

Jahai phonology: A preliminary survey

Niclas BURENHULT
Lund University

1. Introduction

Jahai, a language belonging to the Northern Aslian subgroup of the Aslian branch of Mon-Khmer, is spoken by a community of approximately one thousand individuals in remote parts of Perak and Kelantan, Peninsular Malaysia, and reportedly also by a small community in the adjacent part of southernmost Thailand. Being mobile hunter-gatherers until recently, most Jahai speakers have now settled down in resettlement villages established by the Malaysian government. They are in frequent contact with speakers of Malay, and many share settlements with speakers of Temiar, a Central Aslian language.

This article attempts to give a brief synchronic overview of the phonology of the To' variety of Jahai, as spoken by the 90 or so inhabitants of Kampung Sungai Banun in the resettlement area of Air Banun, in Temengor *mukim*, Hulu Perak district, in the state of Perak, Malaysia. In-the-field collection of the material at issue has been taking place intermittently during the period 1998-2000, and the results presented rest on a rhyming list containing 1,360 lexical items. A great number of Malay loanwords has been identified, representing approximately one fifth of the collected vocabulary. Fieldwork is in progress, and further data are likely to modify, refine and supplement the current results. The present survey does therefore not aim at completeness and is to be considered as preliminary.¹

1.1 Previous research

A short account of the Jahai sound system is to be found in Father Schebesta's early sketch of Jahai grammar, including the introductory note by C.O. Blagden (Schebesta 1928:803-805). This involves brief phonetic exemplification of the various vowels and consonants and some discussion on the problematic syllable-

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and/or word-final segments referred to below as unreleased stops and preploded nasals. Schebesta further stated that stress falls on the last syllable of a word, and he suggested that tones are contrastive in a limited set of lexical items.

More recently, detailed phonological analyses have been carried out on the closely related Kensiw language, also a member of the Northern Aslian subbranch of Aslian. For example, Bishop (1996) provides a thorough account of the Kensiw dialect spoken at Bansakai, in Yala Province, southern Thailand, involving extensive descriptions of phonemes, prosodic features, and word/syllable structure. Of particular interest is the complex vowel system, displaying five tongue heights (atypical for Aslian) and phonemically contrastive nasality. Also, pitch difference is said to be contrastive in a small set of lexical items, a feature similar to the one noted by Schebesta (1928:805) in Jahai. Previous accounts of Yala Kensiw include that of Phaiboon (1984), and a phonological description of the Kensiw dialect spoken in Trang Province, Thailand, has been produced by Bauer (1991).

For accounts of the sound systems of other Aslian languages, see e.g. Benjamin 1976:130-153 for Temiar, Diffloth 1976b:102-111 for Jah Hut, Diffloth 1977 for Proto-Semai, and Kruspe 1999:1-48 for Semelai. General summaries of Aslian phonetics and phonology include Benjamin in press a:24-27 and in press b:4-8, as well as Matisoff (to appear, 7-19). For a reasonably complete list of references related to Aslian linguistics in general, see Burenhult 1999.

2. Vowels

Judging from the data available at present, the Jahai vowel system is distinguished by three degrees of vowel height for the front, central and back positions (see Table 1).⁹ This is in line with the systems described for some other Aslian languages, including Jah Hut (Diffloth 1976b:103), Temiar (Benjamin 1976:131) and Trang Kensiw (Bauer 1991:316), but contrasts sharply with the complex pattern claimed by Bishop (1996:228-232) for Yala Kensiw.

Phonemic vowel nasality occurs but is not very frequent (present in about ten percent of the lexical items collected) and does not involve all vowel positions (see section 2.1 for further discussion on contrastive vowel nasality and environmentally conditioned nasalisation of vowels). As in other Northern Aslian languages, phonemically significant vowel length does not exist. The back vowels display significant rounding, especially /u/ and /o/. Front and central vowels are unrounded. As to the high central vowel, which is usually described as rounded and symbolised by /ʉ/ in other Aslian languages, minimal rounding is limited to certain environments. Thus, to mark the contrast between the rounded back and the non-rounded non-back vowels, the symbol /ɨ/ is preferred to /u/.

Segments which were interpreted by Schebesta (1928:803, 804) as diphthongs are always syllable-final and are more appropriately described as vowel + approximant (/w/ or /j/). No phonemically significant inter-consonantal diphthongs

have been identified in the present material, although non-significant diphthongisation has been observed, notably in final syllable vowels before palatal consonants: [sɛiɕʰ] /sɛɕ/ ‘meat’, [lɔiɕʰ] /lɔɕ/ ‘bow’, [jaŋgɨiŋ] /raŋgɨ/ ‘jew’s harp’.

ORAL			NASAL		
Front	Central	Back	Front	Central	Back
i	ɨ	u	ĩ	ĩ̃	ũ
e	ɔ	o		ẽ	
ɛ	a	ɔ	ẽ	ã	õ

Table 1. Vowel phonemes in Jahai.

2.1 Vowel nasality and nasalisation

Although rather marginal, lexically contrastive vowel nasality is very apparent in Jahai, and nasal equivalents of the oral vowels /i, e, ɨ, ə, a, u, ɔ/ have been identified. These occur only in final syllables. No nasal equivalents of the mid vowels /e/ or /o/ have been found. The following lexical pairs illustrate the oral/nasal contrast:

/kajĩʔ/	‘tarsier’	/kajĩʔ/	‘little finger’
/plɛs/	‘to smear’	/plẽs/	‘(sound of blowpipe)’
/sĩt/	‘honeycomb’	/stĩt/	‘to rub oneself’
/ttlɔt/	‘to stare’	/klɔt/	‘to swallow’
/kawaw/	‘bird’	/wãw/	‘(a type of civet)’
/siruc/	‘to slurp’	/grũc/	‘slender-toed gecko’
/hakɔk/	‘to throw’	/hokõk/	‘to pull limbs of animal’

There appear to be some differences in degree in the production of nasal vowels. In some lexical items nasal vowels are consistently distinctly pronounced and easily recognised, whereas those in other items are more subtle and characterised by much greater variation and unpredictability. In cases where nasal vowels occur in non-conditioned environments, and where phonemic vowel nasality thus can be posited, the former pattern is always the case. However, in conditioned environments (typically nasal consonants, see below) the nasal element in vowels is commonly less salient and less predictable. Still, it cannot be made clear at this point whether the difference in degree of nasalisation in vowels really reflects a distinction between conditioned nasalisation and true nasality, although potentially contrastive pairs like [ŋɔkʰ ~ ŋõkʰ] /ŋɔk/ ‘to sit’, in which the nasalisation of the vowel is not always apparent, and [bɔŋõkʰ] /bŋõk/ ‘(a type of frog)’, in which the vowel appears to be consistently and distinctly nasal, may point in that direction. In the phonetic examples given here, only the distinctly nasal vowels are consistently transcribed as such. Non-distinct examples are transcribed without the tilde, e.g. [mɔh] /mɔh/ ‘nose’, unless some point is made about their nasalisation, in which case the tilde is added for clarity: [mõh] /mõh/ ‘nose’.

As to the directionality of environmentally conditioned nasalisation of vowels, it can be suggested on the basis of the present data that nasalisation is bidirectional, i.e. both progressive and anticipatory, although it is not possible at this stage to determine whether one is stronger than the other and therefore 'primary' (see Blust 1997:150-151 for a discussion on 'primary' vs. 'contragrade' nasalisation). As noted above, the situation is also complicated by the possible presence of phonemically nasal vowels (see also section 3.1.2). What is clear, however, is that anticipatory nasalisation under certain circumstances is avoided in final syllables by means of prepllosion of nasal consonant codas, which effectively seals off the preceding vowel nucleus from nasalising influences (see section 3.1.2). Progressive nasalisation from the onset, on the other hand, is allowed - [mĩtʰ] /mitʰ/ 'eye', [ʔəŋjūtʰ] /ŋjutʰ/ 'throat', [mʂh] /mʂh/ 'nose' - and may even be desirable, as suggested by Malay loanwords in which voiced stop onsets which follow homorganic nasals, and which could therefore perhaps be interpreted as 'postplosions', are assimilated and lost: [ləmũʔ] /lmuʔ/ from Malay *lembu* 'cattle', [rənāh] /rnah/ from Malay *rendah* 'low', [ʃʔaŋjūtʰ] /ʃaŋjutʰ/ from Malay *janggut* 'beard'.

In pre-final syllables, however, nasal coda are not preploded and anticipatory nasalisation is allowed to operate freely, affecting not only the preceding vowel but sometimes also the consonant onset: [mũŋker] /buŋker/ 'to wake up', [mĩntəŋ] /bintəŋ/ 'star' (from Malay *bintang*). Another example of anticipatory nasalisation of word-initial consonants also becomes apparent during infixation of /n/. Word-initial /b/, /w/ and /l/ are then consistently realised as [m] and [n] respectively as the infixed /n/ forms the onset of the following new syllable: [mʂnawaicʰ] from /hawac/ 'macaque', [mʂnawətʰ] from /wawətʰ/ 'rat', [nʂnataʔ] from /lataʔ/ 'waterfall'.

The primary source of environmentally conditioned nasalisation of vowels is nasal consonants. However, there are also occasional examples in which phonemically nasal vowels result in anticipatory nasalisation of non-nasal vowels in the same word. This phenomenon appears to be largely restricted to words where the final syllable onset is a glottal or an approximant, which suggests that only such consonants are transparent to nasalisation: [ʃʔʂhũʔ] /jhũʔ/ 'tree', [kũhʔʂh] /kuhʔʂh/ '(a type of turtle)', [hāwēn] /hawēn/ 'wild boar', [hājēʔ] /hajēʔ/ 'house'.

2.2 Description of vowel phonemes

/i/ is a close front unrounded vowel [i]: [kitʰ] /kitʰ/ 'buttocks', [sil] /sil/ '(a type of tortoise)'. /i/ is the rather common nasal equivalent of /i/: [hĩcʰ] /hĩcʰ/ 'rain', [kəĩ] /kəĩ/ 'wrist'.

/e/ is a close-mid front unrounded vowel [e], slightly more raised than [e], which is rather infrequent: [hēʔ] /heʔ/ 'PRONOUN 1P INC', [təkʰ] /tekʰ/ 'to sleep'. It has no nasal equivalent.

/ɛ/ is an open-mid centralised-front unrounded vowel [ɛ]: [ʔɛkʰ] /ʔɛkʰ/ 'to give', [gɛs] /gɛs/ 'to descend'. /ɛ/ is the rather common nasal equivalent of /ɛ/: [lapɛkʰ] /lapɛkʰ/ 'mud', [pəcʰɛʔ] /pɛʔ/ 'wet'.

/i/ is a close central unrounded vowel, which is slightly more backed than [i]: [hípʔ] /híp/ 'forest', [sítʔ] /sít/ 'honeycomb'. The nasal equivalent /ĩ/ is rather infrequent: [sətʔ sítʔ] /stít/ 'to rub oneself', [taʔícʔ] /taʔíc/ '(a type of large bird)'. In some contexts /ĩ/ becomes slightly rounded.

/ə/ is a mid central unrounded vowel [ə]: [gəs] /gəs/ 'to carve', [ʔəhəj] /ʔhəj/ 'small'. It is rather infrequent in stressed (final) syllables. In pre-final syllables it is a short epenthetic [ɛ] and not phonemic, and in some environments it is commonly omitted altogether. /ɛ/ is the nasal equivalent of /ə/: [cʔənhəʔ] /cñhəʔ/ 'short', [səh] /səh/ 'to meet'.

/a/ is an open central unrounded vowel [a]: [ʔapʔ] /ʔap/ 'tiger', [cʔaʔn] /can/ 'foot; leg'. The nasal equivalent /ã/ has only been identified in two lexical items: [japãh] /japãh/ '(name of Jahai group)', [wãw] /wãw/ '(a type of civet)'.

/u/ is a close back rounded vowel [u]: [dukʔ] /duk/ 'to pounce upon', [tuŋ] /tuŋ/ 'to fell'. /ũ/ is the nasal equivalent of /u/: [cʔũʔ] /cũʔ/ 'blind', [tūs] /tūs/ 'to grub'.

/o/ is a close-mid back rounded vowel [o]: [sopʔ] /sop/ 'lung', [toʔm] /tom/ 'tree'. It has no nasal equivalent.

/ɔ/ is an open-mid back half-rounded vowel [ɔ]: [gɔs] /gɔs/ 'to live', [tɔʔm] /tɔm/ 'water'. /ɛ/, the nasal equivalent of /ɔ/, is the most common nasal vowel: [ʔɛʔ] /ʔɛ/ 'dog', [lɛr] /lɛr/ 'to hiss'.

3. Consonants

The consonant system of Jahai involves 20 phonemes and conforms to the general Aslian pattern (see Table 2). Features of particular interest include the common presence of 'preploded' nasals in word-final position, the neutralisation of syllable-final stops, as well as the presence of the unusual voiceless bilabial fricative /ɸ/.

	Bilabial	Alveolar	Palatal	Velar	Glottal
Plosive	p b	t d	c ɟ	k g	ʔ
Nasal	m	n	ɲ	ŋ	
Fricative	ɸ		s		h
Lateral		l			
Trill		r			
Approximant	w		j		

Table 2. Consonant phonemes in Jahai.

3.1 Description of consonant phonemes and allophonic variation

3.1.1 Plosives

Syllable-initially, voiceless /p, t, c, k/ and voiced /b, d, j, g/ are usually realised as unaspirated bilabial, alveolar, palatal and velar stops. The palatals /c/ and /j/ are affricated [cʰ] and [jʰ], although affrication of /c/ does not usually occur before [i]: [cijas] /cjas/ 'hand'. Non-significant aspiration of word-initial /p/ has been noted occasionally. The voiced/voiceless contrast is illustrated by the following minimal pairs:

[pɔh]	/pɔh/	'to fan'	[bɔh]	/bɔh/	'fruit'
[tɕʰ]	/tɕʰ/	'soil'	[dɕʰ]	/dɕʰ/	'to make'
[cʰɔh]	/cʰɔh/	'to bite'	[jʰɔh]	/jʰɔh/	'to ascend'
[keʰn]	/ken/	'child'	[geʰn]	/gen/	'(a type of tree)'

In syllable-final position, the bilabial, alveolar, palatal and velar stops are unreleased and the voiced/voiceless distinction is lost. These unreleased stops are here transcribed phonetically as [p̚, t̚, c̚, k̚] and symbolised phonemically by the voiceless /p, t, c, k/: [kawip̚] /kawip/ 'sun bear', [dut̚] /dut/ 'navel', [sɛic̚] /sɛc/ 'meat', [dɔk̚] /dɔk/ 'ipoh poison'. It should be mentioned that speakers sometimes produce a delayed and heavily aspirated voiceless oral release of final stops after words uttered in isolation, particularly following /c/ and /k/ but occasionally also /t/. There is no regular pattern to suggest that this voiceless release has any contrastive significance.

The glottal stop /ʔ/ is a voiceless [ʔ]: [ʔap̚] /ʔap/ 'tiger', [jʰɔʔɕʰɛŋ] /jʰɔɕ/ 'bone', [haliʔ] /haliʔ/ 'leaf', [laʔpaʔ] /paʔ/ '(eastern Negritos)'. It is in contrast with /k/: [tɕk̚] /tek/ 'to sleep', [tɕʰ] /tɕʰ/ 'soil'.

3.1.2 Nasals

The nasal phonemes /m, n, ŋ, ŋ̚/ display the same places of articulation as the voiced plosives and occur in both syllable-initial and syllable-final position. In all positions except some word-final environments (see below) they are realised as [m, n, ŋ, ŋ̚]: [mɔh] /mɔh/ 'nose', [nus] /nus/ 'upper lip', [ŋɔ] /ŋɔ/ 'coconut tree', [ŋɔk̚] /ŋɔk/ 'to sit'.

In word-final position, nasals are commonly initiated by a short and very characteristic voiced plosive-like onset: [tɔ^bm] /tɔm/ 'water', [bɔ^dn] /bɔn/ '(a type of fruit)', [pɪpɪɔŋ] /pɪpɪɔŋ/ 'to sing', [wɔ^ŋŋ] /wɔŋ/ 'child'. Such nasal segments have been recorded in several Aslian languages, as well as in many Austronesian languages, notably in Borneo (Blust 1997:154-169), and are variously described as prenasalized (Diffloth 1975:7, 10-12), preocclusivized (Matisoff, to appear, 59), prestopped (Ladefoged and Maddieson 1996:128-129; Bishop 1996:228, 235-236; Kruspe 1999:8-9) and preploded (Blust 1997:154-155). The latter term will be employed here. The segments were also noted in Jahai by Schebesta (1928:805) but interpreted by him as word-final stops followed by "an obscure nasal release",

which rather makes one think of the postnasalised stops described phrase-finally by Benjamin (1976:134) for Temiar. Also, Bishop (1996:235) analyses similar nasals in Kensiw as the syllable-final allophones of voiced stops.

In the present Jahai material, however, there are several reasons for analysing the preploded nasals as allophones of the simple nasals. First, the nasal portion of the segments in question is clearly more salient than the plosive-like onset. The latter, which is conventionally transcribed as a homorganic stop, [b^m, dⁿ, ʃⁿ, ʒⁿ] or [bm, dn, ʃn, ʒn], is caused by a delayed and abrupt lowering of the velum following the oral closure. Preliminary spectrogram studies of Jahai samples do not give a very uniform picture of the onset but they do indicate that there is not always an apparent occlusive or plosive element involved in its production, homorganic or otherwise. However, the conventional way of transcribing preploded nasals, i.e. a nasal preceded by its homorganic stop [b^m, dⁿ, ʃⁿ, ʒⁿ], has been retained in the present material.

Second, as also acknowledged by Bishop (1996:235) for Kensiw, the preploded nasals are historically and cognitively developments from simple nasals and have simple nasal reflexes in other Mon-Khmer languages. Importantly, reduplications of preploded nasals are always realised as the simple nasal counterpart: [səmsə^bm] /sɤmsə^m/ 'to buzz around a nest', [hənhə^dn] /hnhəⁿ/ 'to devour', [ʃiŋjə^ʃn] /ŋjə^ʃn/ 'to dream', [ʃ^ʃəŋj^ʒə^ʒn] /ŋjə^ʒn/ 'wide'. Furthermore, Malay loanwords which originally have final nasals are usually realised with the preploded counterpart: [haja^bm] from Malay *ayam* 'poultry', [bula^dn] from Malay *bulan* 'moon', [kuc^ʒə^ʒn] from Malay *kucing* 'cat'.

Third, there is a clear tendency for the preploded nasals and the word-final simple nasals (the latter making up about 22 percent of the word-final nasals) to turn up in different phonetic environments, and the nature of the environmentally conditioned nasalisation of vowels discussed in section 2.1 may be helpful in stating these conditions. Drawing on data from several Austronesian languages in Borneo, Blust (1997:161-163) suggests that the plosive portion of preploded nasals is intended to prevent so-called contragrade, anticipatory (or coda-driven) nasalisation from spreading from word-final nasals to the preceding vowel in languages whose primary nasalisation is progressive (or onset-driven). It is further predicted that syllable-final nasals are not preploded in final syllables whose vowel nucleus is preceded by a nasal segment, since the syllable nucleus has already been nasalised in the 'right' direction and there is therefore no need to seal off the vowel from contragrade nasalisation by means of prepllosion.

Although it has not been possible to determine which direction of nasalisation is primary in Jahai, the model proposed by Blust appears to be largely applicable to the present material. First, spectrogram studies of preploded nasals in Jahai confirm Blust's suggestion that prepllosion prevents anticipatory nasalisation. Second, the nuclei of those final syllables that are closed by a simple nasal are indeed commonly preceded and nasalised by a nasal segment, e.g. [kən^ʃm] /kɤn^m/ 'to urinate', [gən^un] /gɤn^u/ 'bamboo', [səm^ʃn] /sɤm^ʃn/ 'to request' and [ʔam^ʒn] /ʔam^ʒn/

'siamang', but note exceptions like [masɛm] /masɛm/ 'sour'. Accordingly, the nucleus of final syllables ending with a preploded nasal is almost always preceded by a non-nasal segment. There is a handful of exceptions to this latter pattern, some of which can be explained as Malay loans in which clusters of homorganic nasal and voiced stop are reduced to the nasal: [kami⁹ŋ] /kamiŋ/ from Malay *kambing* 'goat', [kəma⁹ŋ] /kmaŋ/ from Malay *kembang* 'to swell', [həŋa⁹ŋ] /hŋaŋ/ from Malay *enggang* 'hornbill' and [paŋa⁹ŋ] /paŋaŋ/ from Malay *panggang* 'to roast' (see also section 4.2.1). Exceptions not yet accounted for include [tama^bm] /tamam/ '(a type of small animal)', [luŋa^dn] /luŋan/ 'binturong', [həmi^lŋ] /hmiŋ/ 'stomach pain', [bərama⁹ŋ] /bramaŋ/ '(a type of tree)', [ʔəna⁹ŋ] /ʔnaŋ/ 'side', [ɡəno⁹ŋ] /ɡnoŋ/ 'wooden material' and [lamə⁹ŋ] /laməŋ/ '(a type of fruit)'.

This explanation of the distribution of preploded nasals should also predict that the preplodion of a syllable-final nasal is suspended if the syllable nucleus consists of a vowel with phonemic nasality (Blust 1997:172). Since the syllable nucleus in that case is already nasal, there is no need to block coda-driven nasalisation from the final nasal segment. The problem here is that there is at present no way of positively determining whether the vowel of the final syllable in words like [c^əəkɪm] 'peacock-pheasant', [hawɛn] 'wild boar', [hɛŋ] 'mouth' and [katɔŋ] 'claw; nail' is phonemically nasal or if it is nasalised by the following nasal coda which for some unknown reason is not preploded. It will be assumed here, however, that a good many of the words displaying such a pattern do involve a phonemically nasal vowel. More revealing is the fact that there is no example of phonemic nasality in vowel nuclei of syllables ending in a preploded nasal.

Last, it is not possible to analyse the preploded nasals as the word-final allophones of voiced or voiceless stops, since these according to the present analysis merge to become unreleased stops in syllable-final position and contrast with the preploded nasals, as illustrated by the following minimal pairs:

[kəp ^ʔ] /kəp/	'to move hut'	[kə ^b m] /kəɔm/	'many'
[dut ^ʔ] /dut/	'navel'	[du ^d n] /dun/	'to cover'
[sɛic ^ʔ] /sɛc/	'meat'	[sɛi ^l ŋ] /sɛŋ/	'front'
[pək ^ʔ] /pək/	'round object'	[pə ⁹ ŋ] /pəŋ/	'to tap poison'

3.1.3 Fricatives

The voiceless alveolar fricative /s/ has a common pre-palatal variant [sʲ], midway between [s] and [ç], in both syllable-initial and syllable-final position, which is in free variation with [s]. As described by Bishop (1996:234) for Kensiw, individual speakers tend to use one variant consistently. For easier transcription, [s] ~ /s/ will be used here, although the characteristics of this variant are clearly palatal (see Kruspe 1999:9 for a discussion on the similarly problematic /s/ segment in Semelai). Examples of /s/ include e.g. [sə^bm] /səɔm/ 'bird's nest', [kənsi⁹ŋ] /knsiŋ/ 'banded palm civet' and [ʔəs] /ʔəs/ 'fire'.

The voiceless glottal fricative /h/ occurs frequently in syllable-initial and, especially, word-final position: [həkʔ] /hək/ 'to throw', [sih] /sih/ 'to pound', [paʔah] /pʔah/ 'to kneel'. It is not always strictly glottal, as the point of friction is dependent on the surrounding vowels.

The infrequent voiceless bilabial fricative /ɸ/ has been identified in a handful of lexical items and its distribution is restricted to syllable-final position. It contrasts with other segments, including the velar fricative /h/ and the bilabial stop /p/, and has therefore been assigned phonemic status. Examples include [cʰɛɸ] /cɛɸ/ 'to fan fire', [cʰəɸ] /cnɛɸ/ 'tail feathers', [tuɸ] /tuɸ/ 'to plait', [kuɸ] /kuɸ/ '(sound of blowpipe dart hitting its target)', [kətɸ] /ktɸ/ 'to spit', [lɔɸ] /lɔɸ/ 'to leak', and [pələɸ] /plɔɸ/ '(sound of blowpipe)'. Syllable-final /ɸ/ has been identified in other Northern Aslian languages as well, including Kensiw (Bishop 1996:234) and Batek and Mintil (Benjamin, personal communication).

3.1.4 Liquids

The voiced apico-alveolar lateral liquid /l/ is found in syllable-initial and syllable-final position and has approximately the same phonetic shape in all positions: [lɔj] /lɔj/ 'to run', [haleh] /haleh/ 'hungry', [ʔɛl] /ʔɛl/ 'to see'.

The voiced alveolar trill /r/ is found in both initial and final position and is subject to considerable individual and free variation. Syllable-initially, it is realised phonetically either as a short alveolar trill [r] or as an alveolar approximant [ɹ]: [res ~ ɹes] /res/ 'to fall', [raŋɡuiɽ ~ ɹaŋɡuiɽ] /raŋɡuɽ/ 'jew's harp'. Word-medially, /r/ is sometimes realised as an alveolar flap [ɾ] in inter-vocalic position. After [n], it is usually realised as an approximant [ɹ] and is preceded by a short epenthetic stop transition: [sən^dɹɛkʔ] /snɹɛk/ 'to go out', [pən^dɹaʔ] /pnɹaʔ/ '(a type of flower)', [mən^dɹaʔ] /mnɹaʔ/ 'human being', [cʰən^dɹɔs] /cnɹɔs/ 'finger', [man^dɹɔŋ] /manɹɔŋ/ 'skink' (see Benjamin 1985:12 for some discussion on this feature in Aslian and Malay). Syllable-finally, it is realised either as an approximant [ɹ] or, more commonly, as a very distinct and prolonged trill [r]: [dɔr:] /dɔr/ 'to spread s.t.', [sajər:] /sajər/ 'herd'.

3.1.5 Approximants

The voiced labio-velar approximant /w/ is found in both initial and final position: [wawətʔ] /wawət/ 'rat', [bəgiw] /bgiw/ 'wind', [litɔw] /litɔw/ 'boy'.

Similarly, the voiced palatal approximant /j/ is found in initial and final position. Phrase-finally (at least in citation forms), it is subject to partial, barely audible nasality: [j̃]. This 'semi-nasal' phrase-final allophone does not appear to be a source of nasalisation as it has no effect on the preceding vowel. Examples: [jɔkʔ] /jɔk/ 'to undress', [jij] /jij/ 'to carry in one's hand', [gej] /gej/ 'to eat', [jʔahaj] /jhaj/ 'Jahai', [kuj] /kuj/ 'head'.

4. Word and syllable structure

4.1 Word structure

Word-final syllables are always closed, whereas pre-final syllables may be open or closed but always have a consonant as onset, meaning that words always begin and end with a consonant. Roots may be monosyllabic, sesquisyllabic, disyllabic or, occasionally, trisyllabic. Monosyllabic words always display the canonic structure CVC, e.g. [c^hɛp^h] /cɛp/ 'to catch'. Sesquisyllabic words are phonetically disyllabic, but the vowel of the penultimate (in this case initial) syllable is strictly epenthetic and predictable and is omitted in phonemic transcriptions: C.CVC, e.g. [kəŋɛic^h] /k.nɛc/ 'comb'. (The phonetic variation in such epenthetic vowels is discussed in section 4.2.2.1).² Truly disyllabic words have either an open penultimate syllable with a non-predictable vowel, usually /a/, or a closed penultimate syllable, the vowel of which may be either predictable or non-predictable: CV.CVC, e.g. [kawip^h] /ka.wip/ 'sun bear'; CC.CVC, e.g. [təmkal] /tm.kal/ 'male'; or CVC.CVC, e.g. [kaltəŋ] /kal.təŋ/ 'knee'. The main reason for making this distinction between sesqui- and disyllabic forms is morphophonemic, the two forms being subject to different patterns of affixation. This will be discussed in detail elsewhere.

As described for other Northern Aslian languages (see e.g. Asmah 1976:952 for Kintaq and Bishop 1996:240 for Kensiw), trisyllabic roots are commonly Malay borrowings, although some are presumably indigenous, e.g. [kuruhuŋ] /ku.ru.huŋ/ '(a type of owl)'. However, trisyllabic derivatives of indigenous sesqui- and disyllabic roots are very common. No examples of tetrasyllabic lexemes have been found and they are most likely not allowed.

4.2 Syllable structure and distribution of phonemes

4.2.1 Final syllables

Final syllables (including monosyllabic words) invariably display the canonic structure CVC. Every consonant phoneme in Jahai can occur as the coda of such syllables, although stops are unreleased in syllable-final position and the voiced/voiceless distinction is lost (see section 3.1.1). Under certain conditions, nasals are preploded in word-final position (see section 3.1.2). Likewise, every consonant phoneme may occur as syllable onset, with the exception of the infrequent voiceless bilabial fricative /ɸ/. However, onsets consisting of a voiced stop seldom occur after a nasal penultimate coda (see also sections 2.1 and 3.1.2). There are also some restrictions as to the possibility of having a phonemically identical onset and coda. Thus, the palatal stops /c, ɟ/, fricative /s/ and nasal /ŋ/ never occupy both onset

²The term 'sesquisyllable' was coined by Matisoff (1973:86; to appear, 8) and literally means 'one-and-a-half syllable'. Most writers on Aslian (including Diffloth 1976a; Matisoff, to appear; and Kruspe 1999) prefer to exclude the epenthetic vowel from phonemic transcriptions, and this is also the orthography employed here. For reasons of clarity and legibility, Benjamin (1976:152-53) argues in favour of including it.

and coda position (this restriction does not involve the palatal approximant, as evidenced by the form /jij/ 'to carry in one's hand'). A similar restriction applies to the alveolar trill /r/.

All vowel phonemes may occur as syllable nucleus in final syllables, the nasal vowels occurring only in final syllables. The mid vowels /e, ə, o/ are the least frequent oral vowels, nasal vowels being rather rare overall. There appear to be no clear restrictions on the oral vowels as to their co-occurrence with initial and final consonants. Nasal vowels, on the other hand, do not usually occur with initial voiced stops /b-, d-, ɟ-, g-/.³ There are four exceptions to this pattern: /k.lih.dəh/ 'to meander', /taŋ.gəh/ 'to ring', /dl.ɬil/ 'heel', and /da.dəh/ '(a type of reed snake)'. Nor do nasal vowels occur with the preploded allophones of the final nasals /-m, -n, -ŋ-. However, they frequently occur with final /-t/ and /-ʔ/.

4.2.2 Pre-final syllables

4.2.2.1 The penultimate syllable in sesquisyllabic roots

In sesquisyllabic words, the penultimate syllable is open and consists phonetically of a consonant onset and a predictable vowel nucleus, usually [ə]. A limited set of consonant phonemes can occur as onset: the voiceless bilabial fricative /ɸ/, the approximants /w/ and /j/, and all nasals except /m/ are absent (/m/ occurs sporadically and only in combination with final syllables with a nasal onset, e.g. [məŋit] /m.ŋit/ 'NEG', [məŋeʔ] /m.ŋeʔ/ 'size'). There also appear to be other restrictions in sesquisyllabic roots as to which penultimate onset may be combined with the onset of the final syllable. For example, the penultimate onset is almost never identical to the onset of the final syllable, and, moreover, homorganic voiced and voiceless stops are not found in combination. Similarly, stops are not combined with their homorganic nasals. Similar restrictions have been noted in Jah Hut by Diffloth (1976b:104-105).

As noted, the predictable, epenthetic vowel nucleus is usually realised as [ə], but it shows clear tendencies to change in response to certain phonetic environments. Thus, it is usually realised as [i] if followed by an onset consisting of the palatal approximant /j/: [tjɨk] /t.jɨk/ 'to point', [cijas] /c.jas/ 'hand', [sijɨŋ] /s.jɨŋ/ 'to burn', [sijul] /s.jul/ '(a type of cobra)'. Also, if the following onset is a glottal stop /ʔ/ or fricative /h/, the epenthetic vowel sometimes takes on the same phonetic quality as the vowel nucleus of the final syllable: [kəʔep] /k.ʔep/ 'centipede', [taʔaʔ] /t.ʔaʔ/ 'vegetable'. This pattern is much less apparent and [ə] is equally common in this environment: [cəʔiʔ] /c.ʔiʔ/ 'to pour'. Furthermore, if a penultimate plosive onset is combined with a liquid onset in the final syllable, especially /r/, [ə] is commonly dropped altogether in fast speech: [bərəʔ ~ braʔ] /b.raʔ/ 'NEG', [gərəŋ ~ grəŋ] /g.rəŋ/ '(a type of monitor lizard), [pələʔ ~ pləʔ] /p.ləʔ/ '(sound of blowpipe)'.³

³Similar restrictions have been noted in other Aslian languages, e.g. Jah Hut (Diffloth 1976b:103) and Semelai (Kruspe 1999:38).

Realisation is inconsistent, even in the same word, and cannot be stated as rules but should rather be described as tendencies.

4.2.2.2 *The penultimate syllable in disyllabic roots*

In disyllabic roots with an open penultimate syllable, onset position can probably be filled by any consonant phoneme except the voiceless bilabial fricative /ɸ/. However, no unequivocal examples of the syllable-initially rare nasals /ŋ/ and /ŋ/ have been found. There appear to be no clear restrictions as to which penultimate and final onset phonemes may be combined. There are several examples of words in which the two syllables have identical onsets, although it cannot be determined at this point whether these are instances of frozen morphology involving copy of the final onset, e.g. /wa.wəʔ/ 'rat', /pa.puʔ/ 'to die', /ma.muʔ/ 'to beg', /da.dəʔ/ '(a type of reed snake)', /ci.caʔ/ '(a type of tree)'. As noted in section 4.1, the non-predictable vowel nucleus of these open penultimate syllables usually consists of /a/, but there are also several examples of /i/, /u/ and /o/: /ʔa.liʔ/ 'to pass', /ti.məʔ/ 'hard surface', /cu.həʔ/ 'to flow', /pə.kəʔ/ '(a type of gecko)'. The remaining oral vowels, as well as the phonemically nasal vowels, are not found in this position.

In disyllabic roots with a closed penultimate syllable there appear to be some restrictions as to which consonant phonemes may fill the penultimate onset position: voiced stops are notably rare, and approximants and all nasals except /m/ are absent. The coda position is always occupied by a nasal or a liquid. Nasal codas are homorganic with the onset of the final syllable, unless the final onset is a glottal, in which case they are realised as /n/: /ʔm.pəŋ/ 'hole', /ʔn.teŋ/ 'ear', /kaŋ.cəʔ/ 'grandchild', /saŋ.kəʔ/ 'wreathed hornbill', /cŋ.həʔ/ 'short', /kŋ.ʔaʔ/ 'father-in-law'. There are a few exceptions to this pattern, e.g. /tm.kəʔ/ 'cold' and /tm.kal/ 'male'. However, in derivatives involving coda copy, any consonant phoneme allowed as a final syllable coda may fill the coda position of the penultimate syllable (see section 4.3).

The vowel nucleus of closed penultimate syllables is usually a predictable epenthetic [ə]: [həkətʔ] /hr.kətʔ/ 'night'. If the surrounding onset and coda are both alveolar or palatal, the epenthetic vowel frequently becomes a slightly lowered and fronted [ɛ]: [tɛrhicʔ] /tr.hicʔ/ '(a type of small bird)', [cʔɛɪn^dɔs] /cŋ.rəs/ 'finger'. There are also numerous examples of non-predictable /a/ in this position, e.g. /kar.wəʔ/ '(a type of terrapin)' and /ram.pəw/ 'long-tailed macaque'. The close vowels /i/ and /u/ are much less frequent and mainly confined to Malay loans: /lin.təs/ 'to go across', /cun.tiŋ/ 'temple'. One example of /o/ has been found: /hər.jiŋ/ '(a type of small animal)'. The remaining oral vowels, as well as the phonemically nasal vowels, are not found in this position.

4.2.2.3 *Pre-final syllables in trisyllabic words*

Typical examples of indigenous trisyllabic forms include /h.laŋ.kətʔ/ '(a type of ant)', /c.mal.pəkʔ/ '(a type of millipede)', /c.ri.kəkʔ/ 'to jabber', /k.la.ŋis/ 'heart', /b.ru.bəʔ/ 'yellow-vented bulbul', /h.mi.rin/ 'to extinguish by itself' and /ɟ.ri.təw/ 'to

squat'. It is likely that many trisyllabic forms contain archaic morphemes which cannot be analysed synchronically. Thus, such forms are regarded here as monomorphemic.

The onset position of the penultimate syllable is always filled by a sonorous consonant: /m, n, l, r, w/. The coda position of closed penultimate syllables is always filled by a liquid or, usually, a nasal, in which case it is homorganic with the onset consonant of the final syllable. In derivatives involving coda copy, however, any consonant phoneme allowed as a final syllable coda may fill the coda position of the penultimate syllable (see section 4.3). The vowel nucleus of penultimate syllables in monomorphemic trisyllabic words is always a non-predictable /i/, /a/ or /u/. There is one exception with [ə]: [riŋrəwɔŋ] /riŋ.r.wɔŋ/ 'to look around (of animal)'.

Antepenultimate syllables are open, and their onset is typically a stop (voiced or voiceless) or a fricative (/s/ or /h/), although sporadic examples of the alveolar trill /r/ have been found. The vowel nucleus is always a predictable [ə], with one exception: /ku.ru.huj/ 'a type of owl'. There are also two examples of closed antepenultimate syllables, both with non-predictable nuclei: the aforementioned anomalous form /riŋ.r.wɔŋ/ 'to look around (of animal)' and the Malay loan /puŋ.hu.luh/ 'headman'.⁴

4.3 Reduplicative processes

Morphological processes commonly involve two types of partial reduplication which will be referred to here as *coda copy* and *onset copy*.⁵ Coda copy consists of the copying of a word-final syllable coda and its infixation before the final syllable onset, thereby creating a closed penultimate syllable. It entails that, in derivatives involving this process, any phoneme allowed as a coda of final syllables may fill the coda position of the penultimate syllable. Onset copy is restricted to monosyllabic roots and involves the copying of the onset and its prefixation to the root, commonly in order to create a suitable environment for a copied coda. Although several such morphological processes are productive, there are numerous examples in the present word-list which give the impression of being frozen forms, the roots of which are no longer independent morphemes. However, the realisation rules outlined below apply to both productive and non-productive cases of reduplication. In the examples given, synchronically non-existent roots are marked with.

⁴It might be suggested that the antepenultimate /u/ in /ku.ru.huj/ and /puŋ.hu.luh/ (Malay *penghulu*) results from vowel harmony, but the scarcity of examples precludes further conclusions.

⁵This is the terminology introduced by Kruspe (1999). The term 'incopyfixation' has been suggested by Matisoff (to appear, 25-30) to refer to coda copy.

4.3.1 *Phonetic realisation of coda copies*

In most cases, the phonetic realisation of the copy is identical to that of the copied final syllable coda. This applies to stops /-p, -t, -c, -k, -ʔ/, the fricatives /-s, -h/, liquids /-l, -r/ and the bilabial approximant /-w/:

[cʰəp̚r̚ɛp̚ʔ]	/cp.rɛp/	'babbling'	†cɾɛp
[kɪswɛs]	/ks.wɛs/	'to be sweeping'	/kwɛs/ 'to sweep'
[pəl̚pɛl]	/pl.pɛl/	'to be dripping'	/pɛl/ 'to drip'
[ʔiwŋiw]	/ʔiw.ŋiw/	'to be gazing'	/ŋiw/ 'to gaze'

Nasals, however, which are commonly preploded in word-final position (see section 3.1.2), are always realised with the simple nasal counterpart; the voiceless bilabial fricative /ɸ/ is realised as an unreleased bilabial stop [p̚]; and the palatal approximant /j/, which is partly nasalised word-finally, is realised as [j]:

[lɔp̚lɪɸ]	/lɸ.lɪɸ/	'fontanel'	/lɪɸ/ 'fontanel'
[hɔŋpɛjɪŋ]	/h.ŋ.pɛj/	'goose-pimples'	/hɾɛp̚/hɾɛp̚
[pɔŋsɛŋ]	/pŋ.sɛŋ/	'to say'	/psɛŋ
[hɔlɪjdɪj]	/h.lj.dɪj/	'flat ground'	/hdɪj

4.3.2 *Phonetic realisation of epenthetic vowels*

Epenthetic vowel nuclei of penultimate syllables closed by a coda copy are subject to consistent phonetic variation conditioned by the copy. Thus, if the copy is a palatal /c, s, ɲ, j/, the preceding vowel is realised as [i]:

[kəlɪcʰbacʔ]	/k.lc.bac/	'(a type of millipede)'	†kbac
[kɪswɛs]	/ks.wɛs/	'to be sweeping'	/kwɛs/ 'to sweep'
[pɪŋlɔjɪŋ]	/pŋ.lɔj/	'to sing'	†plɔj
[hɪjhɔj]	/hj.hɔj/	'to be yawning'	/hɔj/ 'to yawn'

In cases where the copy is a glottal /ʔ, h/, the preceding vowel is realised as [a]:

[saʔsoʔ]	/sʔ.soʔ/	'blood vessel'	†soʔ
[baʔbɔʔ]	/bʔ.bɔʔ/	'to carry on one's back'	†bɔʔ
[tahtɛh]	/th.teh/	'oriental pied hornbill'	†teh
[nahjʔɔh]	/nh.jɔh/	'high'	/jɔh/ 'to ascend'

With other copies, the preceding vowel is realised as [ə]:

[bətʔɛtʔ]	/bt.ʔɛt/	'good'	†bʔɛt
[dɔkʔdukʔ]	/dk.duk/	'chest'	/duk/ 'to pounce upon'
[səmsɔʰm]	/sm.səm/	'to buzz around a nest'	/səm/ 'bird's nest'
[səŋpɔŋ]	/sŋ.pɔŋ/	'leafbird'	†spɔŋ
[dɔldɪl]	/dl.dɪl/	'heel'	†dɪl
[pɔrɔɛr]	/pr.ɔɛr/	'lower arm'	†pɔɛr
[hɔwhɪw]	/hw.hɪw/	'crested wood-partridge'	†hɪw

Similar realisation rules have been described for Semelai (Kruspe 1999:22-28) and most dialects of Semai (Diffloth 1976a:237).

5. Prosodic features

5.1 Stress

As also noted by Schebesta (1928:805), Jahai has non-contrastive stress that falls invariably on the last syllable of a word, and there is no secondary stress. This applies as much to recent loans from Malay as to indigenous words.

5.2 Tone

Schebesta (1928:805) believed he had identified tonal differences in a limited set of lexical items in Jahai and provided a short list of minimal pairs. Similarly, Bishop (1996:238-239) suggests that pitch difference (mid-level vs. high level) is lexically contrastive in a small number of words in the closely related Kensiw language. Thus far, no such distinction has been identified in the present Jahai material. Significant pitch contrasts have not been noted, and the contrastive pairs listed by Schebesta have been found not to be minimal in the variety of Jahai studied here. The following tables compare the contrastive pairs given by Schebesta (in his original orthography) with the contemporary Jahai To' equivalents:

Schebesta (1928:805):

HIGH LEVEL		LOW LEVEL	
ĩo?	'part of a blowpipe'	_ĩo?	'bough'
_nus	'sleeping mat'	_nus	'lip'
ĩe?	'1S'	_ĩe?	'1D INCL'
_he?	'1P INCL'	_he:i	'1D INCL'
_eg?	'to give'	_eg?	'belly'
_gus	'to rub fat into the face'	_gus	'to come down'

Contemporary Jahai To':

[jo?]	'dart'	?	
[nis]	'sleeping mat'	[nus]	'upper lip'
[je?]	'1S'	[jeh]	'1D EXCL'
[he?]	'1P INCL'	[hej]	'1D INCL'
[?ekʔ]	'to give'	[?eicʔ]	'belly; excrement'
?		[gis]	'to climb down'

6. Conclusion

Although tentative and surely subject to future revisions as fieldwork continues, the present survey provides a first introduction to the sound system of the

To' variety of Jahai. One obvious conclusion to be drawn from the study is that Jahai conforms to the general phonological patterns described for most other languages of the Aslian branch of Mon-Khmer. Thus, Jahai appears to display a typical 3 x 3 vowel system, phonemically significant vowel nasality, peculiar realisations of word-final nasal consonants, closed final syllables, as well as multisyllabic lexemes. It is also characterised by features which are especially associated with Northern Aslian, such as the lack of contrastive vowel length and the presence of the unusual syllable-final voiceless bilabial fricative /ɸ/.

The distribution and phonetic nature of the word-final preploded nasals, as well as the tonal differences identified by Father Schebesta, are aspects of Jahai that are not yet fully understood and will be the subjects of further study.

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Department of Linguistics and Phonetics
Lund University
Helgonabacken 12, S - 223 62 Lund
SWEDEN
<Nielas.Burenhult@ling.lu.se>