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Clustering and evolution of phonological systems across languages in Coastal East Asia

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Abstract:

The present study employs a quantitative method to investigate phonological profiles of languages spoken across the coastline of East Asia, ranging from the Chukotka Peninsula to the Malay Peninsula. The sampling includes 264 linguistic varieties from 17 different genealogical units. 20 typological features related to various domains of phonology, including qualities and contrasts in vowels and consonants, as well as components in the syllable structure and tones are considered. Attention is paid to three points of focus: areal distribution, diachronic change, and learnability. Across Coastal East Asia, there is a north-south divide running across the boundary between Northeast and Southeast Asia. Within these zones, numerable groups of languages share similar phonological features and thereby form Sprachbünde, the formation of which can be traced back to the existence of (pre)historical political entities, population movements and subsequent encounters among speakers of different language families. Under areal diffusion, languages in contact have acquired similar tendencies of retention and innovation for individual phonological features, resulting in deviation across cognate languages spoken in different Sprachbünde. In several cases, a statistical method reveals an obvious signal of particular language families being the source of areal patterns. Among the phonological features under investigation, several features have a lower degree of learnability, especially among L2 speakers in the scenario of language shift, and this is largely due to typological differences from their L1. Cross-cutting between areality and learnability, those features with a higher degree of complexity, such as consonant clusters, tend to reveal more clearly the area-specific tendencies.

Keywords: phonology, linguistic typology, areal linguistics, East Asia, Suvarṇabhūmi

1 Introduction

Northeast and Southeast Asia have been venues for language, ethnicity and culture crossings over several millennia. Despite the continuous interaction among various ethnic and speech communities, these border areas of Eastern Eurasia still manifest a high degree of linguistic diversity and typological variation. Acknowledging the diverse ethnolinguistic and multilingual setting, the present study uses a quantitative-typological approach to investigate phonological systems of languages spoken along Coastal East Asia and illustrate in a probabilistic fashion how they have become what they are today.

In the current study, we define "coastal" as areas within the distance of 750 kilometres from the Western Pacific Coast, as illustrated in Figure 1. This is to draw a more precise scope and exclude areas where the sphere of contact influence would be too extensive, particularly the Central and Western China involving an expansive contact zone across Central Asia, which is not relevant for the focus of the present study. We primarily focus on linguistic varieties on the continent, but also those spoken on such islands with historically intense and long-standing interaction with continental speech communities. This includes Sakhalin Island, Japanese Archipelago and Formosan Island (i.e. present-day Taiwan), where continuous population movements to and back to the continent have been reported (see e.g. Janhunen 1996). Meanwhile, linguistic varieties from Pacific Islands, such as the Philippine Islands and Indonesian archipelago do not belong to the scope of the present study, as they do not involve as intense interaction and bidirectional population movements from and back to the continent as Sakhalin, Japan and Formosa (cf. Blench et al. 2005). The given geographical delimitation results in a coverage of 264 distinct linguistic varieties from 17 different genealogical units, as given in Figure 1.

In terms of theoretical framework, the current study focuses on three aspects: 1) areal tendency, 2) diachrony, and 3) learnability. The aim is to deepen our knowledge on variation in phonological systems at a microareal level, focusing not only on distribution but also interaction and redundancy of various phonemes in the system. The achieved results will serve to supplement previous macro-level investigations, such as the numerous chapters on phonology in *the World Atlas of Language Structures* (Dryer & Haspelmath 2013) by Ian Maddieson, and *the Database of Eurasian Phonological Inventories* (Nikolaev 2018), both of which primarily deal with the distribution of phonemes in the global and Trans-Eurasian contexts, respectively.

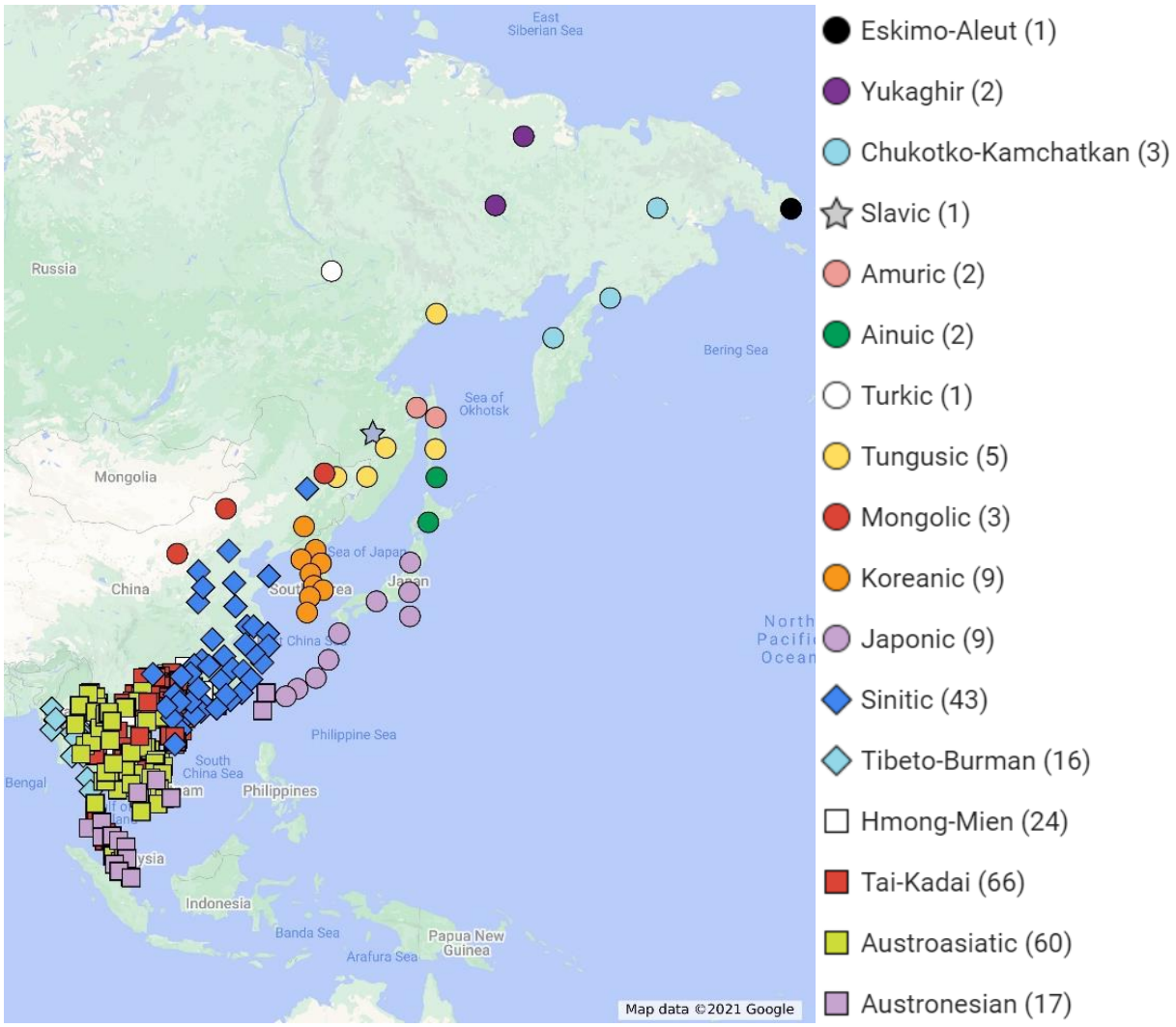

Figure 1. Coastal East Asian languages genealogical units included in this study (n=264)

The findings of this study can also contribute to the ongoing discussion of phonological reconstruction of the mentioned genealogical units and their intermediate protolanguages, such as Proto-Chinese (e.g. Baxter & Sagart 2014) and Proto-Tai (e.g. Pittayaporn 2009). Here, we bring into consideration the areal-typological and acquisitional perspectives to supplement a conventional comparative method, which cannot always maximise the information from language contact and other language-external causes, such as physiological factors (see also Campbell 2020: 314-315 for discussion on methodology).

2 Data and methods

The present study acquires data of 264 linguistic varieties under investigation from secondary sources, such as reference grammars, linguistic atlases, individual studies on phonological systems of Asian languages, as well as master's and doctoral theses published

around the globe. The collected data concerns 20 typological features on phonology, as given in Table 1. The selection of features is motivated by previous individual and comparative studies on phonology of languages spoken in the designated Coastal East Asian zone. This means that selected features tend to be common and representative in one or more genealogical or geographical groups.

Table 1. 20 typological features on phonology under investigation

Feature	Domain
1) 8 or more distinctive vowel qualities 2) Vowel length distinction 3) High front vowel /y/ 4) Distinction between high front vowel /i/ and mid/back vowel /ɨ, ɯ/ 5) Distinction between mid-high front vowel /e/ and mid-low front vowel /ɛ/ 6) Distinction between mid-high back vowel /o/ and mid-low back vowel /ɔ/	Vowels
7) 3 or more series of stop initials 8) Postalveolar fricative initials /ʃ-/, /ʂ-/ and/or /ɕ-/ 9) Voiceless alveolar lateral /ɬ, l̥, ʰl/ 10) Velar nasal initials /ŋ-/ 11) Distinction between unvoiced velar initials /k-, x-/ and voiced velar initials /g-, ɠ-, ɣ-/ 12) Distinction between liquids /r/ and /l/	Consonants
13) Stop codas /-p, -t, -k, -ʔ/ 14) Lateral coda /-l/ 15) Bilabial nasal coda /-m/ 16) Syllabic nasals 17) Initial consonant clusters consonant+liquid 18) Initial consonant clusters obstruent+obstruent	Components in the syllable structures
19) Contrastive level tones 20) Contrastive contour tones	Tones

The data is analysed in a binary format: 1 = present vs. 0 = absent. These binary values are organised in the NEXUS format (Maddison et al. 1997), and fed to SplitsTree4 (version 4.17.0, built 4 March 2021) (Huson & Bryant 2006). In the current study, we utilise a distance-based algorithm, known as NeighborNet, in the SplitsTree software to visualise the typological distance among the languages under study without any assumption or implication about their genealogical relationship (see e.g Szeto et al. 2018 for discussion of the method). With 264 linguistic varieties and 20 typological features, the algorithm generates the NeighborNet diagram, as shown in Figure 2. The diagram shows several clusters of linguistic varieties which share similarities in their typological profiles in the domain of phonology. These patterns of clustering also correspond to areas of convergence discussed in numerable previous studies, and this observation will pave the way for further discussion of macroareas and microareas in Coastal East Asia and individual typological features in the subsequent sections.

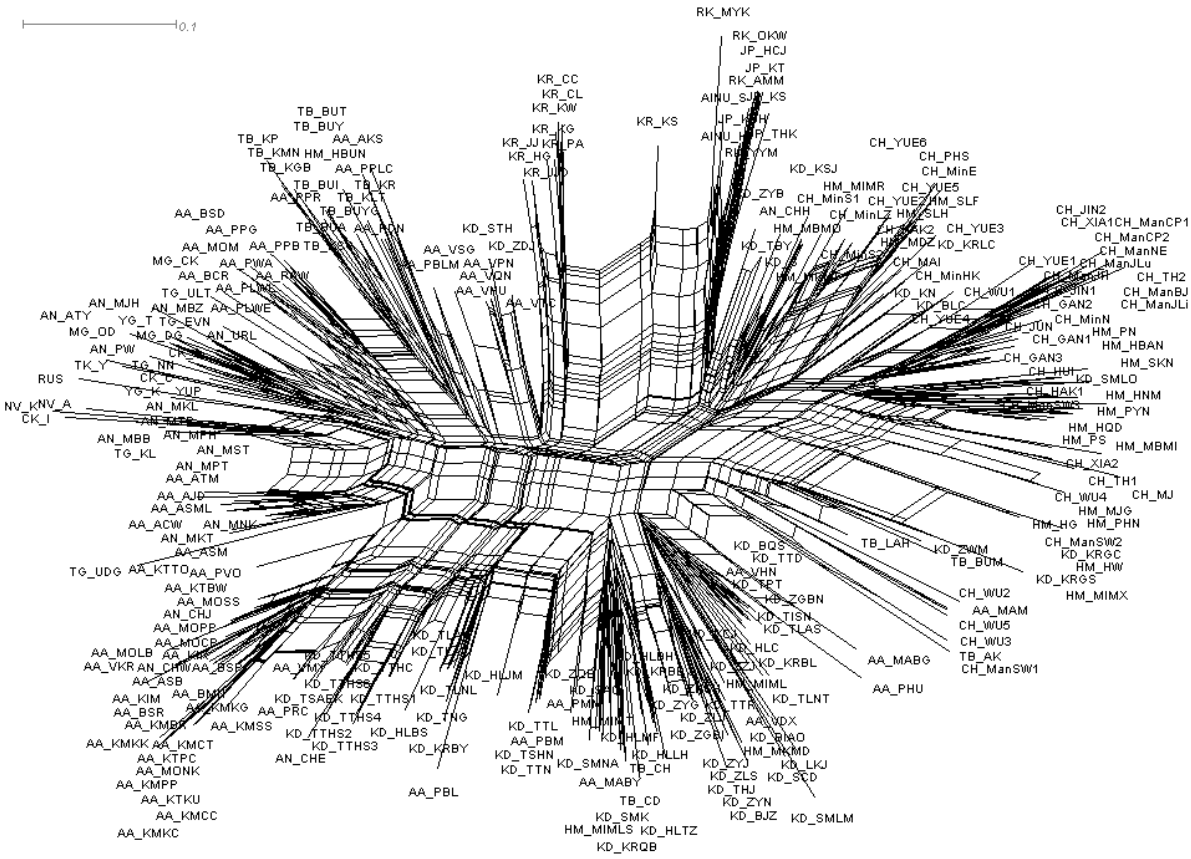

Figure 2. NeighborNet diagram of Coastal East Asian phonologies (n=264)

As for the interpretation of data, we use methods in areal linguistics to identify "Sprachbund", a German translation of the original notion in Russian *jazykovoj sojuz* 'language union' introduced by Trubetzkoy (1923). According to the selected framework, an area qualifies as Sprachbund when it shows such properties as numerosity of languages and shared traits as well as a supporting sociolinguistic setting based on local history (see e.g. Muysken 2008; Campbell 2017; Hickey 20017 for discussion of the criteria). We also apply a quantitative approach in linguistic typology to detect and weight the distribution of areality vs. affinity bias in certain language change and non-change in specific areas (see e.g. Nichols 1992, 1995; Bickel & Nichols 2006; Bickel 2013 for discussion of the method). It is worth noting that our method employed does not consider the trait weight based on typological complexity of each feature (see Campbell 2017: 29-34), as it would entail more discussion on linguistic complexity deduced from a large-scale typological survey, which is not necessarily relevant for the scope of the current study. In any case, we do not deny its contribution to research on this kind of topic, and it can be an area of improvement in future studies.

3 Mainland Southeast Asia as a macroarea

The NeighborNet diagram generated by the SplitsTree software illustrates a significant cluster of 95 linguistic varieties, as illustrated in Figure 3. The cluster contains the datapoints given in Table 2, comprised of five different genealogical units. These datapoints geographically correspond to languages spoken across Mainland Southeast Asia (MSEA), including present-day Southern China, Vietnam, Laos, Cambodia, and Thailand, as shown in Figure 4. From an areal-typological perspective, linguistic varieties spoken within this macroarea share a number of typological features in the area of phonology, which deviate from the rest of areas under investigation.

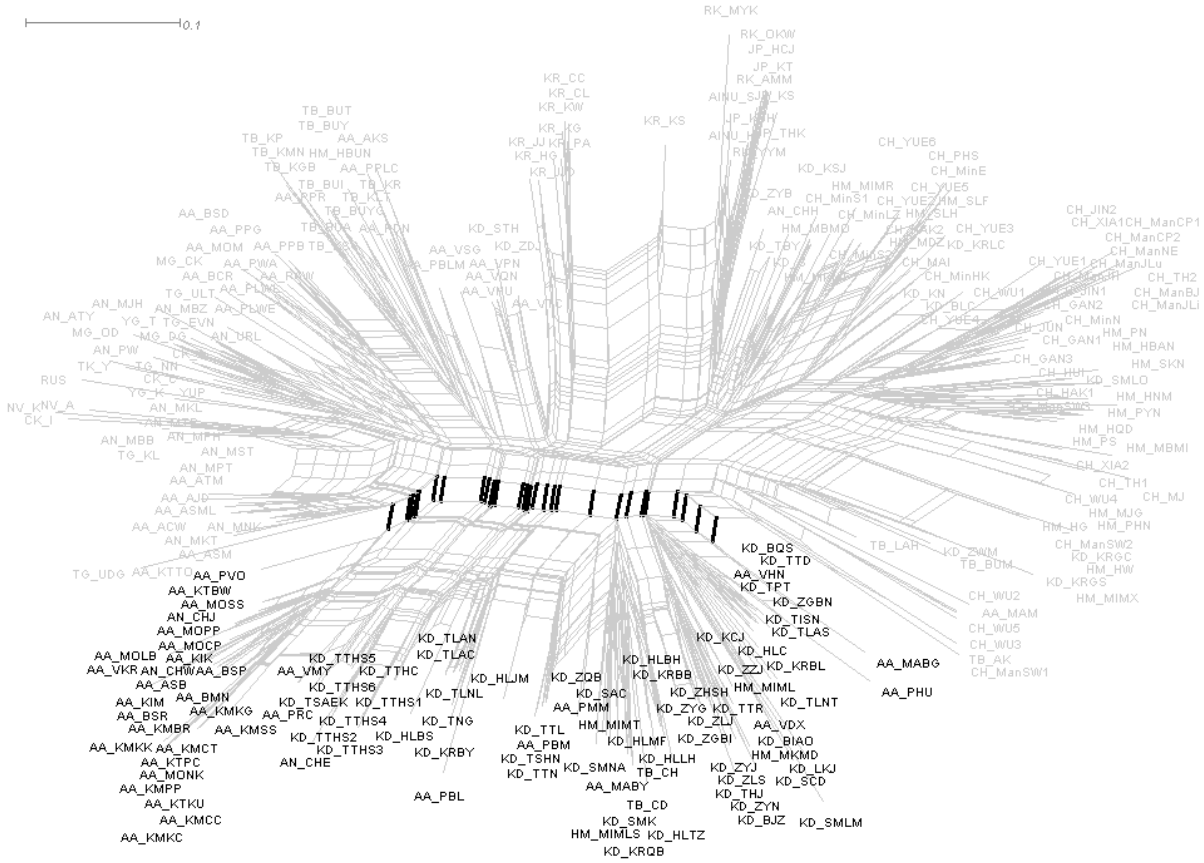

Figure 3. Mainland Southeast Asian cluster (n=95)

Table 2. Linguistic varieties in the Mainland Southeast Asian cluster (n=95)

Genealogical unit	Linguistic varieties
Tibeto-Burman	1) Hakha Chin; 2) Daai Chin
Hmong-Mien	3) Laos Iu Mien; 4) Thailand Iu Mien; 5) Guangdiang Iu Mien (Longsheng); 6) Diangui Kim Mun
Tai-Kadai	7) Langjia Buyang; 8) Yalang Buyang; 9) Baha Buyang; 10) Qabiao; 11) Cun; 12) Lauhut Hlai; 13) Bouhin Hlai; 14) Moyfaw Hlai; 15) Baisha Hlai; 16) Tongzha Hlai; 17) Jiamao; 18) Qiongshan Lingao; 19) Jizhao; 20) Southern Kam (Chejiang); 21) Mulam; 22) Maonan; 23) Ai-Cham; 24) Mak; 25) Chadong; 26) Lakkja; 27) Biao; 28) Guibei Zhuang; 29) Liujiang Zhuang; 30) Hongshuhe Zhuang; 31) Youjiang Zhuang; 32) Lianshan Zhuang; 33) Guibian Zhuang; 34) Qiubei Zhuang; 35) Saek; 36) Yongnan Zhuang; 37) Zuojiang Zhuang; 38) Yanguang Zhuang; 39) Nung; 40) Tai Nüa; 41) Tai Lü; 42) Tai Hongjin; 43) Tai Don; 44) Shan; 45) Northern Lao; 46) Central Lao; 47) Southern Lao; 48) Isan; 49) Phu Tai; 50) Red Tai; 51) Lanna (Lampang); 52) Lanna (Tak); 53) Central Thai; 54) S[outhern] Thai (Chumphon); 55) S Thai (Surat); 56) S Thai (Nakhon); 57) S Thai (Songkhla); 58) S Thai (Kedah); 59) S Thai (Kelantan)
Austroasiatic	60) Bolyu; 61) Bumang; 62) Vo; 63) Blang; 64) Man Met; 65) Hu; 66) Dongxing Vietnamese; 67) Hanoi Vietnamese; 68) May; 69) Kri; 70) Khmu; 71) Mlabri; 72) Western Bru; 73) Pacoh; 74) Kui Ntua; 75) Sapuan; 76) Mnong; 77) Sre; 78) Chong; 79) Si Saket Khmer; 80) Buriram Khmer; 81) Chachoengsao Khmer; 82) Chanthaburi Khmer; 83) Central Khmer; 84) Khmer Khe; 85) Phnom Penh Khmer; 86) Kiên Giang Khmer; 87) Chumphon Mon; 88) Samutsakhon Mon; 89) Phrapradaeng Mon; 90) Lopburi Mon; 91) Nyah Kur; 92) Semaq Beri
Austronesian	93) Jarai; 94) Eastern Cham; 95) Western Cham

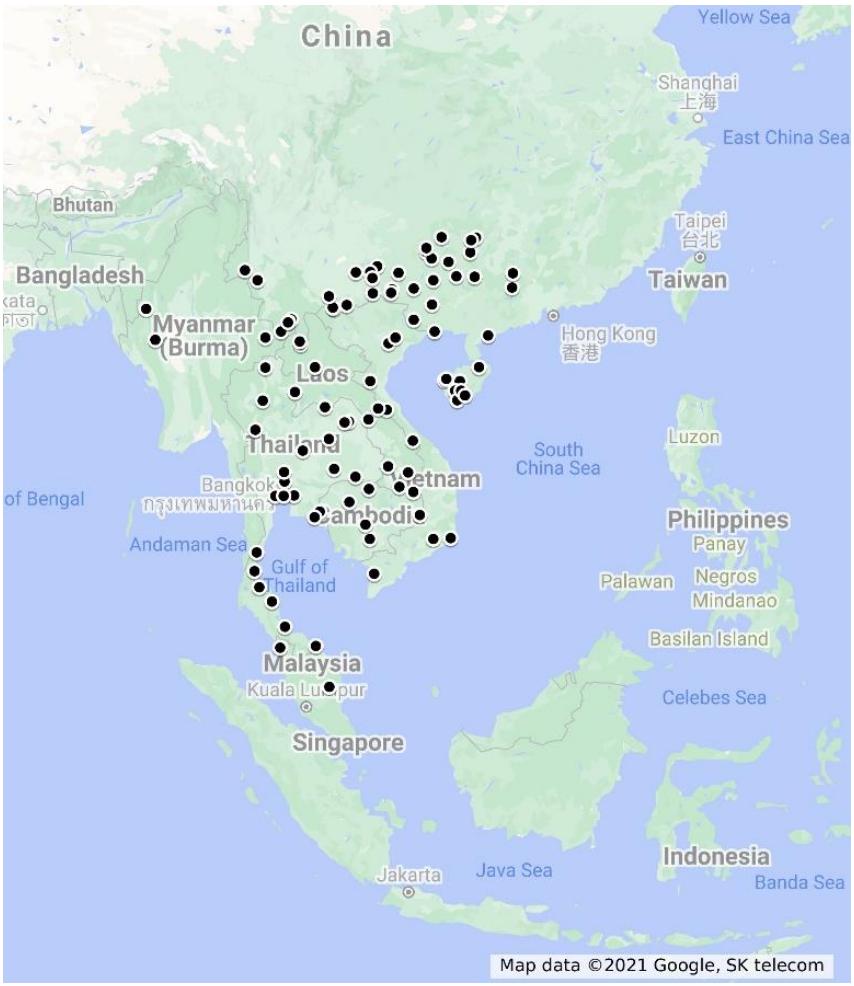

Figure 4. The Mainland Southeast Asian macroarea (n=95)

Characteristic features of the observed macroarea are illustrated in Table 3, which shows whether individual typological features behave differently from those in the rest of datapoints in a statistically significant way. The statistical significance and independence among given variables, i.e. tendencies concerning the presence and absence of individual features in given language groups, are identified through the 2 x 2 chi-squared (χ^2) test, a.k.a. the Fisher's exact test, two-tailed (Fisher 1922). According to the statistical test, almost three quarters of the shared features (14 out of 20) with a statistical significance ($p < 0.05$) can be considered characteristic of this given macroarea, confirming the pre-existing idea of MSEA as a macroarea in its own right (see e.g. Enfield 2005).

Table 3. Characteristic features in Mainland Southeast Asia vs. the rest of Coastal East Asia

Feature	MSEA (n=95)		The rest (n=169)		Adjusted *p*-value	Statistically significant
	present	absent	present	absent		
1) 8± vowels	76	19	92	77	$p < 0.05$	YES
2) long vs. short vowels	92	3	56	113	$p < 0.05$	YES
3) /y/	10	85	46	123	$p < 0.05$	YES
4) /i/ vs. /ɨ, ɯ/	81	14	63	106	$p < 0.05$	YES
5) /e/ vs. /ɛ/	68	27	74	95	$p < 0.05$	YES
6) /o/ vs. /ɔ/	70	25	65	104	$p < 0.05$	YES
7) 3± series of stop initials	71	24	74	95	$p < 0.05$	YES
8) /ʃ-, ʂ-, ɕ-/	27	68	114	55	$p < 0.05$	YES
9) /ɬ, l̥, ʰl/	32	63	50	119	$p = 2.45$	NO
10) /ŋ-/	87	8	127	42	$p < 0.05$	YES
11) /k-, x-/ vs. /g-, ɠ-, ɣ-/	33	62	100	69	$p < 0.05$	YES
12) /r/ vs. /l/	48	47	78	91	$p = 2.45$	NO
13) /-p, -t, -k, -ʔ/	95	0	121	48	$p < 0.05$	YES
14) /-l/	25	70	45	124	$p = 2.45$	NO
15) /-m/	95	0	87	82	$p < 0.05$	YES
16) Syllabic nasals	27	68	56	113	$p = 2.45$	NO
17) CC- [consonant+liquid]	44	51	43	126	$p < 0.05$	YES
18) CC- [obstruent+obstruent]	12	83	10	159	$p \approx 0.40$	NO
19) Contrastive level tones	54	41	99	70	$p = 2.45$	NO
20) Contrastive contour tones	64	31	84	85	$p < 0.05$	YES

At the same time, the information obtained above also confirms several phonological characteristics of MSEA languages mentioned in previous studies (e.g. Comrie 2007; Williams 2013; Enfield 2013; Enfield & Comrie 2015; Enfield 2019; Vittrant & Watkins 2019). The most prevalent features, also previously discussed by Enfield (2011: 69), are a high number of distinctive vowel qualities (8 or more); a systematic vowel length distinction (short vs. long); a symmetrical underlying structure of vowel system (high-mid-low and front-mid-back); and a gap in voiced stop series of the velars (no voiced /g-, ɠ-, ɣ-/). This characterisation of MSEA

type phonology can also be tested empirically by taking into comparison two groups of linguistic varieties of the same genealogical unit, one of which is falls inside and the other outside the macro-MSEA cluster in Figure 5. For instance, the comparison of several Tai-Kadai varieties, Central Gelao and Sui vs. Nung and Saek, show a neat contrast in their typological profiles concerning the vowel system.

Outside the macro-MSEA cluster						**Inside the macro-MSEA cluster**					
Central Gelao (He 1983: 13-14)			**Sui** (Zhang 1980: 8)			**Nung** (Saul & Freiberger Wilson 1980: 10)			**Saek** (Morev 1988: 18-19)		
i		*u*	*i*		*u*	*i i:*	*ɨ ɨ:*	*u u:*	*i i:*	*ɯ ɯ:*	*u u:*
e	*ɤ*	*o*	*e*	*ə*	*o*	*e e:*	*ə*	*o*	*e e:*	*ɤ ɤ:*	*o o:*
	a	*ɒ*		*a*		*ɛ*	*a a:*	*ɔ ɔ:*	*ɛ ɛ:*	*a a:*	*ɔ ɔ:*

Figure 5. Comparison of vowel systems of four Tai-Kadai varieties outside and inside the macro-MSEA cluster

4 Identifying microareas in the Coastal East Asia

Apart from the MSEA macroarea discussed in the previous section, other clustering patterns in the NeighborNet diagram (Figure 2), which correspond to specific geopolitical areas as viewed on the map, are observed. Each microarea shows expected properties of Sprachbund, as previously defined by Muysken (2008) and Campbell (2017), particularly numerosity of shared traits and a contact-favouring language sociology of an area. The microareas observed in the current study correspond relatively well, despite a slight deviation, to those proposed in previous studies, above all, Japan-Korea (Yurayong & Szeto 2020: 133), Lingnan (Szeto & Yurayong 2022; Liao 2022), Core MSEA (Enfield & Comrie 2015: 3), Suvarṇabhūmi (Szeto & Yurayong 2019: 41-43), and Inner Malay Peninsula (Phillips 2013: 30-32).

Characteristic features and tendencies of each feature observed in the designated microareas are illustrated in Table 4. Here, we focus on several microareas with a strong sign of convergence in the phonological system, contributing to the discussion of areal linguistics of Eastern Eurasia. To provide a diachronic perspective, the present study also investigates sound changes that have or have not taken place in language groups, about which reliable sources are available, such as Old and Middle Japanese, Old and Middle Korean, and Middle Chinese. Phonological reconstructions of protolanguage, such as those of the intermediate protolanguages of Tai-Kadai, will also be considered. Relating this diachronic information to areal tendencies in the adjacent areas can hint whether the sound changes in question were motivated or blocked by areal pressure, i.e. area-biased vs. affinity-biased (Bickel 2013).

Table 4. Distributional tendencies of each typological feature in the observed microareas

Feature	Microarea							
	Peripheries	Japan-Korea	Pan-China	Lingnan	Core MSEA	Outer ring MSEA	Suvarṇabhūmi	Inner Malay Peninsula
1) 8± vowels	20%	40%	67%	0%	67%	100%	100%	91%
2) long vs. short vowels	56%	80%	4%	22%	97%	29%	97%	73%
3) /y/	16%	20%	67%	11%	17%	0%	0%	0%
4) /i/ vs. /ɨ, ɯ/	20%	55%	23%	7%	76%	65%	100%	100%
5) /e/ vs. /ɛ/	16%	30%	33%	7%	55%	100%	97%	100%
6) /o/ vs. /ɔ/	4%	5%	31%	7%	57%	100%	100%	100%
7) 3± series of stop initials	16%	50%	35%	37%	64%	88%	92%	18%
8) /ʃ-, ʂ-, ɕ-/	48%	100%	90%	37%	40%	68%	11%	18%
9) /ɬ, ɭ, ʰl/	40%	0%	25%	26%	45%	59%	16%	0%
10) /ŋ-/	64%	0%	81%	100%	98%	91%	81%	100%
11) /k-, x-/ vs. /g-, ɠ-, ɣ-/	96%	40%	38%	37%	38%	79%	30%	100%
12) /r/ vs. /l/	100%	0%	17%	0%	21%	97%	97%	100%
13) /-p, -t, -k, -ʔ/	92%	55%	37%	96%	100%	91%	100%	100%
14) /-l/	84%	40%	8%	0%	3%	18%	62%	55%
15) /-m/	72%	60%	12%	78%	100%	65%	100%	73%
16) Syllabic nasals	0%	5%	58%	70%	31%	18%	24%	0%
17) CC- [consonant+liquid]	20%	0%	15%	11%	14%	74%	97%	18%
18) CC- [obstruent+obstruent]	20%	5%	8%	0%	3%	0%	27%	0%
19) Contrastive level tones	0%	75%	81%	93%	78%	50%	24%	0%
20) Contrastive contour tones	0%	0%	94%	96%	97%	26%	22%	0%

4.1 Japan-Korea

The first microarea to be discussed is Japan-Korea, illustrated in Figure 6. Structural convergence of the two genealogical units in contact, Japonic and Koreanic, have been previously investigated by numerable accounts (Janhunen 1999; Tranter 2012; Vovin 2015a; Yurayong & Szeto 2020). The Japan-Korea cluster includes linguistic varieties from three genealogical units, comprised of the datapoints given in Table 5.

Notable characteristic features in the Japan-Korea Sprachbund are the absence of distinction between back round vowels /o/ and /ɔ/; the palatalisation of /s/ before palatal phonemes /i, ʲV/, e.g. Japanese and Okinawan さ /sa/ vs. し /ɕi/, しゃ /ɕʲa/, or Korean 사 /sa/ vs. 시 /ɕi/, 셔 /ɕʲɔ/; the absence of velar nasal initial /ŋ-/; the absence of distinction between liquids /r/ and /l/, e.g. Japanese ルイス /lu-i-su/ for ‘Ruiz’ (a Spanish name) vs. ‘Lewis’ (an English name), or Korean 리스본 /li-si-bon/ ‘Lisbon’ vs. 로마 /lo-ma/ ‘Rome’; and the absence of initial consonant clusters. Some features are likely stable throughout the attested history of Japanese and Korean, while the others could be result of mutual convergence in the Sprachbund.

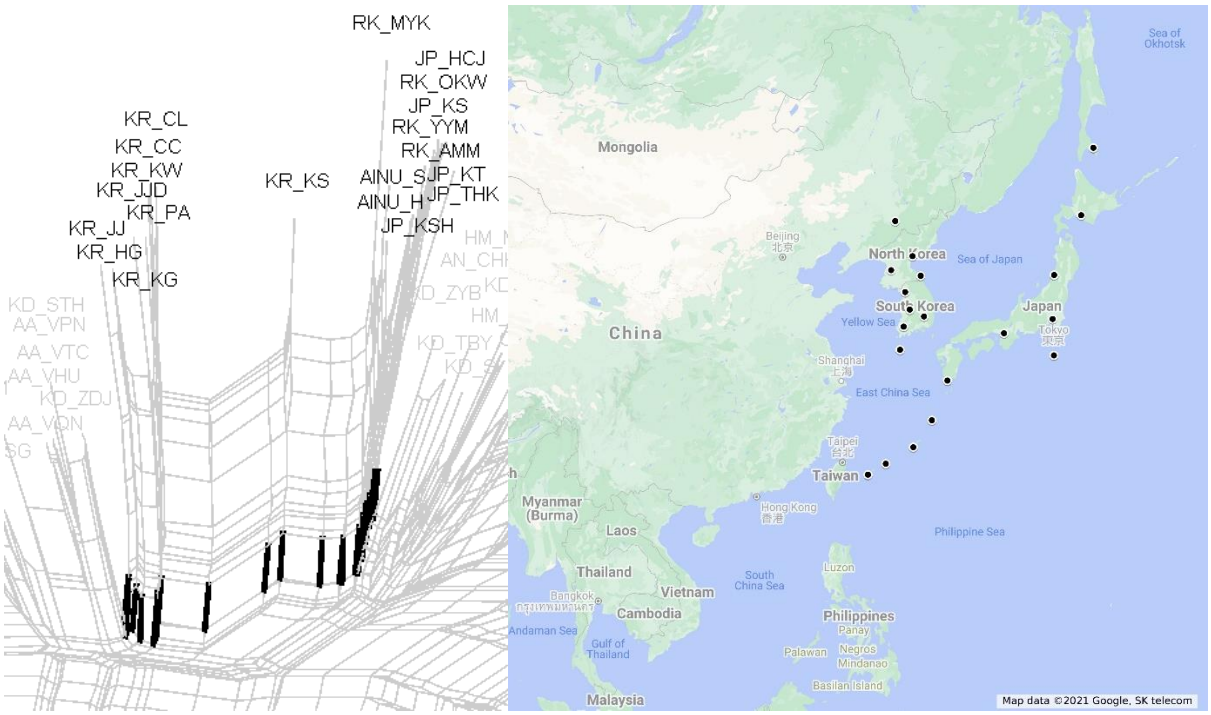

Figure 6. The Japan-Korea cluster and microarea (n=20)

Table 5. Linguistic varieties in the Japan-Korea cluster (n=20)

Genealogical unit	**Linguistic varieties**
Ainuic	1) Sakhalin Ainu; 2) Hokkaido Ainu
Japonic	3) Hachijō; 4) Tohoku Japanese; 5) Kantō Japanese; 6) Kansai Japanese; 7) Kyūshū Japanese; 8) Amami; 9) Okinawan; 10) Miyako; 11) Yaeyama
Koreanic	12) Jiangjiadian Korean; 13) Hamgyŏng Korean; 14) P'yŏngan Korean; 15) Kangwon Korean; 16) Kyŏnggi Korean; 17) Ch'ungch'ŏng Korean; 18) Kyŏngsang Korean; 19) Chŏlla Korean; 20) Jeju

Historically, linguistic convergence in the Japan-Korea Sprachbund must have started as early as the 1st millennium BC when there was still a Japonic speaking community in the Korean Peninsula. The intense contact continued throughout the 1st millennium AD even after the Japonic population had crossed the Korea Strait to settle down in the Japanese Archipelago. A peak of the described convergence period likely took place between Old Japanese and Old Korean from the 4th to 6th centuries AD during the Paekche-Kofun era when new technologies and cultural innovations were imported from the continent to the archipelago, especially those of the Sinitic civilisation (Janhunen 1999: 5-6, 2010: 290; Vovin 2010: 239-240; Yurayong & Szeto 2020: 135).

Given possible alternative explanations between language contact and inheritance, we also compare the mentioned features with older language forms of Japanese and Korean, as given in Table 6.

Table 6. Distribution of typological features throughout the attested history of Japanese and Korean

Feature	Old Japanese	Middle Japanese	Modern Japonic	Modern Koreanic	Middle Korean	Old Korean
6) /o/ vs. /ɔ/	NO	NO	0%	11%	YES	NO
8) /ʃ-, ʂ-, ɕ-/	YES	YES	100%	100%	NO	NO
10) /ŋ-/	NO	NO	0%	0%	NO	NO
12) /r/ vs. /l/	NO	NO	0%	0%	NO	YES
17) CC- [consonant+liquid]	NO	NO	0%	0%	NO	NO
18) CC- [obstruent+obstruent]	NO	NO	11%	0%	YES	NO

The information obtained from older language forms suggests that the absence of initial velar nasal /ŋ-/, and the absence of initial consonant cluster with liquid /Cr-, Cl-/ have never been attested for Japanese neither Korean. Meanwhile, the palatalisation of /s/ before /i, ʲV/, and the loss of distinction between liquids /r/ and /l/ are such features which Koreanic has acquired later under the period of contact with Japonic, although it is unclear when the palatalisation took place on the Koreanic side (Lee & Ramsey 2011: 150).

In any case, the typological shift from Old through Middle to Modern Koreanic can also be explained by internal reconstruction for several features. On the one hand, the emergence and loss of distinction between back round vowels /o/ and /ɔ/ are largely due to vowel rotation and monophthongisation, which have reorganised the Koreanic vowel system several times throughout its history (see Yurayong & Szeto 2020: 125-126). Figure 7 shows the rotational changes which took place in each phrase of the Korean language history.

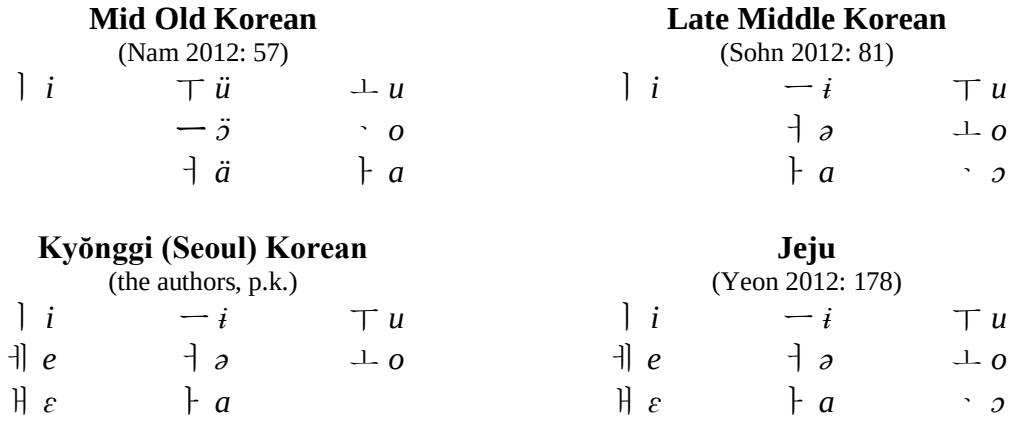

Figure 7. Development of the Koreanic vowel system

Nevertheless, the distinction /o/ vs. /ɔ/ inherited from Middle Korean is still preserved in modern Jeju (Yeon 2021: 170). On the other hand, the initial consonant clusters with two obstruents temporarily emerged in Middle Korean consequently to the loss of Old Korean

unstressed syllable leading to a monosyllabic structure, such as Late Old Korean 菩薩 ***pu**sar* > Middle Korean *psɔr* > Modern Korean *ssal* 'husked rice' (Vovin 2015b). A similar change also took place in a Japonic language, Miyako, e.g. Old Japanese ***tu**ki₂/tu**k**u-* > Japanese *ts**u**ki* ~ Miyako *ksks* 'moon' (Pellard 2015: 22). The change concerning consonant clusters will be discussed further from the perspective of learnability in Section 5.1.

4.2 Lingnan

Lingnan region is a historical territory situated in Southern China, constituted by areas such as Guangdong, Guangxi, Hainan and Northern Vietnam, and was ruled by the indigenous *Baiyue* 百越 tribes whose ethnic and linguistic identity (possibly multiple identities) still remains debatable (see Ramsey 1987; Meacham 1996). Known as an area of ethnic and linguistic diversity, linguistic convergence between two major genealogical units in the area, Sinitic and Tai-Kadai, has been previously speculated by de Sousa (2015), Huang and Wu (2018) and Liao (2022). Meanwhile, Hmong-Mien languages may also play a crucial role in this convergence zone as source of peculiar, shared features of the area (see Szeto & Yurayong 2022: 40-42). The observed microarea neatly corresponds to the described historical territory, as shown in Figure 8, while linguistic varieties which fall under this cluster belong to four genealogical units, as given in Table 7.

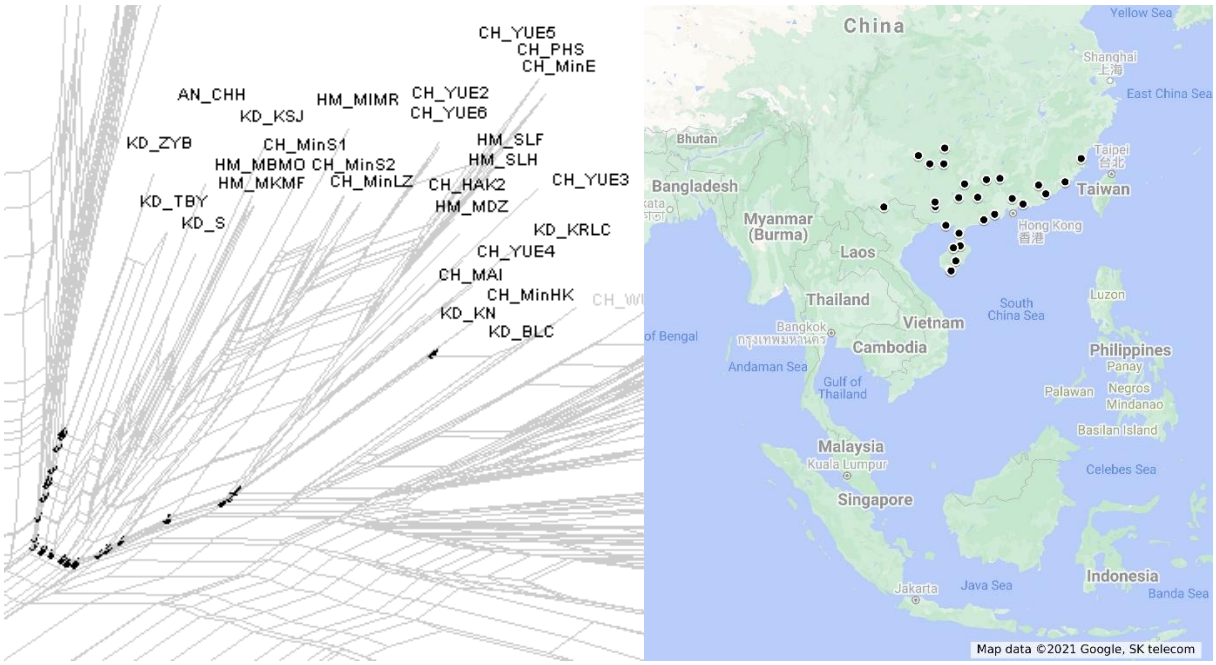

Figure 8. The Lingnan cluster and microarea (n=27)

Table 7. Linguistic varieties in the Lingnan cluster (n=27)

Genealogical unit	Linguistic varieties
Sinitic	1) Eastern Min; 2) Southern Min (Xiamen); 3) Southern Min (Chaozhou); 4) Leizhou Min; 5) Haikou Min; 6) Meixian Hakka; 7) Taishan Yue; 8) Yangjiang Yue; 9) Fengkai Yue; 10) Guiping Yue; 11) Beihai Yue; 12) Southern Pinghua; 13) Maihua
Hmong-Mien	14) Linhua She; 15) Luofu She; 16) Guangdiang Iu Mien (Ruyuan); 17) Biao Min; 18) Fanghai Kim Mun; 19) Dzao Min
Tai-Kadai	20) Lachi; 21) Lincheng Lingao; 22) Northern Kam; 23) Southern Kam (Sanjiang); 24) Sui; 25) Yongbei Zhuang; 26) Central Bouyei
Austronesian	27) Hainan Cham

Typical phonological features observed in the Lingnan Sprachbund are a low number of distinctive vowel qualities (less than 8); the absence of vertically symmetrical vowel system (high-mid-low); the presence of velar nasal initial /ŋ-/; the absence of distinction between liquids /r/ and /l/; the presence of stop codas /-p, -t, -k, -ʔ/, while lacking lateral coda /-l/; and the presence of contrast in both level (high vs. low) and contour tones (falling vs. rising).

The linguistic convergence observed in the Lingnan region can be traced back to the first major wave of contact between Sinitic and Tai-Kadai during the Qin dynasty (221-206 BC), when the Qin Emperor sent a large army to conquer the aforementioned Baiyue tribes in Far Southern China, establishing garrisons and subsequently importing more Han Chinese population to the area for facilitating control over the local inhabitants (see Szeto 2019: 33-37). This early phase of contact resulted in the oldest layer of Sinitic loanwords in Proto-Tai, dating back to the 3rd - 2nd centuries BC at the latest (Pittayaporn 2014).

Linguistic varieties in the Lingnan Sprachbund illustrate features which are not present in their cognate languages, i.e. not observed in Sinitic and Tai-Kadai varieties outside the area (as speculated by Szeto & Yurayong 2022; Liao 2023). Based on the previous observation, we are interested in exploring the source of such contact-induced innovation whether it was a certain genealogical unit or mutual reinforcement which is responsible for the linguistic convergence. Unlike the case of Japan-Korea Sprachbund, ancestor languages, except Middle Chinese, have not been attested for the majority of linguistic varieties spoken in the microarea. With no possibility of adequately consulting historical language sources, we alternatively apply a probabilistic approach to predicting language changes occurring in this convergence zone.

For this particular context, we conduct the Fisher's exact test (one-tailed) with Holm-Bonferroni correction, which can detect areal diffusion, responsible for individual features characteristic of this microarea, as given in Table 8. Applying the probabilistic approach previously conducted in areal-linguistic studies (e.g. Nichols 1992, 1995; Bickel & Nichols 2006; Bickel 2013), we select the dominant features of the Lingnan Sprachbund on the basis of

majority (underlined), and test them against tendencies in three genealogical units, Sinitic, Hmong-Mien, and Tai-Kadai. As for the only Austronesian member, Hainan Cham, it is an obvious case of adopting the Sinitic typology through intense contact and multilingual setting in the southern part of Hainan Island (see Thurgood et al. 2014).

Table 8. Areal signal of each typological feature in the Lingnan Sprachbund

Feature	Lingnan (n=27)		Sinitic (n=43)			Hmong-Mien (n=24)			Tai-Kadai (n=66)		
	present	absent	present	absent	Adjusted *p*-value	present	absent	Adjusted *p*-value	present	absent	Adjusted *p*-value
1) 8± vowels	0	27	24	19	< 0.05	8	16	< 0.05	42	24	< 0.05
2) long vs. short vowels	6	21	0	43	≈ 5.70	6	18	≈ 3.76	58	8	< 0.05
3) /y/	3	24	31	12	< 0.05	3	21	≈ 3.76	10	56	≈ 3.54
4) /i/ vs. /ɨ, ɯ/	2	25	3	40	≈ 5.70	4	20	≈ 3.06	48	18	< 0.05
5) /e/ vs. /ɛ/	2	25	7	36	≈ 2.71	9	15	≈ 0.17	35	31	< 0.05
6) /o/ vs. /ɔ/	2	25	7	36	≈ 2.71	9	15	≈ 0.17	34	32	< 0.05
7) 3± series of stop initials	10	17	11	32	≈ 5.70	11	13	≈ 3.62	41	25	≈ 0.31
8) /ʃ-, ʂ-, ɕ-/	10	17	30	13	≈ 0.11	16	8	≈ 0.46	26	40	≈ 3.54
9) /ɬ, l̥, ʰl/	7	20	4	39	≈ 5.70	17	7	< 0.05	21	45	≈ 3.44
10) /ŋ-/	27	0	34	9	≈ 0.13	23	1	≈ 3.76	62	4	≈ 2.47
11) /k-, x-/ vs. /g-, ɠ-, ɣ-/	10	17	9	34	≈ 5.70	14	10	≈ 1.29	22	44	≈ 3.54
12) /r/ vs. /l/	0	27	9	34	≈ 0.13	1	23	≈ 3.76	21	45	< 0.05
13) /-p, -t, -k, -ʔ/	26	1	27	16	< 0.05	11	13	< 0.05	62	4	≈ 3.54
14) /-l/	0	27	3	40	≈ 2.71	0	24	≈ 3.76	1	61	≈ 3.54
15) /-m/	21	6	15	28	< 0.05	8	16	< 0.05	61	1	≈ 3.54
16) Syllabic nasals	19	8	32	11	≈ 5.70	15	9	≈ 3.62	14	52	< 0.05
17) CC- [consonant+liquid]	3	24	0	43	≈ 5.70	8	16	≈ 0.73	17	49	≈ 1.16
18) CC- [obstruent+obstruent]	0	27	1	42	≈ 5.53	1	23	≈ 3.76	2	64	≈ 3.54
19) Contrastive level tones	25	2	33	10	≈ 1.03	22	2	≈ 3.76	54	12	≈ 1.75
20) Contrastive contour tones	26	1	42	1	≈ 5.70	24	0	≈ 3.76	63	3	≈ 3.54

The grey-shaded blocks ($p < 0.05$) indicate that the areal diffusion in the given microarea has an effect on changes or non-changes in members belonging to certain genealogical unit. An obvious case is a low number of distinctive vowel qualities (less than 8) where statistical significance ($p < 0.05$) is mutually detected when being tested against all three genealogical units, suggesting that the feature in question can be considered a case of areal diffusion or mutual reinforcement in the Lingnan Sprachbund, not commonly observed in cognate varieties outside this contact area.

Individual linguistic varieties of the three genealogical units are also affected by the areal diffusion in different domains. Among the Sinitic varieties in the area, the tendency of high front vowel /y/ has been weakening. At the same time, the presence of Middle Chinese features, such as stop codas /-p, -t, -k, -ʔ/ and bilabial nasal coda /-m/, is reinforced and firmly retained, similarly to Hmong-Mien varieties of the area. Meanwhile, the tendency of voiceless

nasals /ɬ, l̥, ʰl/ commonly observed in Hmong-Mien varieties tends to weaken, but could have also been the source of borrowing for Sinitic and Tai-Kadai varieties in the Lingnan region (see also Szeto & Yurayong 2022: 40-42), highlighting an idea of the Hmong-Mien family being the core member of the multilingual area in Southern China (see further discussion in Bing et al. 2000; van Driem 2011; DeLancey 2013). As for Tai-Kadai, the vowel system is strongly affected by the areal diffusion as it has become less complex and symmetrical with a lower number of distinctive vowel qualities, as well as a lack of distinction for length and various articulatory places. The distinction between /r/ and /l/, which was present in the protolanguage stage (see Ostapirat 2000 for Proto-Kra; Norquest 2007 for Proto-Hlai; Thurgood 1988 for Proto-Kam-Sui; and Pittayaporn 2009 for Proto-Tai), has been lost, while the syllabic nasals have emerged in the Tai-Kadai varieties of the Lingnan Sprachbund.

4.3 Suvarṇabhūmi

Suvarṇabhūmi is another mythical area from the prehistorical period, roughly situated in the area of present-day Thailand and Cambodia, although there is a doubt for its fictional root and function as a medium for nationalist movements in Southeast Asian states (Revier 2018). The name Suvarṇabhūmi has been recorded in the Indic historiography, with concrete evidence of early contact between Indic and indigenous populations found along the coastal areas of Southern Thailand, Southern Cambodia and Southern Vietnam (see also Wongsathit et al. in this volume). Depending on where to locate the areal centre, this microarea can also be regarded as circumstancing the lower Mekong River Basin, or even corresponding to the Dvāravatī political zone back in the 1st millennium AD. In any case, due to the possibility of convergence zone extending further to the east, west and south, we prefer the name Suvarṇabhūmi, given its impressionistic geographical restriction which better allows space for flexibility in determining a Sprachbund. The idea of Suvarṇabhūmi as a Sprachbund has been proposed by Szeto and Yurayong (2019: 41-43), and it geographically covers the area indicated in Figure 9. The Suvarṇabhūmi cluster includes datapoints from three genealogical units with a large proportion of Austroasiatic languages, as given in Table 9.

Phonological features which are widely observed in the Suvarṇabhūmi cluster are a symmetrical vowel system with a high number of distinctive vowel qualities (8 or more), vowel length distinction (short vs. long), three vertical (high-mid-low) and three horizontal places of articulation (front-mid-back). In terms of consonants, stop series with 3 or more distinct articulatory manners (plain-aspirated-voiced(-implosive)); a distinction between liquids /r/ and

/l/; stop and bilabial nasal codas /-p, -t, -k, -ʔ, -m/; and initial consonant clusters with liquids /Cr-, Cl-/ are very common for linguistic varieties spoken in the Suvarṇabhūmi Sprachbund.

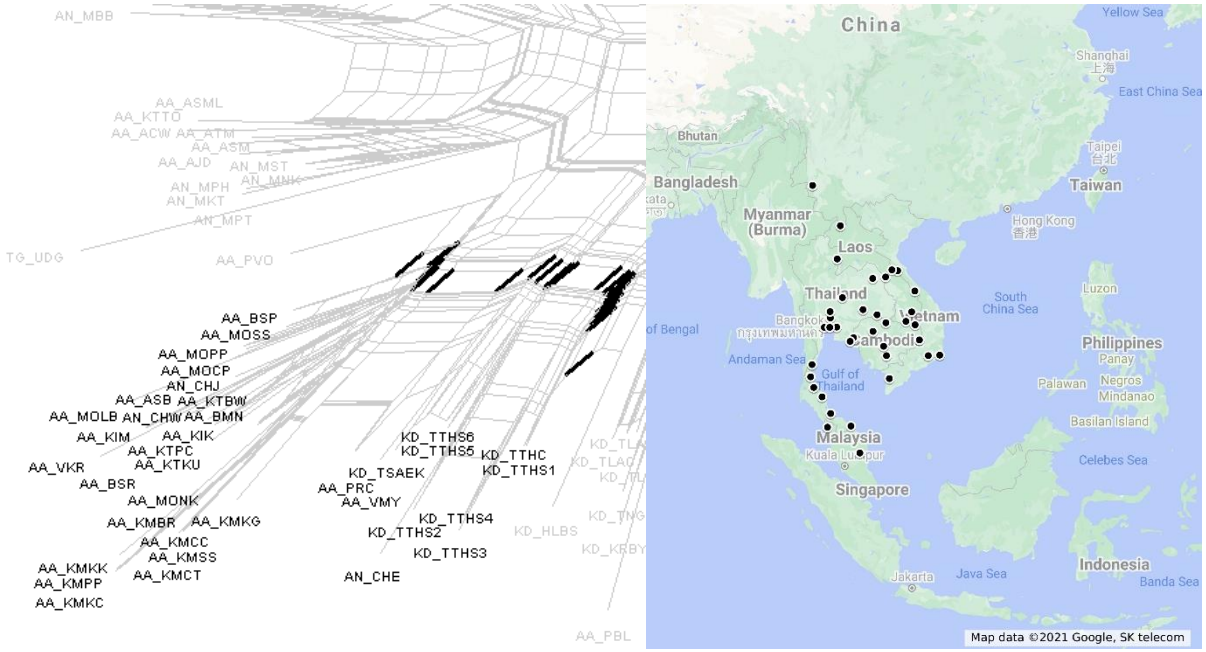

Figure 9. The Suvarṇabhūmi cluster and microarea (n=37)

Table 9. Linguistic varieties in the Suvarṇabhūmi cluster (n=37)

Genealogical unit	**Linguistic varieties**
Tai-Kadai	1) Saek; 2) Central Thai; 3) S[outhern] Thai (Chumphon); 4) S Thai (Surat); 5) S Thai (Nakhon); 6) S Thai (Songkhla); 7) S Thai (Kedah); 8) S Thai (Kelantan)
Austroasiatic	9) Vo; 10) May; 11) Kri; 12) Khmu; 13) Mlabri; 14) Western Bru; 15) Pacoh; 16) Kui Ntua; 17) Sapuan; 18) Mnong; 19) Sre; 20) Chong; 21) Si Saket Khmer; 22) Buriram Khmer; 23) Chachoengsao Khmer; 24) Chanthaburi Khmer; 25) Central Khmer; 26) Khmer Khe; 27) Phnom Penh Khmer; 28) Kiên Giang Khmer; 29) Chumphon Mon; 30) Samutsakhon Mon; 31) Phrapradaeng Mon; 32) Lopburi Mon; 33) Nyah Kur; 34) Semaq Beri
Austronesian	35) Jarai; 36) Eastern Cham; 37) Western Cham

Historically, this Sprachbund could have formed itself as early as the Dvāravatī period between the 4th and 10th centuries when Tai-Kadai populations still had not arrived from their Urheimat in Southern China, while the dominant populations were mainly Austroasiatic-speaking, particularly of the Monic branch in the west and the Khmeric branch in the east (Diffloth 1984; Jenny 2001: 1). This is strongly supported by the predominance of Austroasiatic members in the cluster, which later have closely interacted with Tai-Kadai and Austronesian in the area and very likely influenced the development of those neighbouring languages.

Given that the Suvarṇabhūmi Sprachbund is largely dominated by Austroasiatic languages, we are interested in exploring their influence on other members of different

genealogical units, particularly on Tai-Kadai. Thus, we conduct the Fisher's exact test (one-tailed) with Holm-Bonferroni correction in Table 10 to identify whether prominent features of the Suvarṇabhūmi cluster (see Table 4) observed in the Tai-Kadai varieties have changed or retained solely due to contact with Austroasiatic, or corresponding features in the Austroasiatic varieties in the area have also been affected by their Tai-Kadai neighbouring languages. Based on the results in the Austroasiatic column, the features with a statistical significance ($p < 0.05$) can be regarded as cases in which the Austroasiatic typology had influence on the Tai-Kadai varieties.

Table 10. Areal signal of dominant typological features in the Suvarṇabhūmi Sprachbund

Feature	Tai-Kadai (n=66)		Austroasiatic (n=60)			Suvarṇabhūmi (n=37)		
	present	absent	present	absent	Adjusted *p*-value	present	absent	Adjusted *p*-value
1) 8± vowels	42	24	60	0	< 0.05	37	0	< 0.05
2) long vs. short vowels	58	8	43	17	≈ 4.97	36	1	≈ 0.30
3) /y/	10	56	3	57	≈ 0.33	0	37	< 0.05
4) /i/ vs. /ɨ, ɯ/	48	18	57	3	≈ 4.97	37	0	< 0.05
5) /e/ vs. /ɛ/	35	31	58	2	< 0.05	36	1	< 0.05
6) /o/ vs. /ɔ/	34	32	60	0	< 0.05	37	0	< 0.05
7) 3± series of stop initials	41	25	48	12	≈ 4.97	34	3	< 0.05
12) /r/ vs. /l/	21	45	51	9	< 0.05	36	1	< 0.05
13) /-p, -t, -k, -ʔ/	62	4	60	0	≈ 4.97	37	0	≈ 0.30
15) /-m/	61	5	60	0	≈ 4.97	37	0	≈ 0.30
17) CC- [consonant+liquid]	17	49	43	17	< 0.05	36	1	< 0.05

From a diachronic perspective, it turns out that the Austroasiatic contribution to the Tai-Kadai language history is not the matter of change, but rather reinforcement and retention of Proto-Tai features as reconstructed by Pittayaporn (2009), including 8 or more distinctive vowel qualities with distinction between mid-high /e, o/ and mid-low vowels /ɛ, ɔ/; the distinction between liquids /r/ and /l/; and the initial consonant clusters with liquids /Cr-, Cl-/. At the same time, the results in the Suvarṇabhūmi column further suggest that the Tai-Kadai typological profile has reinforced and blocked changes, such as the emergence of high front round vowel /y/, the loss of the distinction between high front vowels /i/ vs. /ɨ, ɯ/, and the reduction of initial stop series to less than 3, which have taken place in Bolyu and Bugan, Austroasiatic varieties spoken in China. The given description strongly suggests that the multiethnic and multilingual Suvarṇabhūmi area should be considered another significant contact zone and Sprachbund within the MSEA macroarea.

4.4 Locating the Core of MSEA

Comrie (2007: 45) already mentions the problem that scholars have diverse opinions on where the core of MSEA is located. In connection to the present study, we also have our saying on this matter based on the results from a quantitative approach. Re-examining the NeighborNet diagram in Figure 2, the cluster of linguistic varieties, which is a good candidate for a core of MSEA, is illustrated in Figure 10. Referring to Table 4, prominent features of the identified area are the vowel length distinction (short vs. long); initial velar nasal /ŋ-/; stop and bilabial nasal codas /-p, -t, -k, -ʔ, -m/; and contrastive contour tones (falling vs. rising).

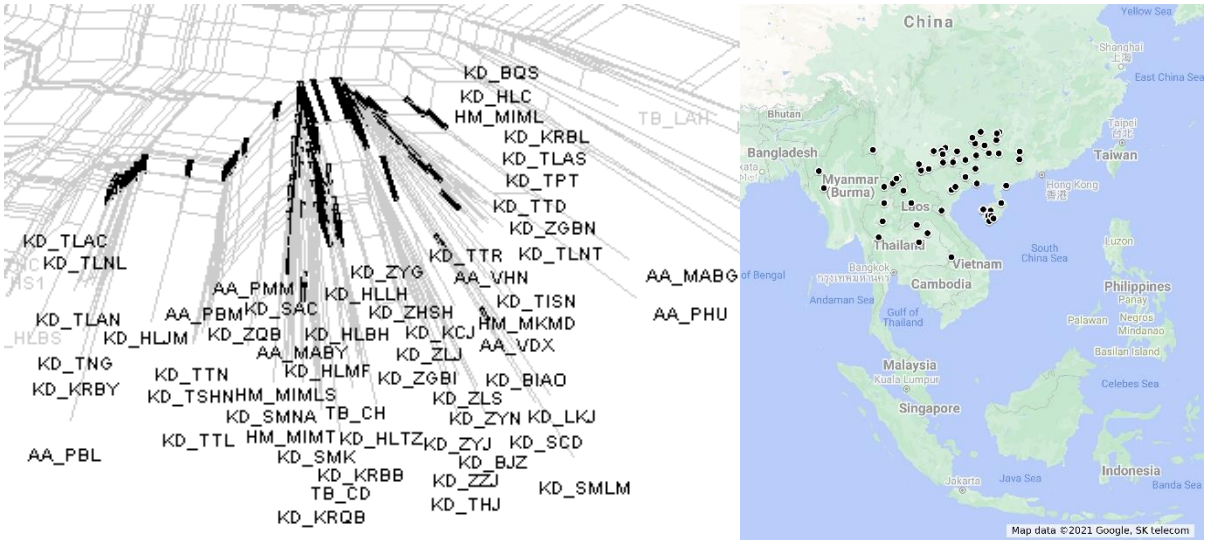

Figure 10. The Core MSEA cluster and microarea (n=58)

The geographical coverage illustrated in Figure 10 mainly includes Far Southern China and northern parts of Vietnam, Laos, and Thailand, essentially not subject to an intense influence by Central Thai and Khmer, the two present-day major state languages in the core of Suvarṇabhūmi Sprachbund. The linguistic varieties under this cluster are given in Table 11. Given this observation on the geographical distribution, we propose an alternative view for Core MSEA as an area surrounding an areal hotbed in the border region between China, Vietnam and Laos. Our proposed core area crucially excludes most parts of Myanmar, Thailand, Cambodia, and the entire Malaysia, as opposed to the definition of Core MSEA by Enfield and Comrie (2015: 3, 6).

Table 11. Linguistic varieties in the potentially Core MSEA cluster (n=58)

Genealogical unit	**Linguistic varieties**
Tibeto-Burman	1) Hakha Chin; 2) Daai Chin
Hmong-Mien	3) Laos Iu Mien; 4) Thailand Iu Mien; 5) Guangdiang Iu Mien (Longsheng); 6) Diangui Kim Mun
Tai-Kadai	7) Langjia Buyang; 8) Yalang Buyang; 9) Baha Buyang; 10) Qabiao; 11) Cun; 12) Lauhut Hlai; 13) Bouhin Hlai; 14) Moyfaw Hlai; 15) Baisha Hlai; 16) Tongzha Hlai; 17) Jiamao; 18) Qiongshan Lingao; 19) Jizhao; 20) Southern Kam (Chejiang); 21) Mulam; 22) Maonan; 23) Ai-Cham; 24) Mak; 25) Chadong; 26) Lakkja; 27) Biao; 28) Guibei Zhuang; 29) Liujiang Zhuang; 30) Hongshuhe Zhuang; 31) Youjiang Zhuang; 32) Lianshan Zhuang; 33) Guibian Zhuang; 34) Qiubei Zhuang; 35) Yongnan Zhuang; 36) Zuojiang Zhuang; 37) Yanguang Zhuang; 38) Nung; 39) Tai Nüa; 40) Tai Lü; 41) Tai Hongjin; 42) Tai Don; 43) Shan; 44) Northern Lao; 45) Central Lao; 46) Southern Lao; 47) Isan; 48) Phu Tai; 49) Red Tai; 50) Lanna (Lampang); 51) Lanna (Tak)
Austroasiatic	52) Bolyu; 53) Bumang; 54) Blang; 55) Man Met; 56) Hu; 57) Dongxing Vietnamese; 58) Hanoi Vietnamese

Our proposal aligns with a previous statement by Sidwell and Jenny (2021) on the role of Thai and Khmer providing a model for the MSEA convergence area, which is, in turn, considered as another Suvarṇabhūmi Sprachbund within the MSEA macroarea in this study.

> ‘The fact that MSEA today appears as a model case of a linguistic area with (standard) Thai as its most typical representative may suggest a different explanation. As has been widely demonstrated, Thai and Khmer, though belonging to two different families, share not only many lexical and grammatical features, but also a long cultural and religious heritage. With Thai as the most influential language in central MSEA in modern times, the MSEA convergence area could also be seen as an area of languages converging on the Thai model, which in turn has been influenced in its development by Khmer (and, at an earlier period, Chinese lects).’ (Sidwell & Jenny 2021: 8)

Considering the distribution of linguistic varieties in Table 11, we can regard Tai-Kadai languages as the dominant language family contributing to the formation of the core MSEA. This is distinguished from the Suvarṇabhūmi Sprachbund which is dominated by the Austroasiatic languages (as discussed in Section 4.3).

4.5 Summary on the microarea discussion

Throughout Section 4, we have presented evidence from the domain of phonology to support the establishing of several microareas across the Coastal East Asian zone: Japan-Korea (Section 4.1), Lingnan (Section 4.2), and Suvarṇabhūmi (Section 4.3). These areas qualify as Sprachbünde, provided that their local histories also support the convergence process across

genealogical units, which may have been typologically remarkably different in their erstwhile stages. We also participate in the discussion of the MSEA macroarea and propose that the area to be labelled as the core of MSEA should concentrate on highlands between Far Southern China, and the northern parts of Vietnam, Laos and Thailand (Section 4.4).

Considering the multilingual situation in each of the proposed microareas, the convergence in Japan-Korea has been mutually reinforced between Japonic and Koreanic, similarly to the reinforcement among Sinitic, Hmong-Mien and Tai-Kadai in Lingnan. As results, these bidirectional convergent scenarios have led to the formation of new shared typological profiles, as opposed to Suvarṇabhūmi and the core of MSEA where languages have been converging towards a pre-existing model from dominant Austroasiatic and Tai-Kadai languages, respectively. It is thus not impossible to talk about Austroasiaticisation as a reinforcing process for the Suvarṇabhūmi Sprachbund, and likewise Taicisation for the core of MSEA.

Next, we consider cognitive and acquisitional factors which may also play a significant role in the typological change of Coastal East Asian phonologies.

5 The perspective of learnability in phonological change and retention

Historical sources show that multilingualism and language shift have continuously been a common issue in Coastal East Asia. Considering the aspect of learnability, second-language (L2) acquisition of most language shifters in the history was imperfect. In cases where L2 speakers became the majority of a speech community, such substrate influence would tend to interfere with the phonology and other language-structural areas (Thomason & Kaufman 1992), e.g. the case of Southern Myanmar and the Reef Islands (Næss & Jenny 2011). This section is concerned with discussion on initial consonant clusters as a good example in which learnability could be responsible for the loss, as well as an example of Pinghua, a Sinitic variety in Far Southern China, which manifests the role of language shift in learnability of L2 phonology.

5.1 The case of initial consonant clusters

Initial consonant clusters have by nature a high level of typological complexity and markedness (Eckman & Iverson 1993; Gierut 2007). Learning consonant clusters is challenging for learners, usually leading to cluster reduction, i.e. “the deletion of one or more consonants from a target cluster so that only a single consonant occurs at syllable margins” (Grunwell 1987: 217). Under normal development, errors in pronunciation and spelling tend to decline as children’s phonemic awareness increases, be it under or without a controlled language

education (Treiman 1991; McLeod et al. 2001). A similar scenario also applies to adult language learners who face problems in both the perception and production of consonant clusters in L2 (Altenberg 2005). In any case, multilingualism and language shift in Coastal East Asia mainly occur with adult language users. Moreover, a systematic language education has been a relatively recent invention and policy, particularly for many areas in the context under discussion, so it seemingly has played a less important role in the development of phonological system, compared to the language-structural factors operating at a deeper level and time depth.

Consonant clusters are now predominantly observed in the Suvarṇabhūmi Sprachbund, while being partially represented in the Peripheries and Outer Ring MSEA (see Table 5). The language history of many languages in Coastal East Asia shows that initial consonant clusters, e.g. present in Old Chinese, Middle Korean, Old Mon, Old Burmese, Proto-Tai-Kadai and Proto-Austroasiatic, have been lost in most modern languages outside the Suvarṇabhūmi cluster. For instance, we can use a Sinitic loanword broadly spread to many languages in Coastal East Asia to trace the loss of initial consonant clusters.

Old Chinese 藍 ‘indigo’ ***N-k.r*ˁ*am* (Baxter & Sagart 2014)
> Middle Chinese ***l****am*^{A} > Cantonese ***l****aam*^{4}, Mandarin ***l****án*
→ Japanese ***r****an*
→ Middle Korean ***l****am* > P’yŏngan Korean ***l****am*, Kyŏnggi Korean ***n****am*
→ Proto-Hmong ****ɲj****eŋ*^{A} > White Hmong ***?***, Iu Mien ***?***, etc.,
but Green Hmong ***nk****aŋ*^{A2} (Mortensen 2000)
→ Proto-Vietic ****?*** > Vietnamese ***ch****àm*
→ Proto-Tai ****gr****aːm*^{A} > Yay ***s****aːm*^{A2}, Cao Bang ***z****aːm*^{A2}, Sapa ***c****aːm*^{A2}, Lao ***kʰ****aːm*^{A2},
but Central Thai ***kʰr****aːm*^{A2} (Pittayaporn 2009)

The case of language-internal change is also observed in Middle Korean, in which consonant clusters result from syncope of polysyllabic Old Korean words as of the 12th century.

쌀 ***ss****al* ‘husked rice’
< Middle Korean ***ps****ɔr*$^{H\text{-}a}$ (Ito 2013)
< Early Middle Korean ****p****ɔ****s****ɔr* (Lee & Ramsey 2011: 89)
< Late Old Korean 菩薩 ****p****(*u*)****s****ar* ‘rice’, cf. Middle Chinese *pʰŭə sar*
< Proto-Korean ****p****a****s****ɔr*^{LH}, ****p****a****s****ar*^{LH} (Vovin 2015b)

However, the tendency of not tolerating consonant clusters become visible in the confusion in the spelling of initial clusters in the 17th century Early Modern Korean. As result, all Middle Korean initial clusters have turned into intensified consonants at the latest in Early Modern Korean (Lee & Ramsey 2011: 67, 89, 131, 254, 257, 294; Rei 2012).

ㅃ ***pp-*** < ㅺ *sp-*, ㅸ *pp-*

ㄸ ***tt-*** < ㅽ *st-*, ㅼ *pt-*, ㅾ *pst-*, ㄸ *tt-*

ㄲ ***kk-*** < ㅿ *psk-*, ㅅㄱ *sk-*, ㅼㄱ *pk*, ㄲ *kk-*

ㅉ ***cc-*** < ㅅㅈ *sc-*, ㅼㅈ *pc-*, ㅉ *cc-*

ㅆ ***ss-*** < ㅅㅅ *ss-*, ㅼㅅ *ps-*

The loss of initial clusters, thus, can be considered as one of the common tendencies of phonological development in the central and northern parts of Coastal East Asia. The motivating force could, but not necessarily, have spread from the north, especially from the speakers of languages in the Peripherical North, which typically do not tolerate consonant clusters (see Janhunen 2007: 78, 2023: 143). However, due to a very broad spread of this isogloss, the learnability explanation seems stronger than the areality explanation in this particular case.

5.2 The case of Pinghua: language shift and learnability

Unlike speakers of other Sinitic languages, Pinghua speakers show genetic affinity with ethnic minorities in Southern China (especially the Tai-Kadai populations) instead of Han Chinese (Gan et al. 2008). They are descended from indigenous populations in Southern China assimilated by the Han Chinese in terms of language, culture, and self-identification.

Despite its history of language shift, Pinghua shares similar phonological features with other Southern Sinitic languages, as given in Table 12. As Sinitic languages in different parts of their dialect continuum have gone through typological changes as convergent with their neighbouring non-Sinitic languages (see Bennett 1979; Hashimoto 1985; Szeto 2019; Szeto & Yurayong 2021), typological profiles of languages in contact with Sinitic in the north, i.e. the Altaic type (including Turkic, Mongolic and Tungusic), and in the far south, i.e. the MSEA type, also play a significant role here. The contrastive tendencies between Northern and Far Southern Sinitic are portrayed in Table 13.

Table 12. Inheritance and areal diffusion in the Pinghua phonology

Affinity-biased features of Sinitic	Area-biased features of MSEA
Presence of high front vowel /y/	Presence of velar nasal initials /ŋ-/
Presence of syllabic nasals	Presence of stop codas
Absence of initial consonant clusters	Presence of contrastive level tones

Table 13. Northern vs. Southern Sinitic

Feature	Altaic type	Northern Sinitic	Far Southern Sinitic	MSEA type
10) velar nasal initials /ŋ-/	Not common	Not common	YES	YES
13) stop codas /-p, -t, -k, -ʔ/	YES	Not common	YES	YES
15) bilabial nasal coda /-m/	YES	NO	YES	YES
16) Syllabic nasals	NO	Not common	YES	Not common
19) contrastive level tones	NO	Not common	YES	YES

However, it is still debatable whether the Pinghua phonology has become what it is today as a result of areal convergence. In any case, there are further examples, such as number of tones: 4 in Standard Mandarin vs. 6 (or 9) in Cantonese, and tendency towards polysyllabicity in Northern Sinitic, as illustrated below.

	‘table’	‘bottle’	‘neck’
Standard Mandarin	*zhuōzi*	*píngzi*	*bózi*
Cantonese	*toi²*	*zeon¹*	*geng²*

The absence of several features in Northern Sinitic (velar nasal initials /ŋ-/ and contrastive level tones) might be associated with the language shift of Altaic speaking population to Sinitic language. Meanwhile, the absence of the other features (stop codas /-p, -t, -k, -ʔ/ and bilabial nasal coda /-m/) cannot be explained by the language shift of Altaic speaking population, but rather that these final consonants became too complex and unlearnable for speakers of Northern Sinitic languages that have a strong tendency of open syllable.

6 Conclusions

This quantitative-typological approach with three complementing perspectives – areal tendency, diachrony and learnability – gives a better understanding of how the Coastal East Asian phonologies have arrived in their modern shapes under a multilingual sociological setting. The quantitative method employed for identifying areal tendency helps interpret the

direction and motivation of sound changes in a language, for which a learnability perspective can also provide relevant language-acquisition explanations.

As for further studies, there remain tasks to complete the diachronic description of each feature in each genealogical unit. In terms of quantitative approach, the trait weight of investigated features based on their typological complexity can also be considered in the statistical analysis. Moreover, it is also crucial to identify the motivation of change or retention in each feature whether the cause was areal diffusion or (un)learnability. Advance in such knowledge can shed light on the role of multilingualism throughout the history and possibly also recent development of multilingual education for language users across Coastal East Asia.

Author Contributions

To comply with the regulations of the Italian academic authority, we declare the distribution of lead responsibility for individual sections as follows: Chingduang Yurayong for Sections 1, 3, 4, 4.1, 4.3, 4.4, 4.5, 5, 5.1, and 6; Pui Yiu Szeto for Sections 2, 4.2, and 5.2. All authors have read and agreed to the published version of the manuscript.

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