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The Phonological Configuration of Word-initial NC Sequences in Jinghpaw

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Abstract: NC (nasal-consonant) sequences have been found to exhibit various phonological configurations in the world's languages in terms of separability, syllabification, and segmenthood. In Southeast Asian languages, especially characteristic are word-initial NCs, which have been described under different NC types. Previous studies on word-initial NCs in the region have often suffered from a lack of diagnostics and/or explicit references to evidence in determining the phonological status of word-initial NCs. This study explores the phonological configuration of word-initial NCs in Jinghpaw, a Sino-Tibetan language of Myanmar and adjacent areas. This study shows that word-initial NCs in the language are heterosyllabic clusters based on about a dozen pieces of phonological and non-phonological phenomena that work together to characterize word-initial NCs as heterosyllabic clusters: speaker intuitions, sonority sequencing, voicing difference, tone assignment, morphological structure, monosyllable-targeting prefix, copying in partial reduplication, shorter first rule in co-compounds, insertion-type language game, numeric control in versification, and text-to-tune alignment in music. Arguments discussed for Jinghpaw, a language with a clear-cut case of heterosyllabic NC clusters, may be used as a reference when studying NC sequences in other languages that may exhibit different configurational types.*

Key words: NC sequences, syllable phonotactics, syllabification, segmenthood, Jinghpaw

1. Introduction

Nasal-consonant sequences (henceforth, NC sequences or NCs) are fairly common phenomena in the world's languages. A major interest with respect to NC sequences in phonology lies in the syllabification of the NC component that may exhibit various configurations (Herbert 1986, Downing 2005, Riehl 2008, Riehl and Cohn 2011, among others), raising issues associated with separability (insepa-

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rable or separable), syllabification (tautosyllabic or heterosyllabic), and segmenthood (unary or cluster). Riehl (2008) showed that NC sequences in English (e.g., co**mb**ine) and Fijian (e.g., [so^{m}**b**u] 'down') behave quite differently, illustrating NC clusters on the one hand and unary NC segments on the other. NC sequences also prevail in Southeast Asian languages, which are particularly characterized by word-initial NCs. Previous studies on word-initial NCs in the region, however, often suffer from a lack of diagnostics and/or explicit reference to evidence in determining the syllable affiliation of the nasal components in word-initial NCs (§2).

In this context, the present study aims to explore arguments regarding the phonological status of word-initial NCs in Jinghpaw (ISO 639-3: kac), a Tibeto-Burman language of the Sino-Tibetan language family spoken in northern Myanmar and adjacent areas of China and India. The language, as given in (1), illustrates rich examples of word-initial NCs. Hanson's (1906) Jinghpaw dictionary, for example, provides about 400 words that exhibit the property. This type of NC does not occur word-medially and finally. The nasal component is always homorganic in the place of articulation with the following consonant.

(1) Word-initial NC sequences in Jinghpaw
[mbjen] 'a variety of wild yam'
[ndai] 'this'
[ɲdʑaŋ] 'to heap'
[ŋgjin] 'cucumber'

Our primary goal in this study is to understand whether word-initial NC sequences in Jinghpaw constitute unary segments or clusters. In terms of the areal context, both possibilities are not unlikely, given that both NC types prevail in neighboring Sino-Tibetan and Southeast Asian languages (see §2). Previous studies of Jinghpaw phonology have suggested that Jinghpaw NCs are clusters. However, the evidence for this position remains mostly unexplored. This paper begins with an overview of previous work (§2) and a brief description of Jinghpaw basic syllables (§3), and then provides about a dozen arguments in favor of cluster analysis based on speaker intuitions (§4.1); sonority sequencing (§4.2); voicing difference (§4.3); tone assignment (§4.4); morphological structure (§4.5); monosyllable-targeting prefix (§4.6); copying in partial reduplication (§4.7); shorter first rule in compounding (§4.8); insertion language game (§4.9); numeric control in versification (§4.10); and text-to-tune alignment in music (§4.11). All of the arguments work together to characterize word-initial NCs in Jinghpaw as heterosyllabic and thus separable and clusters. The Jinghpaw data presented in this paper are first-hand data gathered by the author through original fieldwork in and around Myitkyina, Kachin State, Myanmar, during the period between 2009 and 2020. All data presented, unless otherwise noted, are rendered in a broad phonetic transcription.

2. Previous studies

Whether NC sequences constitute a single segment (unary NC) or two (NC cluster) has been a topic of interest in phonology in relation to the notion of segmenthood (Herbert 1986, Downing 2005, Riehl 2008, Riehl and Cohn 2011, and references therein). Herbert (1986), who generates surface unary NCs by means of a complex rule of unification, claims that all NCs are underlyingly clusters. His claim is based on theoretical assumptions that marked segments such as unary NCs are not allowed in underlying representations (cf. Riehl 2008). In a more recent study, Riehl (2008) shows that there are clear-cut cases of languages with NC clusters (i.e., separable heterosyllabic NC clusters) and those with unary NCs (i.e., inseparable unary NCs), with other cases falling somewhere in between (e.g., separable tautosyllabic NC clusters and separable tautosyllabic unary NCs). NC sequences in English illustrate a clear case of NC clusters. This is evidenced by the following three facts (Riehl 2008: 2–3, Riehl and Cohn 2011: 561). First, NCs are allowed only when they do not violate the Sonority Sequencing Principle (e.g., ***mp**-, te**mp**o, enca**mp**). Second, NCs can appear across morpheme boundaries (e.g., un-tenable). Third, the nasal and obstruent portion can occur independently (e.g., nd, dn). This is quite different for Fijian, which is often cited as a language that exhibits inseparable unary NCs. Three pieces of evidence suggest that Fijian NC sequences are inseparable unary NCs (Riehl 2008: 3–4, Riehl and Cohn 2011: 561). First, voiced stops (and alveolar trills) are always realized with a preceding nasal (e.g., [^{n}d], *[d]) in contrast to voiceless stops, which never occur with the nasal component (e.g., [t], *[^{n}t]). Second, NCs can appear in word-initial position, which generally allows only single segments in the language (e.g., [^{ŋ}**g**one] 'child'). Third, the language only allows open syllables with no final or medial consonant sequences aside from NCs (e.g., [so^{m}**b**u] 'down').

NC sequences also prevail in Southeast Asian languages. Especially characteristic are word-initial NC sequences (Henderson 1965, Riehl 2008, Ratliff 2015, Vittrant and Watkins 2019, among others). Henderson, in her seminal 1965 paper on the topography of phonetic and morphological characteristics of Southeast Asian languages, suggests that "prenasalization" is not an uncommon feature in the region (pp.422–5). Ratliff (2015) goes further, counting word-initial NCs (whether clusters or not) as an areal feature of Southeast Asia based on the fact that they are well-represented across all major language families in the region: Austroasiatic, Sino-Tibetan, Tai-Kadai, Hmong-Mien, and Austronesian. She notes that word-initial NCs are presented variously in grammars and language sketches as combinations of a syllabic nasal and a consonant (N̩C), consonant clusters (NC), complex unitary stop phonemes (^{N}C), or post-stopped nasals (N^{C}). She also proposes the following chain of development of word-initial NCs, and associates this feature with other interrelated features such as the iambic prosodic structure and the preference for the prefix in the region.

(2) Chain of historical development of word-initial NCs (Ratliff 2015: 39–41)
NV.C- > N.C- > NC-. > ^{N}C- > C-/N-

NC sequences are prevalent in the Sino-Tibetan language family (Chang and Chang 1976, Matisoff 2003, 2018). Major types fall into inseparable unary NC and heterosyllabic NC clusters in terms of Riehl and Cohn's (2011) terminology. This is illustrated by Tshobdun Rgyalrong *ⁿdenəʔ* 'for' (Sun and Bstan'dzin Blogros 2019: 3) and Belhare *ŋ.ka* '1sg' (Bickel 2017: 697), respectively. Matisoff (2003: 40) lists Written Tibetan, Zhaba, Luquan Lolo, and Mpi as languages in which "the nasal component does not constitute a syllable by itself" in contrast to Lotha Naga, Mzieme, Lalo, and Jinghpaw, which "have preinitial nasal elements that constitute separate syllables." Matisoff (2003), to my knowledge, is the only work that explicitly offers a classification of Sino-Tibetan languages in terms of the segmental status of NCs. Data based on Matisoff (2003), Namkung (ed.) (1996), Nikolaev, Nikulin, and Kukhto (2015), Moran, McCloy, and Wright (eds.) (2014), and Thurgood and LaPolla (2017) suggest that both types of NC sequences prevail in Sino-Tibetan languages. Unary NCs are found in branches such as Bodic (e.g., Baima, Batang, Bla-brang, Dege, Denjongka, Dongwang, Humla Bhotia, Kami, Khalong, Kyirong, Labrang, Nangchenpa, Nyinpa Cone, Rgyalthang, Soghpo, Thebo, Zhongu, gSerpa), Lolo-Burmese (e.g., Luquan, Mo-ang, Mpi, Nasu, Naxi, Noesu, Nosu, Yi Dafang, Yi Xide), Qiangic (e.g., Ersu, Guiqiong, Lüzu, Muya, Shixing, Zhaba), and rGyalrongic (e.g., Tshobdun, Ergong, Japhug, lCog-rtse). NC clusters, by contrast, are found in Sino-Tibetan branches such as Deng (e.g., Darang), Kiranti (e.g., Belhare), Kuki-Chin (e.g., Moyon), Lolo-Burmese (e.g., Ahi, Akha, Gazhuo, Jino, Lalo), Naga (e.g., Lotha, Mzieme, Sumi), Sal (e.g., Jinghpaw), and Sinitic (e.g., Cantonese, Hakka, Shanghainese, Yue, Wu).

A problem often encountered in descriptions of NC sequences lies in the lack of diagnostics and/or explicit reference to evidence in determining their phonological status, as Riehl (2008: 11) puts it, "However, in many languages, the evidence is less clear-cut, and the lack of consistent, cross-linguistic diagnostics makes the task all the more challenging." Regarding Southeast Asian linguistics, Matisoff (2003: 121) also points out that "From descriptions given in the sources on particular languages, it is often difficult to tell the two types of nasal onsets apart, especially since in both types the nasal element is normally homorganic to the following consonant." Ratliff (2015: 39–40) also notes that "These descriptions [of word-initial NCs] vary with respect to transcription convention, phonological analysis, and even the extent to which phonetic detail or a phonological analysis is provided at all, so it is difficult to compare these objects in detail across languages." This also holds for word-initial NC sequences in Jinghpaw. While there is widespread agreement that the nasal component in Jinghpaw NCs is syllabic (and thus NCs are separable, heterosyllabic, and clusters), evidence in support of this position remains mostly unexplored. Descriptions of Jinghpaw NC sequences are rather simple in previous studies. Maran (1971: 167), for example, only noted that "N is a syllabic nasal and assimilates to the following initial." Almost the same explanations can be found in Burling (1971: 7), Liu (ed.) (1984: 7), Dai and Xu (1992: 6), and Dai (2012: 16–7). Kurabe (2017a: 995–6, 2021: 70–3) very briefly suggested the syllabicity of the nasal component based on phenomena such as

tones, partial reduplication, and language games. With this background, in what follows, this study aims to provide eleven pieces of evidence in support of a heterosyllabic analysis of word-initial NC sequences in Jinghpaw. Before moving on to the discussion, a brief introduction to basic syllable structure in the language is presented in the next section.

3. Syllable structure

This section offers a brief overview of basic syllable structure in Jinghpaw aside from NC sequences. Syllable structure allows up to two prenuclear consonants and one postnuclear consonant, so the maximal structure is:

(3) Maximal syllable structure (Kurabe 2017a: 995)
$\sigma = C_1C_2VC_3/T$

The first consonant C_1 may be any consonant in the consonant inventory (i.e., [p, b, p^h, t, d, t^h, k, g, k^h, ʔ, ts, dz, tɛ, dʑ, s, ɕ, h, m, n, ɲ, ŋ, ʔm, ʔn, ʔɲ, ʔŋ, r, l, ʔr, ʔl, w, j, ʔw, ʔj]) when the second consonant C_2 is not filled. Two sonorants [r] and [j] may optionally occur as C_2 when the preceding consonant is a stop or nasal (i.e., [pr, br, p^hr, kr, gr, k^hr, pj, bj, p^hj, kj, gj, k^hj, mj]). The V slot may be any vowels in the vowel inventory (i.e., [i, e, a, o, u]). The final consonant C_3 can be from an array of optional final consonants, which are always unreleased (i.e, [pˇ, tˇ, kˇ, ʔˇ, mˇ, nˇ, ŋˇ]). Four types of phonetic diphthongs are observed (i.e., [ai, oi, ui, au]), which never occur in closed syllables (i.e., $C_1C_2V_1V_2/T$). Jinghpaw is a syllable tone language, where a tone (T) is assigned to every syllable. Four tones (i.e., á [55], a [33], à [31], â [51]) are contrastive in non-checked (open and sonorant-final) syllables in contrast to checked (stop-final) syllables, which accommodate only short high and low (i.e., áʔ [5] and àʔ [1]). One exception to this rule is the syllable headed by a schwa [ə], which is atonic and phonetically short. It does not occur in word-final position, and in closed syllables. Examples of basic syllable types in the language are presented in (4):

(4) Examples of syllable types

a. CV	[k^há]	'be bitter'
b. CVC	[k^hùt]	'be cooked'
c. CCV	[k^hri]	'be sour'
d. CCVC	[k^hruŋ]	'to live'
e. Cə	[lək^hrá]	'right'

Monomorphemic words in the language are predominantly monosyllabic (e.g., [mjìʔ] 'eye') or disyllabic (e.g., sìndàʔ 'chest').

4. Evidence for word-initial NCs being a heterosyllable

This section explores arguments in favor of a heterosyllabic analysis for word-initial NC sequences in Jinghpaw in terms of: speaker intuitions (§4.1); sonority sequencing (§4.2); voicing difference (§4.3); tone assignment (§4.4); morphological structure (§4.5); monosyllable-targeting prefix (§4.6); copying in partial redu-

plication (§4.7); ordering rule in co-compounds (§4.8); insertion language game (§4.9); numeric control in versification (§4.10); and text-to-tune alignment in music (§4.11). In all of these phenomena, word-initial NCs pattern as heterosyllabic clusters.

4.1. Speaker institutions

Native speakers are often assumed to have conscious knowledge about the syllable counts and syllable breaks of their languages (Blevins 1995: 209–210). Liberman et al. (1974) shows that the ability to segment words into syllables is acquired much earlier than the ability to segment words into individual phonemes. Jinghpaw speakers also appear to have conscious knowledge about syllables, since many speakers gave consistent answers about the number of syllables in words that show sound patterns except NCs (Kurabe 2021).

Speakers' intuitions also provide some cues with respect to the syllable configuration of word-initial NC sequences in Jinghpaw. In order to address speakers' intuitions about NCs, 46 native speakers between the ages of 20 and 30 were consulted to obtain their perception of the number of syllables in the word [mbo] 'glutinous rice' in isolation.[1] The word was judged to be disyllabic by 43 respondents (93.5%), who divided the word into [m] and [bo]. The word was judged to be a monosyllable by three respondents.[2] Along the same lines, native speakers were also asked the same question about the words [ndai] 'this' and [ŋgjin] 'cucumber'. The result is given in (5).

(5) Syllable counts for NC sequences

	Monosyllable	Disyllable	Percentage
[mbo]	3	43	93.5%
[ndai]	0	46	100%
[ŋgjin]	0	46	100%

The nearly consistent responses suggest that word-initial NC sequences are heterosyllabic. It should be noted, however, that speaker intuitions, still useful as a secondary argument, cannot be taken as primary evidence to determine NC status because they sometimes produce inconsistent results (cf. Riehl 2008).

4.2. Sonority sequencing

As illustrated for English NCs in Section 2, sonority is often cited in making

[1] Because Jinghpaw has no term that exactly corresponds to the syllable, the speakers were asked how many "sounds" the given words had. Each speaker was asked questions like "For example, the word [sa] 'to go' consists of one sound and the word [sìndàʔ] 'chest' has two sounds. Then, how many sounds do you think the word [mbo] 'glutinous rice' has? One, two, three, or more?"

[2] In terms of its history, the word [mbo] appears to consist of two morphemes (§4.5). For most modern speakers, however, the word is not analytical. Its historical origin, thus, has little effect on the institution test.

determinations about NC status (Herbert 1986, Riehl 2008). Clements (1990: 285) characterizes the Sonority Sequencing Principle as in (6). Because nasals are more sonorous than obstruents, NC sequences with an obstruent C violate the principle, giving an argument in favor of a heterosyllabic status of NCs.

(6) Sonority Sequencing Principle
Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted.

Jinghpaw syllables, aside from NC sequences, strictly follow the Sonority Sequencing Principle. That is, the syllable peak is always more sonorous than consonants that precede it (e.g., [pa, ta, ka, ʔa, ma, na, ŋa]) or follow it (e.g., [ap, at, ak, aʔ, am, an, aŋ]). In the onset position, the second consonant is always more sonorous than the initial consonant (i.e., [pr, br, pʰr, kr, gr, kʰr, pj, bj, pʰj, kj, gj, kʰj, mj]). This is further illustrated by the well- and ill-formed Jinghpaw syllables given in (7), where (7a)–(7b) are consonant clusters and (7c)–(7d) are vowel sequences.

(7) Well- and ill-formed syllable structure in Jinghpaw
a. [pr-] *[rp-]
b. [pj-] *[jp-]
c. [-ai] *[-ia]
d. [-au] *[-ua]

Word-initial NC sequences, by contrast, may violate the well-established constraint on syllable structure. This is illustrated by Example (8a)–(8c) below, in which the first consonants are more sonorous than the second. These dispreferred sequences are more likely to be parsed as heterosyllabic by the Sonority Sequencing Principle. It should be noted, however, that violations of sonority sequencing are not uncommon cross-linguistically (Clements 1990), and thus should not be taken as the sole type of compelling evidence in NC analysis (cf. Riehl 2008).

(8) Combinatorics of N and C in terms of manner of articulation

a. nasal-stop	[ŋgjin]	‘cucumber’
b. nasal-affricate	[ɲdʑaŋ]	‘to heap’
c. nasal-fricative	[nsun]	‘path’
d. nasal-nasal	[nni]	‘sufferings’
e. nasal-liquid	[nli]	‘seed’
f. nasal-semivowel	[nja]	‘spark’

Note also the related fact that, in terms of manner of articulation, unary NC sequences are usually [–continuant], especially stops and affricates, in the vast majority of the world’s languages (Steriade 1993, Riehl and Cohn 2011). If this is the case, the fact that patterns other than obstruents are observable in word-initial NCs in Jinghpaw (8c)–(8f) suggests that at least these examples are not unary. While there are also NCs involving obstruents as their second member (8a)–(8b),

symmetry and economy suggest that they are also clusters.[3]

4.3. Voicing difference

Unary NC sequences are reported in many languages to be fully voiced. In some languages such as Tshobdun Rgyalrong (Sun and Bstan'dzin Blogros 2019: 3), fully voiced NCs pattern as a singleton (e.g., *ⁿdenəʔ* 'for'), while NCs involving voiceless obstruents pattern as a cluster (e.g., *ntʰom* 'be wondering'). No languages showing the opposite pattern have been reported (Riehl and Cohn 2011: 557–8). If this is the case, the fact that Jinghpaw exhibits word-initial NC examples with voicing contrast suggests that NCs in the language are NC clusters. Examples include:

(9) Voicing difference in NC sequences
a. [mpun] 'spring'
b. [ŋkau] 'some'
c. [ɲtɛun] 'summit'
d. [ɲɛu] 'be crowded'
e. [nsaŋ] 'lizard'

Related to this is the cross-linguistic articulatory preference for fully voiced NC clusters (Herbert 1986, Ohala and Ohala 1991, Hayes and Stivers 1995). NCs involving voiceless obstruents are often disfavored (*NC̥ constraint). Many languages have phonological processes to get rid of them, including post-nasal voicing, nasal deletion, and denasalization (Pater 1999). In this light, both voiced and voiceless obstruents are common in the post-nasal position of word-initial NCs in Jinghpaw. The following (10) provides the number of words listed in Hanson (1906) divided in terms of voicing contrast. The data appear to suggest that the cross-linguistic preference does not operate in word-initial NCs in Jinghpaw.

(10) Number of word-initial NCs in terms of voicing contrast

[mb]	26	[nd]	35	[ŋg]	38	[ɲdz]	2	[ɲdʑ]	12
[mp]	12	[nt]	15	[ŋk]	14	[ɲts]	8	[ɲtɛ]	9
[mpʰ]	28	[ntʰ]	21	[ŋkʰ]	35				

4.4. Tone assignment

Tones sometimes give cues for decision-making about NC status, as Matisoff (2003) puts it: "In tone languages a convenient test of syllabicity is whether the nasal element can bear a tone separate from the following vowel" (p.121 note 92). Recall that, as noted in Section 3, in Jinghpaw each syllable (save syllables headed by a schwa) is assigned one of the following tones: Low (L), Mid (M), High (H),

[3] Example (8f) [nja] patterns differently from a palatal nasal (i.e., [ɲa]) in terms of diagnostics explored in this paper. For example, the word is judged to be disyllabic by native speakers. The insertion language game that inserts a certain syllable into each syllable boundary (§4.9) also breaks up [n] and [j]. The nasal component is also treated as a full-fledged syllable in numeric control in versification (§4.10).

Falling (F), Low-stopped (Lq), and High-stopped (Hq). Four contrastive tones (i.e., L, M, H, F) maximally occur in non-checked syllables and two (i.e., Lq and Hq) in checked syllables. The nasal component in word-initial NC sequences can bear an independent tone. Only L, M, and H are attested for the nasal element. The following (11) summarizes the tonotactic pattern of syllables involving NCs. Not all logically possible combinations are attested (see Kurabe 2017b for the tonotactic asymmetry).

(11) Tonotactic patterns involving NCs (adapted from Kurabe 2017c)

L-L	[m̀bà]	'great'
L-M	[m̀bu]	'blade'
L-H	[m̀bá]	'cloth'
L-Lq	[m̀pʰàt]	'to vomit'
L-Hq	[m̀wót]	'diviner'
M-M	[mbo]	'glutinous rice'
H-H	[ḿwái]	'to respect'
H-Hq	[ḿmút]	'harvest'
H-F	[ḿpʰû]	'dust'

As illustrated by 'blade', 'cloth', 'diviner', and 'dust' above, the nasal component can bear different tonal values from following vowels. These examples suggest that the nasal component constitutes an independent syllable on its own because the tone-bearing unit is the syllable in Jinghpaw. The tonal data thus provides further arguments in favor of the heterosyllabic status of word-initial NC sequences.

4.5. Morphological structure

The morphological structure of NC sequences, as exemplified for English NCs in Section 2, sometimes surfaces in discussions of NC status. Jinghpaw exhibits some NC examples that occur across morpheme boundaries, as illustrated by the negative prefix and the second person possessive prefix, both of which consist of a single nasal element. Examples include:

(12) Negative and second person possessive prefixes

a.	[bu]	'be stubby'	→ [m-bu]	'not be stubby'
b.	[dim]	'to obstruct'	→ [n-dim]	'not obstruct'
c.	[dʑi]	'grandfather'	→ [ɲ-dʑi]	'your grandfather'
d.	[ʔnau]	'younger sibling'	→ [n-ʔnau]	'your younger sibling'

There are also some NC examples that appear to have their diachronic sources in the phonological reduction of preceding elements. This is illustrated by examples given in (13), in which the first syllables appear to involve the word [mam] 'rice' historically.

(13) Rice-related NC sequences
[mbo] 'glutinous rice'
[ŋgu] 'husked rice'
[ŋkʰje] 'red rice'

It should be noted, however, that for most modern speakers, these words are not analytical, and the vast majority of word-initial NCs are not morphologically segmentable. Further, there is no a priori reason to consider that the morphological boundary straightforwardly corresponds to the phonological one given that two separate morphemes sometimes coalesce into a single segment, as pointed out by Riehl (2008: 14, 29–31). The morphological boundary should thus be viewed as secondary evidence.

4.6. Monosyllable-targeting prefix

Affixation also has some implication for the status of word-initial NCs. Jinghpaw has a set of affixes that can only be added to monosyllabic stems. The causative prefix [ɛə-], for example, targets only monosyllabic verbs (Maran and Clifton 1976). The examples given below show that only monosyllables are prefixable with the causative prefix.

(14) Monosyllable-targeting causative prefix

a.	[pjo]	'be happy'	→	[ɛə-pjo] 'to amuse'
b.	[nán]	'be light'	→	[ɛə-nán] 'to light up'
c.	[gəbu]	'be glad'	→	*[ɛə-gəbu]
d.	[gùmróŋ]	'be proud'	→	*[ɛə-gùmróŋ]

When added to stems involving NC sequences, the prefix always derives ill-formed words. This is illustrated by examples given in (15). Our data thus suggest that NC sequences are not monosyllables.

(15) Word-initial NCs and the causative prefix

a.	[ǹdàu]	'be noisy'	→	*[ɛə-ǹdàu]
b.	[ǹnan]	'be new'	→	*[ɛə-ǹnan]
c.	[ŋ̀gàm]	'be steep'	→	*[ɛə-ŋ̀gàm]
d.	[ŋ̀kjéŋ]	'be leaning'	→	*[ɛə-ŋ̀kjéŋ]
e.	[ḿwái]	'to respect'	→	*[ɛə-ḿwái]

The data from the morphological domain thus further suggests that word-initial NCs involve more than one syllable.[4]

4.7. Copying in partial reduplication

Reduplication also treats the nasal component in word-initial NC sequences separately. Reduplication is one of the productive morphological procedures in

[4] The causativization of verbs longer than monosyllables is achieved by means of a causative auxiliary *=ɛəŋún*, which does not discriminate verbs in terms of their phonological make-up.

Jinghpaw. It is exploited in order to mark categories such as habituality, distributivity, plurality, indefiniteness, and emphasis. Many adverbs are also derived by means of reduplication (Kurabe 2017b). What is relevant here is the fact that reduplication is mainly manifested as partial reduplication, copying the last syllable of the root from the left to right. Examples include:

(16) Partial reduplication

a.	[mətsát]	'eight'	→	[mətsát-tsát]	'eight each'
b.	[ləwan]	'be quick'	→	[ləwan-wan]	'quickly'
c.	[gədai]	'who'	→	[gədai-dai]	'who (pl.)'
d.	[sùmrù]	'to consider'	→	[sùmrù-rù]	'to consider on a regular basis'

When applied to word-initial NC sequences, partial reduplication does not copy the nasal component. This can be observed in (17), in which nasal components are left behind in the morphological process. This provides additional support for the position that Jinghpaw NCs are heterosyllabic.

(17) Word-initial NCs and partial reduplication

a.	[ŋkau]	'some'	→	[ŋkau-kau]	'some'
b.	[ǹnan]	'be new'	→	[ǹnan-nan]	'newly'
c.	[ǹten]	'lip'	→	[ǹten-ten]	'lips (emphatic)'
d.	[ǹtʰu]	'sword'	→	[ǹtʰu-tʰu]	'sword (emphatic)'
e.	[m̀bò]	'to bellow'	→	[m̀bò-bò]	'to bellow on a regular basis'

4.8. Shorter first rule in co-compounds

Jinghpaw, as typical of many Asian languages (Wälchli 2005), has a rich lexicon of co-compounds, a type of compounds the constituents of which are in a relationship of coordination. The vast majority of Jinghpaw co-compounds consist of two members that are in a synonymic or antonymic relationship, as illustrated by [ləgo-lətáʔ] (lit. foot-hand) 'hands and feet', [pru-ɕàŋ] (lit. go out-go in) 'to go in and out', and [pʰrò-tɕaŋ] (lit. white-black) 'be black and white'. Co-compounds often convey generic meaning, where the whole expresses more than the sum of its parts, as exemplified by [ʔù-wàʔ] (lit. fowl-pig) 'livestock', [pʰún-kəwá] (lit. tree-bamboo) 'vegetation', and [ləbù-pəloŋ] (lit. pants-jacket) 'clothes'. Further examples of co-compounds include:

(18) Co-compounds

a.	[ŋa-wəloi]	cow-buffalo	'cows, buffalos, and the like'
b.	[mjìt-məsìn]	mind-liver	'mind, temper, and the like'
c.	[dʑùm-mədʑàp]	salt-chili	'salt, chili, and the like; seasoning'
d.	[tsáʔ-tɕərû]	liquor-brewage	'liquor, brewage, and the like'
e.	[du-səlaŋ]	chief-elder	'chiefs, elders, and the like'

The order of the members of Jinghpaw co-compounds are mostly irreversible. Phonology, but not semantics, plays a role in determining the order of the members of co-compounds. Kurabe (2011), noting the asymmetry where co-com-

pounds consisting of disyllables followed by monosyllables are almost absent out of four logically possible combinations of monosyllables and disyllables (i.e., 1-1, 2-2, 1-2, *2-1), proposes an ordering rule (19), according to which the members of co-compounds are ordered.[5] The order of examples given in (18) can be accounted for in terms of the ordering rule (see Kurabe 2011, for more examples).[6]

(19) Shorter first rule
If the syllable length of the two members is not equal, the shorter member comes first.

What is relevant here is the fact that words involving word-initial NC sequences come last when paired with monosyllables, as illustrated in (20). No reverse order in which NCs precede monosyllables has been identified. This fact suggests that syllables involving NCs are longer than monosyllables. Co-compound data thus provide an additional argument in favor of heterosyllabic analysis for word-initial NCs in Jinghpaw.

(20) Word-initial NCs and shorter first rule

a. [rì-ǹtʰu]	spear-sword	'spears, swords, and the like'
b. [mam-ŋgu]	unhusked.rice-husked.rice	'rice (both husked and unhusked)'
c. [kʰàʔ-ǹtsin]	water-drinking.water	'water in general'
d. [dum-ńtâ]	granary-house	'granaries, houses, and the like; shelters'
e. [pʰró-ǹsám]	appearance-look	'appearance, look, and the like'
f. [kʰràŋ-ǹsám]	shape-look	'shape, look, and the like'
g. [ɛoŋ-ǹnan]	first-new	'first and newly'

4.9. Insertion language game

Language games can also be employed in the determination of the syllable structure of NC sequences (Hombert 1986, Gil 2002). For example, based on a backwards language, Hombert (1986: 177) shows that NC sequences in Bakwiri, a Bantu language of Cameroon, are unary segments. By contrast, the insertion-type language game in Jinghpaw treats word-initial NCs as heterosyllabic. The insertion game systematically derives language game words by inserting a copy of preceding

[5] The shorter first rule, known as Panini's Law or Behaghel's Law, is not alien to co-compounds and related phenomena in the world's languages. The rule operates in co-compounds in Sanskrit (Cooper and Ross 1975), modern Greek (Kiparsky 2009), and Japanese (Hayata 1970). The rule is also applicable to English (Malkiel 1959, Mollin 2014, Renner 2014). English examples include irreversible binomials (e.g., bread and butter, law and order, in and around), coordinate compounds (e.g., gum resin, hunter-gatherer), and blends (e.g., cafetorium, Oxbridge).

[6] The shorter first rule is applicable when the syllable length of the two paired members is not equal. When co-compounds are made up of two members that have the same number of syllables, the ordering is determined by other mechanisms such as the higher first rule, whereby the member involving a higher vowel comes first (see Dai 1986 and Kurabe 2011).

syllables into every syllable boundary and then replacing the onset of the copied syllable with a voiceless fricative (Kurabe 2021). Examples include:

(21) Insertion language game

a. [bo]	→	[bo-so]	'head'
b. [ʔwàn]	→	[ʔwàn-sàn]	'fire'
c. [ɛìŋlèt]	→	[ɛìŋ-sìŋ-lèt-sèt]	'tongue'
d. [sìndàʔ]	→	[sìn-sìn-dàʔ-sàʔ]	'chest'

When applied to word-initial NC sequences, the language game breaks up the nasal component and the following consonant, as illustrated by examples in (22). This fact, as suggested by Kurabe (2021: 72), further supports the existence of syllable boundaries within NCs. Note that an epenthetic vowel [i] is inserted for NC sequences in order to avoid the realization of the expected [sn], which is not allowed in Jinghpaw phonotactics.[7]

(22) Insertion game applied to word-initial NCs

a. [mmo]	→	[n-sin-mo-so]	'highway'
b. [nli]	→	[n-sin-li-si]	'seed'
c. [ɲdʑaŋ]	→	[n-sin-dʑaŋ-saŋ]	'to heap'
d. [ŋgjin]	→	[n-sin-gjin-sin]	'cucumber'
e. [ǹten]	→	[ǹ-sìn-ten-sen]	'lips'

4.10. Numeric control in versification

Linguistic art forms also provide evidence for heterosyllabic analysis. Parallelism, which is often considered a defining property of verse (deCastro-Arrazola 2018), plays a role in the analysis. The primary metrical strategy in Jinghpaw verse is syllable counting, wherein a fixed number of syllables, usually ranging from six to eight, systematically occurs per line (Dai and Xu 1992: 446–8, Dai 2012: 417–23, Kurabe 2021: 69–70). As an example, consider the six-line poem below from Dai (2012: 419), which is rendered in the phonetic transcription in this paper.

(23) Six-line poem

Jinghpaw text	English translation
ɛíŋjâŋ gàmgu bòŋ,	Physically strong,
məʈɛàŋ ǹgùn roŋ.	Full of power.
wà dzi lədòʔ tʰàʔ tsoŋ,	Moving beyond the level of paternal ancestors,
wà woi pʰùn tá tʰàʔ tʰoŋ.	Exceeding beyond the standard of maternal ancestors.
ḿpʰrôŋ ŋkʰjoŋ sùt tʰèʔ ràu ŋà,	Being with countless crops,
wəkʰu wəlâ gàn tʰèʔ ràu pra.	Being with infinite animals.

[7] The choice of [i] as the epenthetic vowel may be accounted for in terms of the phonological context in which it occurs (i.e., between two dental consonants [s] and [n]) or its status as a frequent vowel for epenthesis along with [ə] (see Hall 2011).

The verse template for (23) is given in (24). As shown, the verse consists of 38 syllable-holders with symmetric pairs of lines: five, six, and eight syllables per each couplet. What is relevant here is the fact that an equal number of syllable counts is obtained only when the nasal component in word-initial NC sequences is counted as a syllabic placeholder (shown in bold).

(24) Verse template of the six-line poem

1	2	3	4	5			
ɕíŋ	jâŋ	gàm	gu	bòŋ			
6	7	8	9	10			
mə	tɕàŋ	**ŋ̀**	gùn	roŋ			
1	2	3	4	5	6		
wà	dʑi	lə	dòʔ	tʰàʔ	tsoŋ		
7	8	9	10	11	12		
wà	woi	pʰùn	tá	tʰàʔ	tʰoŋ		
1	2	3	4	5	6	7	8
ḿ	pʰrôŋ	**ŋ**	kʰjoŋ	sùt	tʰèʔ	ràu	ŋà
9	10	11	12	13	14	15	16
wə	kʰu	wə	lâ	gàn	tʰèʔ	ràu	pra

The verse-specific reiteration of the number of syllables thus suggests that the nasal component in word-initial NC sequences is a full-fledged syllable.

4.11. Text-setting in music

Non-phonological categories such as musical beats provide additional support for the heterosyllabic analysis. Text-setting is the arrangement of linguistic material (i.e., texts) to musical structure (i.e., tunes) (Halle and Lerdahl 1993, Kubozono 1999, Proto 2015). The default text-setting algorithm in Jinghpaw involves assigning each syllable to each available beat from left to right (Kurabe 2021: 70). To illustrate this, consider a simplified passage from a Jinghpaw hymn given below. The symbol ♪ stands for a musical note, regardless of its temporal duration. Word-initial NC sequences (e.g., ŋ́góʔ 'to venerate', ḿwái 'to respect', ŋ̀ŋai '1sg.DECL'), as shown, are assigned two separate notes in text-setting (indicated in bold), suggesting that the nasal component is a fully-fledged syllable.

(25) Text-to-tune assignment

♪	♪	♪	♪	♪	♪	♪	♪	♪	♪	♪	♪
σ	σ	σ	σ	σ	σ	σ	σ	σ	σ	σ	σ
náʔ	ʔàʔ	**ŋ́**	**gó**ʔ	**ḿ**	**w**ái	mjìt	t^{h}àʔ	ŋai	ʔə	noi	**ǹ**
♪	♪	♪	♪	♪	♪	♪	♪	♪	♪	♪	♪
σ	σ	σ	σ	σ	σ	σ	σ	σ	σ	σ	σ
ŋai	ɲé	ʔàʔ	**ń**	**s**éŋ	ʔai	mjìt	mə	sìn	naŋ	jáʔ	**ɛə**
♪	♪	♪									
σ	σ	σ									
tɛòi	ɛə	práʔ									

Note further that text-setting can cross-linguistically be syllable-based (e.g., English) or mora-based (e.g., Japanese). The strong preference for syllable-based segmentation in text-setting in Jinghpaw can be seen in (25), where morae do not play any role: both monomoraic syllables such as [ʔə] and bimoraic syllables such as [wái] and [naŋ] are assigned exactly to one note each.

5. Conclusions

Phonological studies show that NC sequences may exhibit various phonological configurations in the world's languages in terms of separability, syllabification, and segmenthood. Word-initial NC sequences, which prevail in Southeast Asian languages, have also been described under different NC types. In spite of their relevance to phonological theory and areal linguistics, previous descriptive studies often suffer from a lack of diagnostics and/or explicit reference to evidence in order to determine the configurational status of word-initial NCs. The present study explored the syllable configuration of word-initial NC sequences in Jinghpaw, which showcases a rich lexicon of word-initial NCs. The present study explored the clusterhood of word-initial NCs in the language based on eleven types of arguments in favor of heterosyllabic analysis. Phonological phenomena such as sonority sequencing (§4.2), voicing difference (§4.3), and tone assignment (§4.4) are confirmed to be valid as diagnostics in order to investigate the syllable phonotactics of word-initial NC sequences. Phenomena in the morphological domain such as morphological structure (§4.5), affixation (§4.6), reduplication (§4.7), and compounding (§4.8) also shed light on the phonological status of word-initial NCs. This study also showed that language play and extra-linguistic phenomena such as speaker intuitions (§4.1), language games (§4.9), numeric control in versification (§4.10), and text-to-tune alignment in music (§4.11) also provide evidence for the linguistic patterns. Arguments based solely on speaker intuitions, sonority sequencing, voicing difference, and morphological structure are not sufficient in order to demonstrate the clusterhood of word-initial NC sequences. However, the arguments on which they are based become stronger when put together with other

types of evidence. Arguments discussed for Jinghpaw, a language with a clear-cut case of heterosyllabic NC clusters where syllable boundaries are clearly identifiable between the nasal portion and following consonant, can potentially be used as a reference when studying NC sequences in other languages that may exhibit different configurational types. I hope the present study contributes to a better understanding of the phonology of NC sequences.

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【要　旨】

ジンポー語における語頭NC連続の音韻構成

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鼻音と子音の連続（NC 連続）は，分離可能性，音節化，分節音性などの観点から様々な構成を示しうる。東南アジアでは語頭の NC 連続が語族を越えて広く観察されるが，従来の多くの研究ではその音韻構成が充分に検討されてこなかった。本稿では，ジンポー語（シナ・チベット語族：ミャンマー北部）に観察される語頭の NC 連続を検討し，様々な音韻的・非音韻的現象をもとに，この言語の NC 連続が異音節クラスターであることを示す。具体的には，話者の直感，聞こえ度，有声性，声調付与，形態構造，単音節標的型接辞，部分重複，並列複合語の語順，挿入型ルドリング，韻文の音節調整，歌詞とメロディーのアラインメントなど様々な現象において，語頭の NC 連続が異音節クラスターとして振る舞うことを指摘する。明瞭な異音節クラスター型の NC 連続を持つジンポー語から得られた議論は，異なるタイプの NC 連続を持つほかの言語の分析にも示唆を与える。