HEMANGA DUTTA

STRENGTH ASYMMETRIES AND PALI GEMINATES: AN OT ACCOUNT

ABSTRACT: This paper addresses the notion of phonological strength asymmetries and patterns that the segments display with reference to gemination processes in Pali. Segmental properties inherent in a segment and cross linguistic well formedness conditions play a significant role in triggering gemination. Pali data on gemination derived as a process of assimilation from its source language Sanskrit brings to the fore that whenever there are two adjacent obstruent clusters, one in the coda position and another in the onset position, the segment in the coda position assimilates to the following consonant in the onset position and thereby strengthens the claim of positional privilege theory and onset coda asymmetry in segmental distribution. The same phonological process applied when a flap /r/ occupies the coda position followed by an obstruent in the onset position. However, what is interesting to observe is that whenever the segment in the onset position is either a liquid or a nasal being preceded by an obstruent in the coda position of the previous syllable the onset segment assimilates to the preceding coda segment. It can be argued in the framework of Complexity Condition (Kaye et al. 1990, Rice 1992) which claims that a more complex segment is a better candidate to be assimilated whereas the less complex segment is susceptible to alternation. Hence I propose the constraints here Agree CC>> *GG>>*LL>>*NN in an Optimality Theory model (Prince and Smolensky 1993).

KEYWORDS: segmental distribution, constraint rankings, gemination, optimality.

0. INTRODUCTION

The present study is based on the assumption that there lies a positional asymmetry in the patterning of segmental speech sounds in a phonological string. Segments in different positions exhibit asymmetric articulatory and acoustic properties. As it turns out exploring that phenomenon leads us to unravel the thread running through the central areas of word phonology. Segmental distribution and phonological asymmetries in relation to different phonological processes across world languages can be explained on an explicit canvas by taking into account many theories.
which emerged in the realm of phonological literature such as licensing-by-cue approach, Perceptibility map theory, Dispersion theory, Pure prominence model or Positional privilege approach to mention a few. Licensing-by-cue model developed by Steriade in 1997, claims that perceptual factors are responsible for assigning a particular position to be strong or weak. In other words, features are licensed in those positions which phonetic conditions make maximally robust and perceptually prominent. P-map theory (Steriade 2001), a mental representation that captures the degree of distinctiveness of different contrasts in various positions addresses the notion of phonological strength in an indirect fashion. The perception of phonological similarity is influenced by auditory factors such as the availability of cues to the relevant contrast. It has been found cross linguistically that marked structures are unevenly distributed throughout language, with strong or privileged positions allowing a greater range of structures and neutralization in weak positions. In the patterning of segmental speech sounds in a phonological set up there is a correlation between the prosodic environment and the phonological licensing of features. According to Positional privilege theory (Beckman 1998) there are some linguistic positions such as root initial syllables, stressed syllables, syllable onsets, roots, long vowels etc. which enjoy a special perceptual advantage in the processing system of the languages via psycholinguistic or phonetic prominence over the component of non-privileged positions which include non-initial syllables, unstressed syllables, syllable codas, affixes, clitics, function words and short vowels, etc. The privileged positions can broadly be divided into two sub components: psycholinguistic prominence and phonetic prominence. Whereas the former refers to those positions bearing the heaviest burden of lexical storage and retrieval as well as processing, phonetic prominence takes into consideration various physical cues that include increased duration or amplitude, pitch extreme, and, release burst. Similar lines of thought were developed by Backley and Kuniya in 2009 in their Element theory according to which prosody does not only provide the organizational aspect but also the contents of melody. Strong or privileged positions frequently allow a greater range of licensing of features. As for instance, the laryngeal feature [+s.g] is mostly attested in the word onset position (Barnes 2006). Onsets tend to allow a greater range of structures than codas. Thus onsets can be said to
be stronger than codas on the ground that codas are prone to deletion or change whereas onsets are found to be prone to alternation cross linguistically (Beckman 1998). Strength relations pertaining to the onset/coda asymmetry can be attributed not only to privileged positions under the rubric of phonological licensing of features but also to concrete and empirical phonetic evidence. It further implies that there is a correlation between physical acoustic cues and prosodic position in a phonological domain.

In this paper, I am going to reflect on the process of Pali geminates with reference to onset/coda asymmetry and the notion of phonological strength relations. The data in the paper shows that adjacent consonants have to form a geminate. And the geminate formed is the lowest on the sonority scale. When the adjacent consonants are of the same sonority, the coda assimilates. But if there is an asymmetric sonority value between the two adjacent segments the onset too assimilates. Section 1. in the paper focuses on the phonological process of gemination and its relationship with segmental distribution. Section 2. talks about the literature on onset/coda asymmetry cross linguistically from a wide range of perspectives such as phonetic and phonological approaches, language evolution theories, and, psycho-neuro linguistic evidence. Section 3. is on Pali geminates and their Sanskrit counterparts with a focus on the formulation of the general rules governing the doubling of consonants in Pali. An attempt has been made in section 4. to consider the Pali data on geminates from the perspective of complexity condition (Kaye et al. 1990, Rice 1992). Section 5. tries to explain the patterns of the Pali gemination process in the constraint based approach of Optimality theory (Prince and Smolensky 1993) which is followed by a general summary and conclusion in Section 6.

1. SEGMENTAL DISTRIBUTION AND GEMINATION

The process of gemination too adheres to the laws of segmental distribution and segmental asymmetries cross linguistically. Gemination can be considered as a process of fortition as geminate consonants are reported to resist lenition processes, even when occupying traditional
lenition sites, whereas single consonantal segments in the same locations readily undergo segmental weakening. Backley (2001) shows that singletons behave like dependents, while geminates behave like heads. Some segments are frequently geminated and some rarely undergo gemination. Geminates are cross linguistically marked. The relative sonority of a geminate positively correlates with its markedness (Kawahara 2005). The universal ranking is shown in (1):

\[
(1) \quad \text{*Geminates Glide} \gg \text{*Geminates Liquid} \gg \text{*Geminates Nasal}
\]

\[
\text{*GG} \gg \text{*LL} \gg \text{*NN}
\]

This is supported by cross linguistic geminate inventories and phonological alternations (Podesva 2002). Podesva (2002) hypothesizes that a phonological dispreference against sonorant geminates exists because these geminates are easily confusable with corresponding singletons. Sonorants are spectrally continuous with flanking vowels and as a result their constriction durations are difficult to perceive. Adaptive dispersion theory (Flemming 1995), P-map theory (Steriade 2001), and speech perception highlight similar issues. Mielke (2007) claims that sonorant geminates are rarely found in the database of geminate inventories of almost 500 languages. Sonorant geminates are cross linguistically marked.

2. ONSET AND CODA ASYMMETRY:
A CROSS LINGUISTIC SURVEY

Onsets are considered to be obligatory components whereas there is no language requiring an obligatory coda in its canonical syllable structure. The asymmetry between onset and coda lies in the fact that onsets allow more open classes of consonants than codas. The processes of strengthening such as aspiration and lengthening are assigned to the onset position whereas codas are subject to weakening processes such as devoicing. In the same fashion it is observed that the phonological phenomenon of deletion is more pronounced in the coda position where insertion is very rare. Consonants are inserted in the form of glides or glottal stops in many languages requiring obligatory onsets. The asymmetry evident in the behavior of onsets and codas can be found in
the uncontroversial observation that children acquire open syllables prior to closed syllables (see Locke 1993). Even case studies on language acquisition reveal the fact that CV units are acquired by babies prior to CVC units. The Maximal Onset Principle in phonology which provides a favored position to onsets as compared to codas in the world languages is indeed a part of UG. Language change also favors the phenomenon of onset/coda distribution in world languages. As for instance, Bybee (2001) claims that CVC syllables are derived from CV syllables on account of a loss of vowel in CVCV sequences. The loss of schwa in the word final and foot final positions (Pandey 1989) has given rise to CVC syllables from CVCV sequences. The ‘lost vowel’ hypothesis for the emergence of closed syllables can account for exceptional complex consonant clusters in certain languages. In this context mention must be made of Gondi (Andres 1977, Steever 1998) which shows asymmetry in the distribution of consonants at word edges and word internally. The onset/coda debate can be analyzed with reference to language evolution theory too, which claims that the seeds of human linguistic ability can be traced back to human muscular control for articulation (Lieberman 2002). Even Carstairs-McCarthy (1999) has argued along similar lines with special reference to CV units. It tries to bring to fore the notion that onsets have greater perceptual distinctness than codas. Pandey (2007) maintains that the preponderance of open syllables in world languages has its bearings upon the biological motivation of underscoring the increased resonance over the production of syllables, a function which codas are not able to perform in an efficient fashion. Indeed, the literature on Psycholinguistics and Neurolinguistics related to speech processing makes the debate pertaining to onset/coda asymmetry more convincing and fascinating. The speakers of languages with both CV and CVC type syllables, show preference for the former. Orthography too bears ample testimony to such processing. Korean speakers prefer CV type segmentation to VC type segmentation, although Korean has both types of syllables represented in its orthography, known as Hankul as put forth by Derwing, Yoon, and Cho (1993), in a word blend experiment. The phonetic study conducted by Engestrand and Krull (2000) on Dutch spontaneous speech shows the preponderance of derived CV units which emerge as an outcome of nasal deletion, vowel contraction, vowel epenthesis, cluster simplification, etc. although Dutch has VC syllables in its phonemic inventory.
3. PALI GEMINATES AND THEIR SANSKRIT COUNTERPARTS

In this section, I am going to consider some geminates from Pali and compare them to their Sanskrit counterparts. The data is extracted from Wilhelm (1955) as shown in (2).

<table>
<thead>
<tr>
<th>Sanskrit Roots</th>
<th>Pali Counterparts</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. atma (soul)</td>
<td>atta</td>
</tr>
<tr>
<td>b. ṣabdə (word)</td>
<td>ṣaddə</td>
</tr>
<tr>
<td>c. ṣaptə (seven)</td>
<td>ṣatto</td>
</tr>
<tr>
<td>d. suptə (asleep)</td>
<td>suatto</td>
</tr>
<tr>
<td>e. gupta (secret)</td>
<td>gutta</td>
</tr>
<tr>
<td>f. muktə (free)</td>
<td>muttə</td>
</tr>
<tr>
<td>g. ṣakrə (curved)</td>
<td>ṣakkə</td>
</tr>
<tr>
<td>h. patə (pot)</td>
<td>pattə</td>
</tr>
<tr>
<td>i. sukə (light)</td>
<td>sukkə</td>
</tr>
<tr>
<td>j. ṭənə (moment)</td>
<td>ṭəngə</td>
</tr>
<tr>
<td>k. sərbə (all)</td>
<td>səbbə</td>
</tr>
<tr>
<td>l. uktə (this)</td>
<td>uttə</td>
</tr>
<tr>
<td>m. utkələ (Orissa)</td>
<td>ukkələ</td>
</tr>
<tr>
<td>n. pakva (cook)</td>
<td>pakkə</td>
</tr>
<tr>
<td>o. pənə (leaves)</td>
<td>pənən</td>
</tr>
<tr>
<td>p. kərmə (work)</td>
<td>kəmmə</td>
</tr>
<tr>
<td>q. pudgələ (person)</td>
<td>puggələ</td>
</tr>
<tr>
<td>r. sətpuruśə (good person)</td>
<td>səppuruśə</td>
</tr>
</tbody>
</table>

The Pali data on gemination are instances of assimilation from its source language Sanskrit. The close investigation of the Pali geminates drives home the point that mostly the segment in the onset position is not subject to change whereas the segment in the coda position is prone to change. Indeed, the segment in the coda position assimilates to the segment in the onset position. As for instance, consider the following instances shown below in (3):
Hence from the data on Pali it is revealed that whenever there are two adjacent obstruent clusters, one in the coda position and another in the onset position, the segment in the coda position assimilates to the following consonant in the onset position and thereby establishes the claim of positional privilege and onset/coda asymmetry in distribution. Similar logic will be applicable if the coda is occupied by a flap /ɾ/ followed by an obstruent in the onset position, as we have seen in the example (2k):

sərbə (all) : səbbə.

But what is interesting to observe is that whenever the segment in the onset position is either a liquid or nasal being preceded by an obstruent in the coda position of the previous syllable, the onset segment assimilates to the preceding coda segment. For illustration, consider the following examples shown in (4):

(4) a. atma (soul) > atta
    b. suklə (light) > sukkə
    c. ləgnə (moment) > ləggə
    d. əgni (fire) > əggi
    e. ʊəkə (curved) > ʊəkkə
    f. putrə (son) > puttə

This phenomenon can be explained with reference to the sonority parameter. We have already seen that whenever there are two adjacent segments of the same sonority value, mostly obstruents, the coda segment assimilates to the following obstruent in the onset position. But when the adjacent segments are of asymmetric sonority value, that is, liquids or nasals in the onset position and obstruents in the coda position, the
former assimilates to the latter and thereby violates the dictum of positional privilege. This can be explained using the framework of the Complexity Condition within the purview of Government Phonology. A more complex segment is a better candidate to be assimilated than a less complex segment is susceptible to alternation. This issue is explained on an explicit canvas in the following section. From the Pali data on gemination some general rules\(^1\) can be formulated governing the principle of doubling of consonants, shown in (5) below:

(5)

i) Stop + Stop = the second consonant gets priority in getting geminated.  
\[ \text{ṛbdṛ} \ (\text{word}) : \text{ṛddṛ} \]

ii) Stop + Nasal = Stop gets priority over nasal to get geminated.  
\[ \text{ṛgni} \ (\text{fire}) : \text{ṛggi} \]
\[ \text{ṛatma} \ (\text{soul}) : \text{ṛatta} \]

iii) Stop + Approximant = Stops gets priority over approximants.  
\[ \text{ṛjogjṛ} \ (\text{deserving}) : \text{ṛjoggo} \]

iv) Stop + rhotic = stops gets priority over rhotics.  
\[ \text{ṛputṛ} \ (\text{son}) : \text{ṛputṛ} \]

v) Stop + Lateral = Stop gets priority over lateral.  
\[ \text{ṛaplu} \ (\text{to jump}) : \text{ṛappu} \]

vi) Rhotic +Nasal = Nasal gets priority.  
\[ \text{ṛkṛmṛ} \ (\text{work}) : \text{ṛkṛmmṛ} \]

vii) Lateral + Approximant = Lateral is given preference over approximant.  
\[ \text{ṛmuljṛ} \ (\text{price}) : \text{ṛmullṛ} \]

\(^1\) However, there are some exceptions to the general pattern. They are left for future analysis. For example:

<table>
<thead>
<tr>
<th>Sanskrit</th>
<th>Pali</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) danta (subdued)</td>
<td>danta NOT datta</td>
</tr>
<tr>
<td>(ii) budh.ta (to know)</td>
<td>buddha NOT butta</td>
</tr>
<tr>
<td>(iii) yajña (sacrifice)</td>
<td>yajja NOT yañña</td>
</tr>
<tr>
<td>(iv) ud.majjati (out from submersion)</td>
<td>ummajjati NOT uddajjati</td>
</tr>
</tbody>
</table>
Here we can take into consideration the internal makeup of the segments which plays a crucial role in triggering a phonological process.

4. PALI GEMINATION AND COMPLEXITY CONDITION

The issue of gemination as seen in the above Pali data brings to our notice a specific pattern of organization in a phonological domain. It can be argued that a more complex segment is a better candidate for assimilation whereas a less complex segment resists alternation or less susceptible to change. Now a question arises as to what the parameters which can define the Complexity Condition in the realm of phonological literature are. The Complexity Condition is one of the strategies which regulate the governing relations among segments in terms of constituent and inter-constituent governments. Complexity Condition is one of the phonological devices adopted by the proponents of Government Phonology (GP) the basis of which lies in the sonority sequencing principles. Kenstowicz (1994) claims that the construction of complex onsets and codas is guided by a sonority sequencing principle which requires onsets to rise in sonority toward the nucleus and codas to fall in sonority from the nucleus. The principles underlying the sonority sequencing principle governing the organization of segments in a syllable or a word are taken into account by elemental composition of consonants and the governing relations existing between them in GP which is addressed as Complexity Condition (Kaye et al. 1990; Rice 1992).

Rice (1992) has argued that greater sonority implies greater complexity. For convenience, consider the following representations shown in (6) for coronal stops, nasals and laterals under the rubric of the theory presented by Rice:
(6) From Rice (1992): Representation of coronal stop, nasal and lateral

Here, SL= Supralaryngeal ; AF= Air Flow; SV= Sonorant Voice

From the above representation it is evident that laterals have more SV structure than nasals and in that scale stops can be placed at the bottom in terms of SV structure. In terms of complexity too stops are the least complex segments which resist assimilation and laterals and rhotics etc. are susceptible to alternation by virtue of the fact that they are more complex in the ladder of complexity hierarchy. For convenience consider the following representation in (7) below:

(7) Representation of stop and lateral

5. PALI GEMINATES AND CONSTRAINT RANKINGS IN OPTIMALITY THEORY

However, the notion of sonority and complexity condition is not a satisfactory explanation to analyze the process of gemination attested
with the Pali data shown above. Both the theories of Government phonology in general and its sub-branch Complexity Condition are predominantly concerned with the issue of phonological representation. These theories, mainly of representation, do not correlate the internal acoustic phonetic cues pertaining to a segment and its distribution in prosodic positions and hence it seems they have failed to capture the generalizations exhibited by the Pali geminate process. Strength asymmetries in the patterning of segments can be addressed in Optimality theory (OT) with the help of markedness constraints (Prince and Smolensky 1993).

OT, enunciated by Prince and Smolensky is usually considered a development of Generative Grammar and a successor of harmonic grammar, which shares its focus on the investigation of universal principles, linguistic typology, and language acquisition. This theory propagates the view that the observed forms of language arise from the interaction between conflicting constraints. The three components such as GEN, CON and EVAL are universal in nature, but the differences existing in the languages of the world can be assigned to different rankings of the universal constraint set and in the light of this phenomenon language acquisition can be viewed as the process of adjusting the rankings of these constraints. OT assumes that there are no language specific restrictions on the input. This is richness of the base, according to which, every grammar can handle every possible input, that is, given any input, it is the task of the GEN to generate an infinite numbers of candidates or possible realizations of that input and it is the grammar of a particular language that determines which of the infinite candidates will be assessed as optimal by EVAL. However, it is the notion of markedness which can throw ample light upon the issue of asymmetry in the patterning of segments. We have already seen in this paper that whenever there are two adjacent segments of same sonority value, mostly obstruents occupying coda positions assimilate to the following obstruent in the onset position. However when the adjacent segments are of asymmetric sonority value, that is, liquids or nasals on the onset position and obstruents in the coda position, the former assimilate to the latter and thereby violate the dictum of positional privilege. This process can be addressed by taking into consideration the following constraints in the OT framework in (8):
a) IDENT C/_V: This is a positional faithfulness constraint which assigns supremacy of onsets over codas in a syllable domain. It assigns a violation for each prevocalic consonant whose features in the output are different than the input.

b) AGREE CC: Adjacent consonants need to be identical. It implies *C1C2

c) *GEMINATE OBSTRUENT: Obstruent geminates are avoided.

Now, consider the example shown in (9) repeated from (3):

(9) Sanskrit      Pali
    uktə (this) > uttə

(10) 

<table>
<thead>
<tr>
<th></th>
<th>AGREE CC</th>
<th>IDENT C/_V</th>
<th>*GEMINATE OBSTRUENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) uktə</td>
<td>⬤</td>
<td>![</td>
<td>⬤</td>
</tr>
<tr>
<td>b) uttə</td>
<td>![</td>
<td>![</td>
<td>⬤</td>
</tr>
<tr>
<td>c) ukkə</td>
<td>⬤</td>
<td>![</td>
<td>![</td>
</tr>
</tbody>
</table>

In this tableau we see that candidate a) violates AGREE CC constraint although it satisfies the lower ranked constraint *GEMINATE OBSTRUENT. The candidate c) too violates the higher ranked constraint IDENT C/_V and lower ranked constraint *GEMINATE OBSTRUENT. But the candidate b) does not violate the higher ranked constraint AGREE CC and INDENT C/_V and hence it emerges as the optimal candidate.

The constraint rankings can be formulated in the following fashion as shown in (11):

(11) AGREE CC>> IDENT C/_V, *GEMINATE OBSTRUENT

The ranking of these constraints won't change even if a flap /ɾ/ occurs in the coda position followed by a stop /b/ in the onset. As for instance, consider the example (12), repeated from (2):
(12) sərbə (all) : səbbə

However, here we can postulate the constraint *GEMINATE SONORANT over *GEMINATE OBSTRUENT as shown in the tableau in (13).

(13)

<table>
<thead>
<tr>
<th>sərbə</th>
<th>AGREE CC</th>
<th>IDENT C/_V</th>
<th>*GEMINATE SONORANT</th>
<th>*GEMINATE OBSTRUENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) sərbə</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) sərtə</td>
<td>*!</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) səbbə</td>
<td></td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

Here, the candidate a) violates the higher ranked constraint AGREE CC and the candidate b) violates not only IDENT C/_V but also *GEMINATE SONORANT. So the winner is the candidate c) which violates only the lowest ranked constraint *GEMINATE OBSTRUENT.

However, this constraint ranking will not be sufficient to explain the process of suklə becoming sukkə not sullə. This process violates the positional privilege theory and IDENT C/_V constraint. This phenomenon implies that whenever the segment in the onset position is either a liquid or nasal being preceded by an obstruent in the coda position of the previous syllable, the onset segment assimilates to the preceding coda segment. So we need to categorize the markedness constraint*GEMINATE SONORANT in a more detailed and specific sense in the order *GG>>*LL>>*NN to be ranked over IDENT C/_V. This constraint implies that geminate glides are rarely found in languages, followed by geminate liquids and geminate nasals.

Consider the following tableau shown in (14) for the candidate:

suklə > sukkə
Here the candidate b) is the winner as here the constraint rankings are AGREE CC>> * GG>>*LL>> *NN >> IDENT C/_V, *GEMINATE OBSTRUENT.

The motivation for such rankings can be attributed to the fact that gemination always takes place; even if the only option is to create a geminate sonorant. Consider the tableau in (15) with two adjacent sonorants:

(15)

<table>
<thead>
<tr>
<th>muljə</th>
<th>AGREE CC</th>
<th>*GG</th>
<th>*LL</th>
<th>*NN</th>
<th>IDENT C/_V</th>
<th>*GEMINATE OBSTRUENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) muljə</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) mullə</td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) mujjə</td>
<td></td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above tableau clearly shows us as to why the AGREE CC constraint should be placed higher than*GEMINATE SONORANT. This implies that the constraints should be arranged in such a fashion that they will satisfy the AGREE CC constraint at the cost of avoiding a geminate sonorant. If the ranking were the reverse, it would be better to leave the consonant sequence disagreeing than to alter it to become a geminate sonorant. Hence, the ranking *LL >> AGREE would incorrectly select *mulyə over mullə. However, among the geminates *GG is always ranked higher than *LL and *NN and thus it prohibits the candidate c) from being the optimal candidate.
6. CONCLUSION

This paper shows on an explicit canvas repair strategies Pali phonology adopts that fit into the debate between onset/coda asymmetry as well as the view on positional faithfulness. The patterns which the Pali geminates display are not random but very systematic. There is a correlation between gemination and prosodic positions in a phonological domain. This paper shows gemination is triggered by a certain consonantal class of segments and certain segments undergo the process of gemination. The motivation for Pali gemination lies in the fact that a more complex segment is a better candidate to be assimilated whereas the less complex segment resists alternations. In terms of complexity too, stops are the least complex segments which resist assimilation, and laterals, approximants, etc. are susceptible to alternation by virtue of the fact that they are more complex in the ladder of complexity hierarchy. As far as the constraint rankings within OT are concerned, Agree CC, and, Ident C/_V are higher ranked than *Geminate obstruent in Pali when there are adjacent segments of similar sonority value, such as obstruents. But whenever the segment in the onset position is either a liquid or a nasal being preceded by an obstruent in the coda position of the previous syllable, the onset segment assimilates to the preceding coda segment and the ordering of the ranking will be Agree CC>> *GG>>*LL>>*NN >> Ident C/_V, *Geminate Obstruent. It is because gemination always takes place even if the only choice is to create a geminate sonorant. But within *Geminate sonorant, the ranking *GG>>*LL>>*NN is very much functional in Pali gemination processes. It supports the cross linguistic observation that geminate glides are a marked feature followed by geminate liquids and geminate nasals.

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