fails to be licensed, then we may also develop another version of licensing saturation in which it is less local and viewed over the whole domain. The reasoning follows from the fact that since there is a limit on word size in language, which varies from language to language, then we can perceive of licensing saturation points that define the restrictions on word size per language. This saturation point may be defined over the whole domain or over V-positions.

The distinction between more basic and less basic licensing functions distinguishes between less marked structure and more marked structure. This means that simple syllable structures that only require basic licensing, such as a CV language type, require less licensing than languages with CC clusters that also need type II licensing. A characterisation of saturation over a domain must therefore oppose the syllable structure type with licensing potential in relation to domain size. This is depicted in (35) where SS stands for syllable structure complexity, LP for licensing potential and DS for domain size.

(35) Defining saturation points

	SS (x)	LP (z)	DS (licensing path) (y)
a. (i)	increase	increase	decrease
(ii)	decrease	decrease	increase

b. (i) $z = x+y$ where $z = (x-1) + (y+1)$

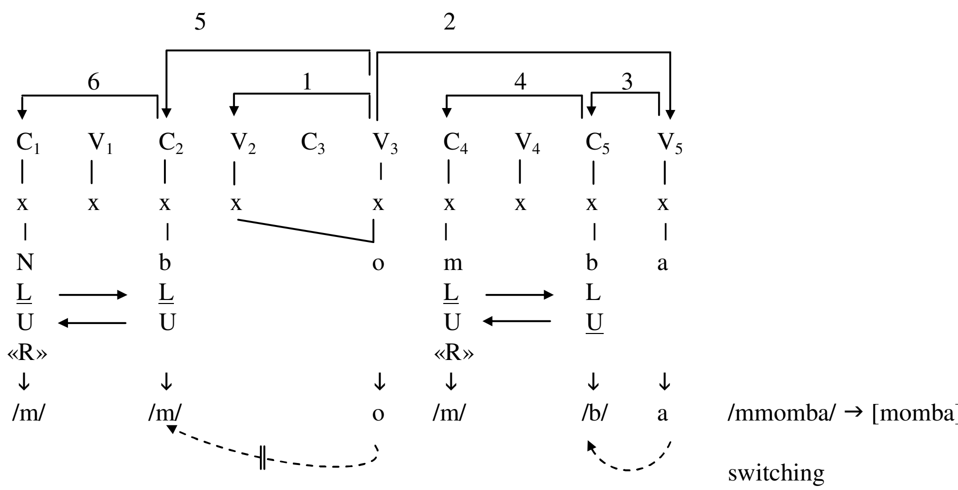
(ii) $LP = SS\downarrow + DS\uparrow$ or $LP = SS\uparrow + DS\downarrow$

(iii) $z = k$?

In (35a, i) increasing the complexity of SS also increases the LP needed to license such structure in which case LP will be depleted quicker from the greater demand resulting in a shorter (but more complex) licensing path and hence a shorter phonological domain. The converse relation holds for (35a, ii); a decreased complexity in SS requires less LP to be sanctioned and thus can accommodate more structure which means an increase in phonological domain size. This relation can be represented as in (35b, i&ii) which shows that licensing potential (z) represents a functional relation between syllable structure complexity (x) and domain size (y). The question for the characterisation of licensing saturation, expressed in (35b, iii), is whether we can equate LP to a constant (k) and further, whether such a constant should be deemed universal.

Under such a view of licensing saturation we could regard ML as resulting from a saturation point being reached in the resolution of an increase in SS complexity (the need to license voiced NC's) which implies more licensing functions that demand increased LP. Such a saturation point will be regarded as varying from language to language so that the Lamba and Kwanyama variant have a higher licensing point (and are thus able to license more processes within a domain) than the Ganda variant where ML also applies before a simplex nasal. Consider in this instance the Lamba variant with the Bemba example in (36). Numbered licensing relations are not intended to represent order of occurrence.

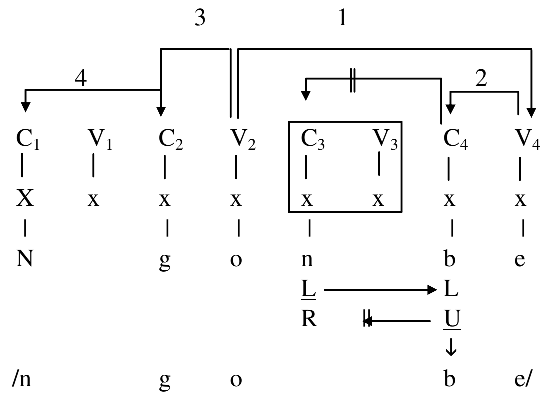
(36) N + βó:mba → mmó:mba *mbó:mba 'I work'



In (36), the head of the domain is the root vowel V_3, which is part of a long vowel. I consider the systematic long vowel found before all NC clusters to be a result of historical derivation as in assumed in the Bantu literature. In the synchronic phonology, this vowel has the additional task of licensing the following nucleus to license government in the second NC cluster. V_3 thus governs and licenses its dependent V_2, in order to define the long vowel. V_3 also licences the final position V_5 to exist and to be a government-licensor, so that V_5 can license C_5 to govern C_4. V_5 also licenses switching in C_5 so that the spreading L head from C_4 is operator in C_5. In addition, V_3 also licenses C_2 to exist and to govern C_1. ML results from the fact that under licensing saturation II, V_3 fails to license switching in C_2 where as a result the (L) element retains its head status. For ease of exposition only the licensing relations relevant to ML are given here but V_3 also licenses all the other processes in the domain whether directly or indirectly.

In the Kwanyama variant switching is sanctioned but the spread of a place element is not, so homorganicity fails to be expressed resulting in deletion of the deviant structure. The process is illustrated in (37) where the numbering reflects the order of licensing relations.

(37) ŋgombe → oŋgobe 'cattle'



The head nucleus V_2 licenses V_4 to exist and to government license C_4. V_2 also licenses C_2 to exist and to be a government licensor. Failure of C_4 to govern C_3 means failure to impose its place element on C_3 and consequently, the lack of a government relation means the intervening nucleus fails to be licensed under the ECP and is stray erased with V_3 indicated by the framed structure in (37).

Finally in the cases where ML applies before a nasal we can relate this to a co-occurrence restriction that bars a non-head (L) in the presence of an (L)-head. In other words, switching fails to be licensed in the presence of an (L)-head in the domain. This is a mirror image of the process involved in the general version of ML as can be seen from the co-occurrence restrictions the two processes are derived by:

(38) ML1: presence of switching in domain bars another application of switching.

ML2: presence of (L) head in domain demands any other (L) to also be head.

The boundaries of licensing saturation II, in terms of an actual saturation point, still need to be determined in order to constrain the principle. The aim here was to show that it is a viable undertaking to try to express the fact that languages respond differently with respect to the order in which they license processes.

We have seen that ML results from the inability to license particular processes or relations, in particular switching and government, in response to a restriction on the complexity that can be expressed in a phonological domain in Bantu. In fact, the fact that various other processes, such as post-nasal voicing, stop deletion and nasal deletion (mostly before a fricative), which reflect a preference for voiceless NC's, apply in Bantu, makes the idea that voiced NC's fail to be licensed in particular instances, not so surprising.[32]

5. Conclusion

The notion of Licensing Inheritance suggests that licensing potential is spread in varying degrees in a phonological domain: recessive V-positions depend on preceding V-positions for their licensing tasks. Because of this, a V-position that has itself licensed a preceding or following C-position to be a governor cannot also license another V-position for the same task. By virtue of its own action, a government licensor has depleted its licensing potential for further tasks of the same nature. This has been termed licensing saturation. This failure to license government after depletion of licensing potential has been interpreted as the failure to license switching in NC clusters in Bantu that then gives the ML effects.

By the treatment of licensing as being of three different types that stand in an implicational relation, the observation that CV is the simplest syllable type finds

[32] But see Rosenthall [48] for the view that voiced prenasalised stops are preferred in Bantu.

explanation. The hierarchical order of licensing types simultaneously unfolds syllable structure complexity.

Finally, the second version of licensing saturation, that assumes an upper limit on licensing potential, draws a relation between syllable structure complexity and phonological domain size, so that a flat licensing path has more potential for increased phonological domain size.

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