Morphological effects on Pali gemination:
A preliminary study

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ABSTRACT: Around the turn of the 20th century (Childers, 1879; Müller, 1884; Whitney, 1889; Gray, 1899; Duroiselle, 1906), neogrammarians began studying the Pali language and its grammar. One area of particular interest was the phonological process of assimilation. Pali evidences both progressive and regressive assimilation and it is generally the case that a consonant geminate is formed (Krishnaswamy, et al., 2019). Recent studies (Junghare, 1979; Suzuki, 2002a,b; Gupta, 2003; Schmeiser, 2008; Dutta, 2017) have attempted to explain base-medial consonant gemination in phonological terms.

Though these accounts have furthered our understanding of Pali base-medial consonant gemination, very few studies have considered morphological effects on Pali gemination. The current study, though exploratory in nature, suggests that a problem arises in phonological analyses of Pali geminates in that Pali words evidence different cluster realizations based on morphological factors. In short, the study analyzes the effects of affixes on Pali gemination and suggests that an explanation based solely on syllable structure or sonority is insufficient and calls for further research.

Keywords: Pali, gemination, regressive and progressive assimilation, consonant clusters.

RESUMEN: *Efectos morfológicos sobre la geminación en pali: estudio preliminar.* En el cambio del siglo XX (Childers, 1879; Müller, 1884; Whitney, 1889; Gray, 1899; Duroiselle, 1906), los neogramáticos empezaron a estudiar el idioma pali, incluyendo su gramática. Un área de mucho interés durante esa época fue el proceso fonológico de la asimilación. El pali tiene asimilación progresiva, así como regresiva, y por lo general se forma una geminada consonántica (Krishnaswamy, et al., 2019). Algunos estudios más recientes (Junghare, 1979; Suzuki, 2002a,b; Gupta, 2003; Schmeiser, 2008; Dutta, 2017) han tratado de explicar la geminación consonántica en bases léxicas en términos sólo fonológicos. Junghare (1979) se concentra en la escala de sonoridad de Jespersen (1909), haciendo notar que cuando la primera consonante tiene un valor igual o más alto que la segunda consonante, ocurre la asimilación regresiva. Suzuki (2002a,b) prefiere ver el fenómeno en términos de fuerza consonántica, lo cual depende del grado de constricción oral. En estos estudios, el grupo consonántico nasal + consonante se ve como excepción; Schmeiser (2008) ofrece una explicación articulatoria que tiene en cuenta esta excepción.

Aunque estos estudios nos han ayudado a entender mejor cómo funciona la geminación consonántica en bases léxicas en Pali, muy pocos estudios han considerado los efectos morfológicos de la geminación en Pali. El estudio actual, aunque sea exploratorio, sugiere que existe un problema cuando hay un análisis fonológico de las geminadas; el problema es que las geminadas producen diferentes resultados basados en factores morfológicos. En resumen, el estudio analiza los efectos de afijos en la geminación en pali y sugiere que la explicación basada únicamente en la estructura silábica o sonoridad no es suficiente y declara que hay que investigar en más detalle este fenómeno.

Palabras clave: Pali, la geminación, la asimilación progresiva y regresiva, los grupos consonánticos.

1. INTRODUCTION[1]

Pali is a Middle Indo-Aryan language and is no longer actively spoken, though it is the liturgical language of Theravada Buddhism. As such, many still seek out its grammar as it is the primary language used in Theravada Buddhist chants, prayers, and scriptures. Though many detailed grammar textbooks exist (e.g., Collins, 2006), the study of Pali linguistics has, until recently, lagged. Junghare's (1979) study of Pali phonology served as an impetus for a greater understanding of Pali as a linguistic system. Since then, a steady stream of studies (Suzuki, 2002a,b; Gupta, 2003; Schmeiser, 2008; Dutta, 2017) has directly treated issues in Pali phonology or others (Lahiri & Hankamer, 1988; Yu Cho, 1995; Cser, 2000; Wilson, 2001; Wright, 2002; Hock[2], 2010; Krishnaswamy, et al., 2019; Goswami, 2021) have included the language in their discussion pertaining to other languages on the Indian subcontinent; a common area of interest in all these works is Pali gemination.

In Sanskrit, word-medial consonant clusters were often[3] transmitted into Pali as geminates, as a result of either progressive or regressive assimilation, as in (1):

(1)   a. <u>progressive assimilation</u>: Sanskrit: *ca<u>kr</u>a* 'wheel'
       → Pali: *cakka*
      b. <u>regressive assimilation</u>: Sanskrit: *sa<u>pt</u>a* 'seven'
       → Pali: *satta*

Near the turn of the 20th century (Childers, 1879; Müller, 1884; Whitney, 1889; Gray, 1899; Duroiselle, 1906), neogrammarians began analyzing in detail the complexities of Pali grammar. One area of great interest to them was Pali gemination, and even more specifically, gemination found in a word-medial consonant cluster. Building from their rigorous research of Pali grammar, linguists in recent years have sought to explain Pali gemination in linguistic terms. They have offered insight into the phonology of the language to see *how* gemination was governed, with their research divided into four areas: Hankamer & Aissen (1974) and Junghare (1979) offered an explanation based on sonority; Selkirk (1980), Rice (1990), and Kessler (1994) viewed the phenomenon in prosodic terms; Suzuki (2002a,b) preferred to focus on consonant strength; and Schmeiser (2008) used an articulatory framework. This body of work has increased our understanding of Pali gemination, however it is generally

confined to the base-medial position in the language. Given Pali's morphological richness, however, it is surprising to note very few studies (see Kessler, 1994) that consider morphological effects on Pali gemination.

The aim of the current study is to further our understanding of how the addition of affixes influences the phonological process of consonantal gemination. To achieve this, it is first crucial to understand how Pali gemination works in the base of a word and then see how the process is affected in derived words. The rest of the paper is designed as followed: §2 briefly discusses the language background and phonemic inventory of Pali, §3 considers Pali gemination as it pertains to the base of a word, §4 offers a discussion of Pali gemination in derived words, and §5 concludes.

2. THE PALI LANGUAGE

2.1. Language background

Pali is one of the thirteen unclassified Middle Indo-Aryan dialects derived from Sanskrit (Gordon, 2005). Pali has remained similar to Sanskrit, which in all likelihood is due to its primarily spoken usage by Buddhist monks, from roughly the 6th century BC to the 3rd century BC (Gupta, 2003). Though there is much discussion regarding its origins, Junghare (1979) suggests that Pali has its origins in Northeast India, in the modern province of Bihar. Junghare (1979) also notes that it is the possible origin of the language, Māgādhi. It is worth noting that, given Pali's phonemic contrast in vowel duration, Pali is written in the literature as either *Pali*, *Paali*, *Pâli*, or with the macron, *Pāli*.

Pali went from being a primarily spoken language to one known for its written form when it was used to write the Tipitaka, the body of work that comprises the early Buddhist scriptures (1st century BC). In modern usage, it continues to be the liturgical language of Theravada Buddhism, which comprises many Southern Asian countries such as India, Sri Lanka, Bhutan, Burma (Myanmar), Thailand, Cambodia, and Vietnam. In short, Pali offers a unique linguistic context because it was a spoken variety of Sanskrit spoken by few and died out in its vernacular form, yet it holds the distinction of being the language used to write a canonical text for one of the World's main religions.

2.2. Pali's phonemic inventory

Pali's phonemic inventory consists of approximately forty-five phones – thirty-five consonants and ten vowels. As in Latin, vowel duration in Pali is phonemically-contrastive. The alphabet is phonetically-based in that every letter represents only one sound. The following table offers the consonant inventory.

In Table 1, take note that the dot below the retroflex consonants is at times represented to the left of the consonant (e.g., *.l*) in older texts. Similarly, the tilde (i.e., ~) may either be listed above or to the left (e.g., *ñ* or *~n*). I also have added the corresponding IPA phonetic symbol for

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[2] Hock (2010, p. 87) treats how consonant clusters in Sanskrit change to "aspirate" (his quotes) clusters in Middle Indo-Aryan, of which Pali is a part. In his study, he mentions a two-step process, proposed initially by Palaschke & Dressler (1999), in which gemination occurs and then postaspiration (e.g., Sanskrit *asti* to Middle Indo-Aryan *att^{h}i* 'is'). In addition, Hock (2010, p. 88) includes an intriguing connection to Andalusian Spanish (e.g., 'estos casos' [et^{h}ok^{h}aso], 'these cases'); though outside of the scope of the current study on Pali, it bears mentioning and seems to merit further research.

[3] The exception to this is when a nasal is in coda position in a heterosyllabic sequence, as in Sanskrit: *danta* Pali: *danta* 'subdued'. In these cases, the nasal blocks gemination.

Table 1: The Consonant Inventory for Pali in Orthography (adapted from Duroiselle, 1906, p. 6; Suzuki, 2002a, p. 101; Schmeiser, 2008, p. 304)

Manner	Labial	Labiodental	Dental	Alveolar	Retroflex	Palatal	Velar
voiceless stops	p		t		ṭ /ʈ/		k
	pʰ		tʰ		ṭʰ /ʈʰ/		kʰ
voiced stops	b		d		ḍ /ɖ/		g
	bʰ		dʰ		ḍʰ /ɖʰ/		gʰ
fricatives		v	s		ṣ /ʂ/	ś /ʃ/	h
voiceless affricates						c /tʃ/	
						cʰ /tʃʰ/	
voiceless affricates						j /dʒ/	
						jʰ /dʒʰ/	
nasals	m		n		ṇ /ɳ/	ñ /ɲ/	ṁ /ŋ/
liquids				l	r /ɻ/, ḷ /ɭ/		
					ḷʰ /ɭʰ/		
approx.						y /j/	

those cases in which the orthographical grapheme greatly differs from its phonetic symbol counterpart. Finally, I note that Table 1 includes consonants without an oral stricture, *h* and *ṁ* (Suzuki, 2002a, p. 101); in the case of the latter, it is often represented as `n* in Pali grammar texts. Duroiselle (1906, p. 6) notes that this phone "has no classification; it is merely a nasal breathing found after short vowels."

Concerning the vowel inventory, Pali has ten vowels; of which eight are at the phonemic level, and two (the short mid-vowels, [o,e]) are unfaithful allophones of their long counterparts, *ō, ē*); Pali maintains phonemic contrast regarding vowel duration, otherwise. The following table offers the vowel inventory:

Table 2: The vowel inventory for Pali in orthography (adapted from Duroiselle, 1906)

Place of articulation	Vowels
front	i, ī, u, ū
mid	o, ō, e, ē, a /ɐ/
back	ā

Observe in Table 2 that the grapheme *a* is a mid-vowel when short in duration and a back vowel when long in duration. The written form of the other vowels coincides with their modern phonetic symbols. Finally, regarding both the consonantal and vocalic inventories for Pali, I note the great disparity found in the literature in the use of graphemes to represent the language's different sound inventories; for this reason, I include the IPA phonetic symbols to avoid any confusion.

In the following section, we observe how consonants in heterosyllabic clusters interact when words are transmitted from Sanskrit into Pali.

3. BASE-MEDIAL GEMINATION IN PALI CONSONANT CLUSTERS

A challenge in Pali for linguists is to fully understand one aspect of internal sandhi, namely gemination. Crosslinguistic evidence suggests that the presence of gemination in the intervocalic position is very frequent (Kubozono, 2017). Recall from (1) above that it is generally the case that consonant clusters in Sanskrit in a VCCV order become a consonant geminate in Pali. Initially, grammarians such as Childers (1879) and Müller (1884) suggested that the sound change within words was phonetically motivated. Later, Junghare (1979) based her linguistic analysis on Jespersen's (1909) sonority scale, listed in Table 3:

Table 3: Jespersen's (1909) sonority scale (adapted from Junghare, 1979: 127)

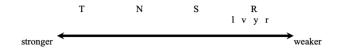| Category	Sonority Value
Low vowels	1
Mid vowels	2
High vowels	3
Glides	4
Nasals	5
Voiced fricatives	6
Voiceless fricatives	7
Voiced stops	8
Voiceless stops	9
	10

Using Jespersen's (1909) sonority scale, she hypothesized that assimilation occurs when the sonority value of the consonant with the lower (or equal) sonority value is the one that "spreads" its feature of place and manner of articulation, causing a geminate:

(2) a. stop + stop: Sanskrit: *bhakta*
                          Pali: *bhatta*   'rice'
    b. liquid + stop: Sanskrit: *sarpa*
                          Pali: *sappa*   'snake'
    c. liquid + fricative: Sanskrit: *karsaka*
                          Pali: *kassaka*   'farmer'
    d. liquid + nasal: Sanskrit: *karna*
                          Pali: *kanna¡*   'ear'
    e. fricative + stop: Sanskrit: *hasta*
                          Pali: *hatta*   'hand'

In the case of (2a), using Jespersen's (1909) sonority scale in Table 3, we note the sonority value of the coda stop is equal (10) to that of the following onset, resulting in regressive assimilation[4]. In (2b), the coda liquid has a sonority value of 5, whereas the following onset stop has a sonority value of 10. In (2c), the coda liquid has a sonority value of 5, whereas that of the following onset fricative is 8. In (2d), the coda liquid has a sonority value of 5, whereas that of the following onset nasal is 6. Finally, in (2e), the coda fricative has a sonority value of 8, whereas that of the following onset stop is 10. In short, from the examples in (2), we observe that the consonant with the lower (or equal) sonority value is that which "spreads" its features of place and manner of articulation. In general, a less sonorous consonant geminates and a more sonorant member of a cluster deletes (Yu Cho, 1995, p. 596).

In Cser's (2000, p. 5) review of models of sonority, he notes in relation to Pali gemination that "…this highly general change can indeed only be coherently described with reference to sonority, which, of course, also defines permitted syllables in the same language(s). The change itself, however, cannot be captured in terms of syllable structure" (See Kessler [1994] for counter argument). In Suzuki's (2002a,b) thorough, two-part treatment of consonant cluster changes in Pali, he argues against an analysis based on sonority and for one on the degree of oral stricture. Among his assumptions in his analysis, he includes his "consonant strength hierarchy of Pali assimilation", listed in Figure 1:

Figure 1: Consonant strength hierarchy of Pali assimilation (adapted from Suzuki, 2002b)

In Figure 1, 'T' represents stops, 'N' for nasals, 'S' for sibilants, and 'R' for semivowels. The hierarchy is "… based mainly on the degree of oral aperture. In Pali assimilation one of the members of the input cluster is chosen to maximize the contrast between the output and the adjacent

vowel(s). Thus, consonants with an *oral closure* (my emphasis), i.e., stops and nasals, are preferred to those without one, i.e., sibilants and semivowels" (Suzuki, 2002b, p. 64). He utilizes Optimality Theory as his framework, offering a series of Preserve (PRES) constraints, following Jun's (1994, 1995) work. The premise of these constraints is to preserve certain feature specifications. In Suzuki's (2002a,b) view, assimilation occurs not in terms of sonority, but rather in terms of consonant strength. In those cases between distinct stops or nasals, the onset would dominate the coda.

His work is convincing, and the data seem to suggest that oral closure/stricture does indeed play a central role in Pali assimilation. However, if oral closure/stricture is the central role, a framework based on gestures and their constriction seems more apt to concisely discuss the issue at hand. Schmeiser (2008) discussed Suzuki's (2002a,b) observations using Articulatory Phonology (Browman & Goldstein, 1989, 1990, et seq.), making use of Byrd's (1994, 1996) notion of a Phase Window. To summarize, Schmeiser (2008) suggests that Pali gemination occurs when the oral constriction location of the coda consonant is *not* the velum. That is, if the cluster begins with velum widening, the consonant with the lower sonority value is not able to "spread" its feature, and thus gemination does not occur.

For Schmeiser (2008), the cluster that involves a nasal in coda position is kept intact (i.e., no gemination) to ensure optimal perceptibility, given Downing's (2005, p. 209) argument that a nasal + stop sequence "is a single articulatory and acoustic gesture…and tends to be perceived and realized as reduced."

Dutta's (2017) extensive work on Pali geminates and strength asymmetries is done through an OT account; the author sums up Pali gemination regarding two adjacent obstruents, "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" (p. 55).

In short, the aforementioned studies have suggested that base-medial Pali consonant gemination is much more predicable than previously thought, citing either prosodic, segmental, or articulatory conditions in their argument. In the following section, we view how morphology affects the phonology of the language; more specifically, we view how morphological effects produce different outcomes in Pali gemination.

4. DISCUSSION

4.1. Morphological effects on Pali gemination

Internal sandhi in Pali has long been a fascination to grammarians, especially when it results in consonant gemination. Childers (1879, p. 99) initially offers a less hopeful response to analyzing internal sandhi, "It would not only be a misapplication of labour, but positively misleading, to work out the rules of internal

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[4] I know of no example in which an equal sonority value of the two consonants produced progressive assimilation.

sandhi…"; he later adds that sandhi is "to a great extent optional." (p. 100). Later, Müller (1884, p. 59) states, "…as the rules of internal sandhi form a part of the phonetics…" and notes that what he terms as "word sandhi" is not as imperative in Pali as it is in Sanskrit. He goes on to say that it only "takes place in certain cases" and varies "greatly as to its use or neglect" (p. 59). He also makes a very important distinction regarding the style of language used. That is, he notes that in prose, it is almost exclusively used in pronouns and/ or indeclinables that are in conjunction with a verb or noun. In short, for neogrammarians, though it was a phonetically-driven phenomenon, it was, it seemed, one that was left not fully-explained or understood.

Kessler's (1994) work on Classical Sanskrit suggests that phonological factors alone might not be able to explain sandhi and suggests that morphological factors might influence consonant cluster production[5]. Thus, the question that begs to be asked is this: Is Pali consonant gemination altered in any way when we add affixes to the stem? That is, will the addition of affixes affect how we currently view gemination within the base? In what follows, I analyze the effects that suffixes and prefixes have on consonant gemination to determine if we do indeed need a separate explanation for them or if our current understanding of Pali gemination within a base extends to affixes as well.

4.2. The suffixes *-ta* and *-ya*

In Kessler's (1994, p. 44) study, he suggests that different rules are not needed for suffix formation: "The situation is slightly obscured for stem-final consonants because the most common case in the morphology is for that consonant to form an onset with the ending." The following example, (3), illustrates this *tendency*, seen here with the suffix *-ta*, which is used to form either a past participle or change a comparative into a superlative.

(3)   Sanskrit: *sak + ta*   Pali: *satta*   'attached'

In the above example in (3), both consonants have equal sonority and thus the regressive assimilation, the predicted answer, indeed occurs. From the example in (3), it would appear at first blush that the consonant in the suffix is the one that geminates, as in the examples found in (2).

The only exception is the noted case in Schmeiser (2008) of the nasal in coda position, as in (4):

(4)   Sanskrit: *da<u>n</u> + <u>t</u>a*   Pali: *da<u>n</u>+ <u>t</u>a*   'subdued'

It is curious to note, though, that the suffix begins with a voiceless stop, which has the lowest sonority value in the consonant inventory and thus we ask, does the stop, as in (3), geminate (except when preceded by a nasal) because of sonority or because of a morphological effect? In addition, another question is, if the example in (3) follows the general trend for Pali gemination, does this trend extend to other suffixes?

Let us, then, consider another suffix, *-ya*, which takes place in the Passive Voice in the formation of verbal bases of the 3rd conjugation, of some gerunds, and of numerous derived nouns (Duroiselle, 1906, p. 15). Curiously, the consonant *y* either neutralizes with the previous consonant or fully assimilates to it, as in (5):

(5)   a. Sanskrit: *mad + ya*
          Pali: *majja*   'intoxicant'
       b. Sanskrit: *gam + ya*
          Pali: *gamma*   'gone'

In (5a), the stop and the glide neutralize and then geminate, however, in (5b), the geminate is formed with the preceding nasal. Unlike its *–ta* counterpart, the consonant in *-ya* does not geminate. O'Bryan (1971, p. 36) points out that *ya* following a dental obstruent (e.g., *mad + ya*) results in a change from *dy > jj*.

In addition, in the case of (5b), we see progressive assimilation in that the stem-final consonant is that which causes gemination. Given that the nasal has a lower sonority value (6) than the glide (4), it is not surprising that we see progressive assimilation. In short, though it seems that sonority value continues to suggest a trend, the examples for *-ta* and *-ya* suggest that further analysis is needed to fully understand the complex nature of consonant assimilation in Pali, especially as it relates to suffixes. We will now move to prefixes to ascertain if a similar pattern emerges.

4.3. The prefix *ud-*

The prefix *ud-* 'out of,' 'from,' 'up,' 'above,' 'away,' always evidences regressive assimilation into a geminate, regardless of sonority. For example, recall Junghare's (1979) approach based on a sonority value. The consonant with the lower sonority value "spreads" its feature of place and manner of articulation, as in (6):

(6)   liquid + stop: Sanskrit: *sarpa*
               Pali: *sappa*   'snake'

In (6), given that the stop has a lower sonority value than a liquid, we correctly predict that the stop will "spread" its features and thus the geminate will be *pp*, and not **rr*. If we look, however, at a consonant cluster in the prefix environment, a different result occurs, as in (7):

(7)   stop + nasal: Sanskrit: *ud + mujjati*
               Pali: **uddujjati* 'out from submersion,' 'rises out of water'

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[5] Lahiri & Hankamer (1988, p. 336) found that Bengali geminates showed that tautomorphemic and heteromorphemic geminates are indistinguishable acoustically and geminates derived by total assimilation are indistinguishable from other types of geminates. This might suggest that morphology plays a lesser role in consonant cluster production and thus serve as a counter argument.

In (7), given that stop again has a lower sonority value than the nasal, we might[6] incorrectly predict *uddajjati, and yet the actual realization is ummajjati. Dutta (2017, p. 56) states in a footnote that this is an exception to the general pattern and leaves it for future research. Moreover, as seen below in (8), the prefix ud- uniformly undergoes assimilation:

(8) a. Sanskrit: ud + cinati
       Pali: uccinati 'chooses', 'picks out'
     b. Sanskrit: ud + khipati
       Pali: ukkhipati 'raises', 'throws up'
     c. Sanskrit: ud + sāha
       Pali: ussāha 'endeavor', 'effort'
     d. Sanskrit: ud + loketi
       Pali: ulloketi 'looks up', 'looks for'

In (8), in a sonority-value analysis, one observes that only in the case of the voiceless stop in (8b) would we expect ukkhipati, in that a voiceless stop has a lower sonority value than a voiced one (in this case, /d/). In the other examples, we would incorrectly predict the gemination to involve the voiced stop, if we are to base our argument on the sonority value of the segment. This, however, is not the case, as the voiced stop assimilates to an affricate (8a), a fricative (8c), and a liquid (8d). In short, the prefix ud- is seemingly problematic for recent analyses because the morpheme boundary only allows the consonant of the base to geminate, and never the consonant that is part of the prefix, regardless of its sonority relationship to its adjacent consonant. That said, it is a well-known observation in the morphophonological literature that prefixes interact differently with roots and stems than suffixes (Fábregas & Krämer, 2020, p. 1). Therefore, it is not entirely surprising that prefixes in this language pattern differently than suffixes. In (8), we see that a general pattern based on the sonority pattern does not work; in these examples, the prefix blocks[7] this pattern, and instead, the onset of the base always geminates.

In short, the data from these affixes in the current study seem to suggest that morphology affects Pali gemination differently than in a base of a word and thus we need to formalize an explanation that concisely captures its full effects. As concerns suffixes, they produce a variety of results; in one case, a nasal in coda position before a dental obstruent blocks gemination (e.g., danta 'subdued'), yet in another, a nasal before a glide (e.g., gamma 'gone') produces progressive assimilation; finally, in a third case, majja 'intoxicant', we see neutralization of the dy cluster. Future research will need to consider the role

that prosody, sonority, articulatory factors, and/or perhaps even grammatical function play on Pali gemination in the suffix environment.

Regarding prefixes, the data suggest that they pattern differently than their base-medial and suffix counterparts. That is, regressive assimilation always results in words that contain the prefix ud- regardless of sonority. It should be noted, however, that the vast majority of Pali prefixes end in a vowel; future research will need to investigate if there are any exceptions to what the data suggest in the current study.

5. CONCLUSIONS

Pali is a highly-inflected, morphologically-rich language. Pertaining to gemination, Duroiselle (1906, p. 14) notes that it "takes place mostly in the formation of the passive voice, the passive perfect participle, the base of verbs of the third conjugation, of the infinitive, gerund, potential passive participle and in the formation of the desiderative, also under the influence of certain suffixes in the derivation of words." Future research will need to address each of these areas in detail to ascertain morphological effects on Pali gemination.

The current study has treated the effects on gemination in the morphological categories of affixes: two suffixes and one prefix. The study has suggested that previous accounts of the base of a word do not suffice when treating cases that involve morpheme boundaries. In addition, it has argued against a previous analysis based solely on syllable structure to capture morphological effects on Pali gemination. Finally, it called for future research to consider the interaction between phonological and morphological factors on Pali gemination.

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[6] Recall that Sanskrit gam + ya gives way to Pali gamma 'gone'. One might predict, based on gamma and the previously noted danta 'subdued', that a nasal either blocks gemination or is the consonant that "spreads its feature" (i.e., it never undergoes gemination from the neighboring consonant).

[7] A counter argument, though unlikely, could be made solely on place of articulation in that the prefix ends in a dental consonant and the following onset is always behind in the vocal tract. The rule, then, would be that the consonant that geminates is always the one further back in the vocal tract.

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