Arrernte: A Language with No Syllable Onsets

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That syllable onsets are present in all languages is widely regarded as axiomatic, and the preference for syllabifying consonants as onsets over codas is considered a linguistic universal. The Central Australian language Arrernte provides the strongest possible counterevidence to this universal, with phenomena generally used to determine syllabification suggesting that all consonants in Arrernte are syllabified as codas at the word level. Attempts to explain the Arrernte facts in terms of syllables with onsets either make the wrong predictions or require proposals that render the putative onset universal unfalsifiable.

Keywords: syllabification, phonological universals, onset, complex codas, Arandic

Within phonological theory, it has long been believed that any language that has closed syllables (CVC, VC) also has open ones (CV) (see, e.g., Jakobson 1962, Jakobson and Halle 1956, Clements and Keyser 1983, McCarthy and Prince 1986). It should therefore not be possible for a language to always prefer the syllabification of consonants as codas to the preceding nucleus over their syllabification as onsets to the following nucleus. Sommer (1970, 1981) argued that the North Queensland language Kunjen provided evidence to the contrary, but McCarthy and Prince (1986) showed that the evidence, based largely on facts of reduplication, was inconclusive and could be accounted for without recourse to VC syllabification (albeit with some sacrifice of simplicity).[1]

Prosodic and morphological evidence from Arrernte ([arə́n̪t̪ə]), an Arandic language of Central Australia, provides more extensive evidence for syllabification of consonants exclusively as codas. Facts that are recalcitrant to an analysis by CV syllables are seen to follow naturally from an analysis involving VC(C) syllabification.[2] Although some of the properties of Arrernte can be accounted for within a CV system by positing extra machinery or constraints in the

This article is based on Breen 1990, some sections of which have been either omitted or condensed and other sections added by the current authors. Although Breen 1990 remains unpublished, some data and a summary of the arguments from that paper appear in Evans 1995.

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[1] Onsetless syllables have also been proposed for at least some positions in Barra Gaelic words (Kenstowicz and Kisseberth 1979, Bosch 1988; but see Carnie 1993 for a counterargument).

[2] Syllables are composed of a vocalic nucleus with a coda of one or two consonants, but no onset.

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phonological component, accepting an analysis of exclusively onsetless syllables derives all of these properties directly. Stress assignment, prosodically conditioned allomorphy, reduplication, and a transposing game known as Rabbit Talk are all straightforwardly explained under a model (whether rule- or constraint-based) in which all syllables in Arrernte are vowel-initial. Rejecting such a proposal in favor of the Jakobsonian CV universal leads to a more complex analysis of Arrernte morphophonology than the facts warrant under either a rule- or a constraint-based approach.

1 Initial and Final Vowels in Arrernte

A description of the Arrernte vowel system is provided in appendix B.

Proposing that all syllables in Arrernte are vowel-initial and consonant-final immediately requires us to say something about the 25% of Arrernte words that are pronounced in isolation with an initial consonant, and about the vowel that can often be heard at the end of many Arrernte words, again when pronounced in isolation. In Arrernte orthography all words are written with a final *e* (Henderson and Dobson 1994), but we assume (as per Breen 1990) that this does not represent any phoneme present in the words. In speech a vowel is generally only realized in this position before a word that is (orthographically) consonant-initial (as in (1)). Thus, a vowel is always found at word junctures. It is common, but by no means universal, to end an intonational phrase, and thus a word spoken in isolation, with [ə]; there is wide individual and regional variation on this point (see also Breen and Green 1995). This vowel may be stressed on occasion, as when it is the only vowel in the utterance (in this case it is normally somewhat lower, so that /mpe/ 'come on' is pronounced [mbá]).

We argue that the vowel that surfaces before words that are written with an initial consonant (e.g., between 'child' and 'your' and between 'your' and 'I' in (1b)) is actually the underlying initial phoneme of these words. ((1a–b) are from Green 1994.)

(1) a. Arelhe anyente apmere ikwerenhele aneme.
woman one home her-at is-PRES
'One woman is at her home.'
Pronounced: [aɻə́l̪an'ə́ndaMə́ɻikʷə́ɾə̪n̪əlanə́m(ə)]
Underlyingly: /aɻel̪ an'ent aMeɻ ikʷeɾe̪n̪el anem/[3]

b. Ampe ngkwinhe the areke apmereke.
child your I see-PAST camp-at
'I saw your child at the camp.'
Pronounced: [ámbəŋgʷɛ́:n̪ət̪aɾə́kaMə́ɾək(ə)]
Underlyingly: /amp eŋkʷin̪ et̪ aɻek aMeɻek/

Thus, there are no underlyingly consonant-initial words in the Arrernte lexicon, and all words end in a consonant or consonant cluster.

[3] A key to the phonemic transcription used in this article can be found in the appendices.

The majority of words in Arrernte begin with one of the other two vowels, /a/ or /i/. In Henderson and Dobson's (1994) dictionary, /a/-initial words account for around 50% of the entries, /i/-initial words about 15%, and [u]-initial words (claimed to derive from initial /e/ plus rounding of the following consonant; see appendix B) under 10%, the other 25% being written with initial consonants. There are no words written with an initial *e*.

Consonant clusters that can occur word-medially are also permitted word-initially (with a few very specific exceptions; see appendix A). These facts are consistent with an analysis of all Arrernte words as underlyingly vowel-initial, with something remaining to be said about the nonappearance of initial /e/.

Further evidence that all Arrernte words are vowel-initial comes from stress assignment and the prosody sensitivity of verbal plural and reciprocal morphology. In Arrernte, stress is assigned within a word to the first nucleus that is preceded by a consonant. Thus, if the word begins in a consonant, stress falls on the first vowel; if the word begins in a vowel, stress falls on the second nucleus (vowel) in that word.

(2) a. ikʷén't'
'policeman'
b. atʷérem
'is fighting'
c. Nénirem
'are standing'
d. mpʷárem
'is making/doing'

If consonant-initial words, such as those in (2c–d), are indeed underlyingly /e/-initial, then stress in Arrernte falls on the second syllable and is computed at some level where the initial /e/ is present.

According to Henderson (1990), plural and reciprocal morphology on Arrernte verbs is sensitive to whether stems are mono- or disyllabic. The plural morpheme illustrated in (3) has two allomorphs, /ewar/ and /erir/; the plural/reciprocal morpheme in (4) has the allomorphs /ir/ and /er/.[4]

(3) a. inŋel + PL_1 → inŋel-ewar
'be like'
b. ar + PL_1 → ar-erir
'watch'
c. aŋk + PL_1 → aŋk-erir
'talk'
d. mpʷar + PL_1 → mpʷar-ewar
'make'

[4] The morpheme glossed PL_1 is the common plural morpheme. The morpheme glossed REC/PL_2 or just PL_2 is a less common plural form that is also used to mark the reciprocal on transitive verbs and a small number of intransitives.

e. taŋk + PL_1 → taŋk-ewar
'be pleased'

(4) a. inŋeḽ + PL_2 → inŋeḽ-ir
b. aṛ + REC/PL_2 → aṛ-er
c. aŋk + REC/PL_2 → aŋk-er
d. $mp^waṛ$ + REC/PL_2 → $mp^waṛ$-ir
e. taŋk + PL_2 → taŋk-ir

As (3a) and (4a) illustrate, the allomorphs /ewar/ and /ir/ attach to disyllabic stems; as (3b–c) and (4b–c) illustrate, /erir/ and /er/ attach to monosyllabic stems. Examples (3d–e) and (4d–e) show that stems that surface as consonant-initial or cluster-initial monosyllables pattern with disyllabic and not with monosyllabic stems.

This suggests that, at the level at which these morphemes are combined with the stem, these stems all begin with a vocalic nucleus.

An alternative to the initial-vowel hypothesis, rejecting the existence of underlying initial /e/ in words such as (2b–c), requires metrical structure to be sensitive to the presence of onsets. Analyses in this vein are pursued by Davis (1988) and Goedemans (1996).[5] That stress placement is insensitive to the presence of onsets is a generalization so widespread and well founded cross-linguistically, however, that an alternative proposal is to be preferred unless empirical coverage is lost. In fact, any approach that rejects the existence of word-initial vowels across the board in Arrernte suffers from the problem of making the wrong predictions. We return to this question in section 3.2.

Phrase-initially, /e/ never surfaces, except when it is rounded ([u]; see below). Note that a word uttered in isolation constitutes a prosodic phrase and so words uttered in isolation never surface with an initial (unrounded) /e/. Word-initial but phrase-medial /e/ surfaces because it is surrounded by consonants to give it "shape." We claim that /e/ is a weak or placeless vowel, not specified for any features beyond its vocalicness (it is specified only as [−consonantal]). The other surface features of /e/ are given to it by the surrounding phonemes (see appendix B).[6] Other vowels are not deleted phrase-initially because they are specified for place features. An interesting case is that of initial [u], which derives from initial /e/ adjacent to certain rounded consonants and which does not delete. The association of the /e/ with adjacent rounding features appears to be enough to rescue it from "weakness" and subsequent deletion at the phrasal level.

Having established that all Arrernte words are underlyingly vowel-initial and consonant-final, we feel it is important to point out that this in itself does not constitute an argument for VC(C) syllabification in Arrernte. It is quite conceivable that Arrernte generally syllabifies according to a CV(C) pattern, subject to the requirements that all words be vowel-initial and consonant-final. Initial vowels are argued for in this section primarily so that the facts presented in section 2 can

[5] Davis suggests this for a different dialect than the one our analysis is based on, but we believe our analysis applies to that dialect, Western Arrernte, too.

[6] In fact, the realization of /e/ is determined mostly by the following consonant, which further argues in favor of a close relationship between a vowel and a following, rather than a preceding, consonant in Arrernte.

be understood more easily. However, the reduplication and Rabbit Talk facts presented in section 2 argue that being vowel-initial and consonant-final are properties not of words in Arrernte, but of all syllables.

2 No Onsets

In this section we assume the initial-vowel hypothesis argued for in section 1. It should be remembered that initial unrounded /e/ does not surface on a word that is the first word in its intonation phrase. We provide paradigms of reduplication and Rabbit Talk (a transposing game), and we show how the paradigms are derived straightforwardly if VC(C) syllabification is assumed and no onsets are allowed. The example analyses are expressed in terms of serial derivations, with the final forms being derived stepwise from underlying forms, but the facts would be just as easily accounted for by a constraint-based approach (as found for reduplication in McCarthy and Prince 1993 and for transposition in Itô, Kitagawa, and Mester 1996, for example) that allowed consonants to be syllabified exclusively as codas.[7] Finally we indicate how historical changes in Arrernte phonology are consistent with a change to VC(C) syllabification.

2.1 Reduplication

Frequentative, habitative, and attenuative reduplication (shown in (5)–(7)) all seem to copy a portion of the base that ends in a consonant or consonant cluster and contains any immediately preceding vowel. These reduplicative affixes are always of the form VC(C)VC(C), with the copied portion representing one or both of the VC(C) sequences. If the Arrernte syllable shape is VC(C), reduplication is described most straightforwardly in terms of syllables and feet.

The frequentative, illustrated in (5), is suffixed to the verb stem. The frequentative suffix is a foot consisting of /ep/ plus a reduplicant. The reduplicant corresponds to the final syllable of the base if VC(C) syllabification is assumed.

(5) *Frequentative reduplication*

a. eN-em	→	eNepeN-em
'is standing'		'keeps standing'
b. unt-em	→	untepunt-em
(i.e., ent^{w}-em	→	ent^{w}epent^{w}-em)[8]
'is running'		'keeps running'

[7] This could be achieved by a number of means. One would involve ranking the constraints NO-ONSET (a syllable does not have an onset) and CODA (every syllable has a coda) above the familiar ONSET (every syllable has an onset) and NO-CODA (a syllable does not have a coda). Another might achieve the same effect by indirect means, such as outranking both ONSET and NO-CODA with a constraint that requires vowels to align with the left edge of syllables (or something similar). The effect of such a constraint would be to ensure that all syllables are vowel-initial; it therefore differs from NO-ONSET only in name, not in effect. Constraints of this sort are quite clearly ruled out in Optimality Theory as generally practiced, where each and every constraint is required to express a (violable) universal linguistic tendency (Archangeli 1997, Sherrard 1997).

[8] The dual representation of this and similar words is explained in appendix A.

c. atʷ-em	→	atʷepatʷ-em
'is hitting'		'keeps hitting'
d. aṯer-em	→	aṯereper-em
'is laughing'		'keeps laughing'
e. empʷaṛ-em	→	empʷaṛepaṛ-em
'is making'		'keeps making'
f. akemir-em	→	akemirepir-em
'is getting up'		'keeps getting up'
g. an'enteḻil-em	→	an'enteḻilepil-em
'is putting together'		'keeps putting together'

In (5a–c) a monosyllabic base is reduplicated in its entirety.

(5) a. eN- + /ep + σ-/$_{\text{FREQ}}$ → eN + /epeN-/
→ eNepeN-
(→ NepeN- (phrase-initially))

In (5d–g) the stems are polysyllabic, and only the last syllable is reduplicated.

(5) d. aṯ.er- + /ep + σ-/$_{\text{FREQ}}$ → aṯer + /eper-/
→ aṯereper-
e. empʷ.aṛ- + /ep + σ-/$_{\text{FREQ}}$ → empʷaṛ + /epaṛ-/
→ empʷaṛepaṛ-
(→ mpʷaṛepaṛ- (phrase-initially))

The habitative, illustrated in (6), is formed by suffixing /-eṉ/ to the stem followed by reduplicating the final two syllables of the suffixed stem.

(6) *Habitative reduplication*

a. aḻkʷ	→	aḻkʷeṉaḻkʷeṉ
'eat'		'food'
b. aŋk	→	aŋkeṉaŋkeṉ
'talk'		'talker'
c. atʷer	→	atʷereṉereṉ
'fight'		'weapon'
d. aṯer	→	aṯereṉereṉ
'laugh'		'laughter'
e. eṯ	→	eṯeṉeṯeṉ
'poke (e.g., in the eye)'		'instrument for poking'

In (6a) the monosyllabic stem /aḻkʷ/ is augmented by /-eṉ/ to form the base /aḻkʷ.eṉ/. This base, consisting of only two syllables, is reduplicated in its entirety to give the habitative form /aḻkʷeṉaḻkʷeṉ/. In the disyllabic form in (6c), by contrast, the stem /atʷ.er/ augmented by /-eṉ/ gives rise to a trisyllabic base, only the last two VC(C) syllables of which are reduplicated, resulting in the habitative /atʷereṉereṉ/.

The attenuative, illustrated in (7), is formed by prefixing to the stem. The prefix consists of a foot comprising a reduplicant followed by /-elp/. The reduplicant corresponds to the first syllable of the bare stem.

(7) *Attenuative reduplication*

a.	aṛ-em	→	aṛelpaṛ-em
	'looking'		'starting to look'
b.	eN-em	→	eNelpeN-em
	'standing'		'slouching, leaning'
c.	il-em	→	ilelpil-em
	'telling'		'telling a bit, starting to tell'
d.	at^{w}-em	→	at^{w}elpat^{w}-em
	'hitting'		'tapping, patting'
e.	emp^{w}aṛ-em	→	emp^{w}elpemp^{w}aṛ-em
	'making'		'starting to make'
f.	itir-em	→	itelpitir-em
	'thinking'		'half-thinking'
g.	ekut'-em	→	ekelpekut'-em)
	(i.e., eket'^{w}-em	→	ekelpeket'^{w}-em)
	'gathering'		'beginning to gather'

For monosyllabic stems, as in (7a–d), the reduplicant is the entire stem (not including the present tense marker /-em/).

(7) c. /σ-elp-/$_{\text{ATTEN}}$ + il- → /ilelp-/ + il-
→ ilelpil-

For polysyllabic stems, as in (7e–g), the reduplicant is only the first VC(C) syllable of the stem.

(7) e. /σ-elp-/ + emp^{w}.aṛ- → /emp^{w}elp-/ + emp^{w}aṛ-
→ emp^{w}elpemp^{w}aṛ-
(→ mp^{w}elpemp^{w}aṛ- (phrase-initially))

Uniform VC(C) syllabification therefore allows us to derive the reduplication facts of Arrernte straightforwardly, with reference only to the syllabic structure of the morphemes that contain reduplicants. Prefixes involving reduplication reduplicate syllables from the left edge of the base, whereas suffixes involving reduplication reduplicate syllables from the right edge of the base.

2.2 Rabbit Talk

Rabbit Talk is a language game that involves transposing the initial portion of a word to the end of the word, not unlike the Pig Latin of English.

(8)

	Arrernte word		*Rabbit Talk form*	
a.	emeṇ	→	eṇem	'plant food'
b.	enṯem	→	emeṇṯ	'giving'

c.	ekʷeṇet'ek	→	eṇet'ekekʷ	'to put in'
d.	itirem	→	iremit	'thinking'
e.	araŋkʷ	→	aŋkʷar	'no'
f.	ulkeṭ	→	eṭulk	'perentie'[9]
	(i.e., elkʷeṭ	→	eṭelkʷ)	
g.	alpet'ek	→	et'ekalp	'to go back'
h.	iŋʷeṉṯ	→	eṉṯiŋʷ	'tomorrow'
i.	eyaṉ	→	aṉey	'there (nearby)'
j.	el'aṭ	→	aṭel'	'now, today'
k.	ekel	→	elek	'right, OK'
l.	aṭʷ	→	eyaṭʷ	'initiated man'
m.	iŋk	→	eyiŋk	'foot'
n.	emp	→	eyemp	'come on!'

Under an analysis of Arrernte whereby all syllables are of the shape VC(C) at the word level, the process for creating Rabbit Talk forms from Arrernte words involves transposing the first syllable of the word to the end of the word. If the initial word is monosyllabic, however, Rabbit Talk forms are produced by adding the syllable /ey/ to the beginning of the word. As always, words that begin in /e/ lose this initial vowel in phrase-initial position, giving rise to consonant-initial Rabbit Talk forms in this environment.

(8) e.	ar.aŋkʷ	→	aŋkʷ.ar	(transposition)
g.	alp.et'.ek	→	et'.ek.alp	(transposition)
		(→	t'ek.alp	(phrase-initially))
l.	aṭʷ	→	ey.aṭʷ	(transposition)
		(→	yaṭʷ	(phrase-initially))

2.3 Historical and Comparative Evidence

Arrernte belongs to the Pama-Nyungan language family, which covers the major part of the land area of Australia and which is generally characterized by phonological conservatism. The typical word in most languages is a CV or less often CVC syllable followed by a CV syllable. Monosyllables are absent or limited to a handful of function words. Some languages do not permit final consonants; others allow a limited set of consonants in this position. Many do not allow initial vowels, and hardly any allow initial consonant clusters. Most do not allow initial laterals or rhotics, and some do not allow any initial apicals. Stress normally falls on the first vowel.

However, there are a few areas where, independently, wholesale changes have occurred. The two most extensive and best known of these are the Cape York Peninsula (the Paman languages; see, e.g., Hale 1976a,b, Sommer 1970, 1981) and the Arandic area of Central Australia. Changes in both areas have included dropping of initial consonants or initial CV, shift of stress, loss of

[9] A species of lizard.

vowel length, prestopping of nasals, lenition of stops, and loss of final vowel. Other changes in Arandic include transfer of roundness from vowels to consonants and pre-palatalization of apicals. Some of the results in the two areas are strikingly similar: a profusion of vowel-initial and cluster-initial words, no restrictions on initial consonants, many monosyllables, stress (on polysyllables) on the second vowel or the first vowel following a consonant, unusual segments (such as, in Arandic, prestopped nasals and velar glide). To give just one example from the relatively few cases where a common ancestral form can so far be reconstructed, ancestral **ŋali* 'we two' (preserved unchanged in many modern languages) has descended as *ali, li, le, lay* in various Paman languages, *il, al^{y}, a^{y}l* in Arandic.

Koch (1997) proposes a series of twelve sound changes to account for present Arandic phonology. In their presumed order, they are as follows (paraphrased):

1. *Nasal prestopping* Nasals following a stressed vowel, possibly only short, were prestopped when the initial consonant of the word was not also nasal.
2. *Origin of velar glide* Velar stop became a glide when following a long stressed vowel.
3. *Shortening of long vowels*
4. *Nasal-stop cluster reduction* Homorganic nasal plus stop clusters were reduced to the nasal after unstressed vowels.
5. *Pre-palatalization of apicals before /i/* Apical obstruents, nasals, and laterals became pre-palatalized when the preceding vowel was stressed and the following vowel was /i/.[10]
6. *Vowel centralization* Vowels in unstressed syllables were reduced to schwa, (a) word-finally, (b) in word-final closed syllables, (c) in the medial syllable of trisyllables, and (d) in the penultimate syllable of four-syllable words.
7. *Final vowel addition* Schwa was added to words with final consonants.
8. *Rounding of /a/ after initial /w/* The resulting [o] was later reinterpreted as /u/.
9. *Loss of initial consonant* All initial consonants disappeared.
10. *Stress shift to second syllable*
11. *Reinterpretation of initial rounding* Initial /uC/ was reinterpreted as /eC^{w}/.
12. *Neutralization of initial /a/ and /i/* This was needed because initial vowels in Arandic do not reflect the original first syllable vowel. Rules for predicting present-day vowels have not been discovered.

Changes 1 through 10 apply to pre-Arandic; dialects differ with respect to changes 11 and 12.

Clearly, we do not accept all of Koch's proposals. For example, we would replace change 6a with one deleting final vowels, and we would not accept change 7 as a phonological change.[11]

[10] Some dialects maintain a set of contrastive pre-palatalized phonemes. In Arrernte they have merged with other series in a variety of ways (see Koch 1997:280–281), although pre-palatalized consonants exist at present as allomorphs in the series that we have labeled *retroflex*.

[11] Koch (1997:283) writes, "According to the analysis of Breen, modern Arandic languages lack a final vowel in the underlying form of words; any actually occurring vowels are predictable and are generated by phonological rules. In

We would have a wider view of change 11, regarding it as applying to all instances of /uC/, not just initial ones, and not, as Koch does, just those resulting in a consonant with rounded release (Koch regards all morphemes in Arandic languages as having final schwa, and none as having initial /e/; see also Breen and Green 1995). In addition, of course, we have to fit in the change from CV to VC syllabification.

At this stage we can only speculate on this. As Koch (1997:293) says, "[T]here are no apparent languages of the same subgroup that have not undergone the same sound changes."[12] It is likely that the change took place in stages, a first stage involving a change in syllabifying words of form CVCV from CV.CV to CVC.V. This may have been associated with a loss of final vowel opposition (and so of phonemic final vowel, our replacement for Koch's change 6a) resulting from change 5, in which a vowel feature is transferred to a preceding consonant.

A further change from CVC syllabification to VC may have triggered change 9, the loss of initial consonants, by having the result that these consonants became unparsed segments, no longer syllabifiable because they could not be codas. This must have followed change 8.

Alternatively, the change to VC may have been caused by the loss of initial consonants. There are numerous examples in Australia of initial consonant loss unconnected with any preceding change in syllabification (or, for that matter, shift of stress). The syllabification change may have been associated with the decline in salience of the initial vowels associated with changes 10, 11, and 12.

3 Possible Alternative Proposals

In the previous section we showed that the reduplication and transposition facts of Arrernte follow straightforwardly and cleanly from the assumption that syllables in Arrernte are onsetless and that all consonants are syllabified as codas at the word level. However, the cost of this simplicity of analysis and straightforward derivation of the Arrernte facts is abandoning CV as the universal basic syllable shape. Clearly, the more restrictive version of Universal Grammar, if tenable, is the best, so if there is a viable alternative to VC(C) syllabification for Arrernte, it should be preferred.

There are three types of alternative to our claim that all syllables are onsetless and consonants are always syllabified as codas at the word level: (a) all morphemes end in /e/ and none begin with /e/; (b) all bound morphemes begin with a vowel, but free morphemes may begin with a consonant; all morphemes end with a consonant; (c) although syllabification follows the "regular" CV(C) pattern, all morphemes begin with a vowel and end with a consonant.

In section 3.1 we demonstrate that viewpoints (a) and (b) are untenable analyses of Arrernte,

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this analysis, S[ound] C[hange] 7 would represent the addition to the grammar of the relevant phonological rules." In fact, Breen does not regard this vowel addition as being a phonological process at all; rather, it is simply phonetic (see section 1).

[12] Similarly, we do not yet feel able to speculate on whether the VC(C)-targeting reduplications discussed in section 2.1 arose before or after the changes that we associate with VC(C) syllabification (a matter on which an *LI* reviewer expressed interest).

not only complicating the grammar unnecessarily but also making incorrect predictions. Viewpoint (c), explored in section 3.2, can be forced to make the right predictions under a constraint-based analysis of the Arrernte facts, but only at the cost of obscuring the generalizations gained in sections 1 and 2 and, we claim, rendering the universal CV claim unfalsifiable. We will also show that viewpoint (c) fails under a rule-based account.

3.1 Rejecting Initial /e/

In section 1 we showed that stress assignment and prosody-sensitive allomorphy in Arrernte can be explained straightforwardly if all words are underlyingly vowel-initial. We also admitted that these facts alone could be accounted for by giving weight to onsets (as in Davis 1988) or by aligning feet with onsets (as in Goedemans 1996), thus introducing onset sensitivity into the phonology. If the initial-vowel hypothesis is rejected and onset sensitivity preferred, then the thesis of this article, that all syllables at the word level in Arrernte are vowel-initial, cannot be upheld. In this section we show that rejecting the initial-vowel hypothesis outlined in section 1 actually makes incorrect predictions with respect to the facts introduced in section 2. Here we examine just a few examples of how positing underlying initial /e/ is essential to any analysis of the facts in section 2.

First, with regard to Rabbit Talk, rejecting the existence of an initial /e/ immediately brings up the problem of explaining the disappearance of the /e/ that remains in initial position once the first consonant is transposed, and the appearance of /e/ between the consonants, in cases such as (8b).

(8) b. Input: n̪t̪em
Output: men̪t̪
n̪t̪em = n̪t̪ + em → em + n̪t̪ (transposition)

Opponents of the initial-underlying-/e/ hypothesis would be forced to ascribe the appearance of /e/ between /m/ and /n̪/ to epenthesis in order to avoid an impermissible consonant cluster, and the disappearance of initial /e/ to a constraint against word-initial /e/. If we are to invoke /e/-dropping in this case, however, it seems sensible to invoke it in the lexical cases as well, since this allows us to explain the facts in (2)–(4) without recourse to onset weighting, using mechanisms that are already justified. Furthermore, the epenthesis of /e/ to break up impermissible consonant clusters could not be justified in cases such as (8k), where the consonants separated by /e/ would otherwise form the perfectly legitimate Arrernte cluster (and actual word for 'wind') /lk/.

(8) k. kel = k + el → el + k (transposition)
(→ lk (phrase-initially))

On the other hand, one might reject our starting assumption that final /e/ in Arrernte is not phonologically part of the word. In this case the underlying form of (8b) would be /n̪t̪eme/ and the transposition process would take the first C(C)V and transpose it. This would require the stipulation that every word in Arrernte ends in the phoneme /e/ (we argue in section 1 that this final vowel is not phonemic, since its appearance is quite predictable, and that it should be regarded

as a final release). Further, the Rabbit Talk facts follow less cleanly from such an assumption than from an account involving initial vowels and onsetless syllables. Such an account takes anything up to the end of the first cluster and moves it to the end of the word, deletes /e/ where it occurs before another vowel or in initial position, and then epenthesizes a final /e/.

(8) b.	nṯeme = nṯ + eme	→	emenṯ	(transpose CC)
		→	menṯ	(delete initial /e/)
		→	menṯe	(epenthesize final /e/)
e.	araŋkʷe = ar + aŋkʷe	→	aŋkʷear	(transpose VC)
		→	aŋkʷar	(delete /e/ before V)
		→	aŋkʷare	(epenthesize final /e/)
h.	iŋʷenṯe = iŋʷ + ẹnṯe	→	enṯeiŋʷ	(transpose VC)
		→	nṯeiŋʷ	(delete /e/ initially)
		→	nṯiŋʷ	(delete /e/ before V)
		→	nṯiŋʷe	(epenthesize final /e/)
j.	l'aṭe = l' + aṭe	→	aṭel'	(transpose C)
		→	aṭel'e	(epenthesize final /e/)

Problems arise in accounting for reduplication under a viewpoint that rejects initial /e/. The habitative form in (6e) cannot be explained without recourse to initial underlying /e/. If the underlying form of the stem were really /t/, we would expect the output to be */tentenṯ/ rather than the correct /teneteṇ/.

(6) e. [t + eṇ] + RED → *tenteṇ

This problem can be circumvented once again by assuming that /e/ is really the final phoneme of every Arrernte word. Under this assumption, (6e) has the underlying representation shown here.

(6) e. [te + ṇe] + RED → teneteṇe

This approach again suffers from the problem of positing a noncontrastive and prosodically predictable element as a phoneme. In addition, it makes incorrect predictions for other types of reduplication. Under these assumptions, the frequentative form in (5f) derives from /akemire + pe + RED-/. Reduplication of the final syllable of the stem would give /akemirepere-/, not /akemirepire-/.

It therefore appears that any account of Arrernte must accept that all words are vowel-initial and consonant-final. If these requirements are not stipulations but follow from an assumption that all syllables in Arrernte have codas but no onsets at the word level, all the facts presented in this article derive straightforwardly from these assumptions alone, without recourse to further machinery.

3.2 Alternative Hypotheses Using CV Syllables

In this section we consider possible alternatives within both serial-derivation and constraint-based approaches wherein the basic syllable shape of CV is upheld for Arrernte, and we reconsider the

evidence presented in section 2 in the light of these. Both of the approaches sketched here assume that the initial-vowel hypothesis argued for in section 1 is correct.

3.2.1 Serial Derivation A serial-derivation approach that preferred onsets to codas would have to posit templates for reduplication and Rabbit Talk that consist of elements other than (maximal) syllables.

To form the frequentative (5), the final syllable of the stem minus its onset is reduplicated and suffixed to /ep/, which is in turn suffixed to the original stem.

Frequentative = stem + /ep + $\sigma_{(\text{no onset})}$/

(5) d. a.ṯer + /ep + $\sigma_{(\text{no onset})}$/ → a.ṯer + /ep + (ṯ)er/
→ a.ṯe.re.per

To form the habitative (6), /eṉ/ is suffixed to the stem; then the final two syllables of the stem, minus the onset of the penultimate syllable, are reduplicated.

Habitative = [stem + /eṉ/] + /$\sigma_{(\text{no onset})}$ + σ/

(6) c. [a.t^{w}er + /eṉ/] + /$\sigma_{(\text{no onset})}$ + σ/ → a.t^{w}e.reṉ + /$\sigma_{(\text{no onset})}$ + σ/
→ a.t^{w}e.reṉ + /(t^{w})e.reṉ/
→ a.t^{w}e.re.ṉe.reṉ

To form the attenuative (7), the first syllable plus the onset of the following syllable is reduplicated.

Attenuative = /σ + onset + elp/ + stem

(7) e. /σ + onset + elp/ + em.p^{w}aṛ + em → em + p^{w} + elp + em.p^{w}aṛ + em
→ em.p^{w}el.pem.p^{w}aṛ-em

Rejecting VC syllabification misses the generalization that unites these kinds of reduplication (that consonants associate with preceding vowels rather than following ones) and forces one to propose a different reduplicative template for each kind of reduplication, as well as forcing a mismatch between morphological and prosodic boundaries.

It might be argued that phonotactic constraints mandate the dropping of certain onsets from the reduplicant. In the case of the frequentative, the onset is dropped because any cluster with /p/ as its initial element is ill formed, and thus /ep/ + onset will always be ill formed. In the case of the attenuative, on the other hand, the requirement that all Arrernte words be vowel-initial would rule out any onset in the initial position of a reduplicant prefix. Since this material is being reduplicated from a vowel-initial base, no consonant-initial reduplicants will ever be formed in any case.

The loss of the onset in the habitative, however, cannot be so easily explained. The onset is lost immediately after /ṉ/, which is able to form a cluster with the laminal-dental stop, yet no reduplicative form like */aṯereṉṯereṉ/ (from the stem /aṯer/ 'laugh') can exist (the correct form is /aṯereṉereṉ/; see (6d)), even though the clusters are well formed (see appendix A). The dropping of onsets in reduplication cannot therefore be explained as satisfaction of a phonotactic require-

ment. The copying of an onset between the reduplicated syllable and the prespecified [elp] in the attenuative forms is not readily explained either.

Rabbit Talk would have to be described as transposition of the initial part of the word up to and including the first cluster. That is to say, the transposed element corresponds to the first syllable plus the onset of the second syllable.

(8) b.	en̪.t̪em = en̪.t̪ + em	→	em + en̪.t̪	(transposition)
		→	e.men̪t̪	(resyllabification)
		(→	men̪t̪	(phrase-initially))
h.	i.ŋʷen̪t̪ = i.ŋʷ + en̪t̪	→	en̪t̪ + i.ŋʷ	(transposition)
		→	en̪.t̪iŋʷ	(resyllabification)
		(→	n̪t̪iŋʷ	(phrase-initially))

Transposing the onset to the second syllable in addition to the entire first syllable is done to meet the requirement that all words begin in a vowel, while still transposing something.

A rule-based derivational theory is better served by accepting VC(C) syllabification in Arrernte. In fact, there is no reason why such a theory should not embrace VC(C) syllabification. If CV(C) syllabification is achieved by ordering a rule that syllabifies consonants with subsequent vowels ahead of a rule that syllabifies hitherto unsyllabified consonants with preceding vowels (as schematized in (9a)), then VC(C) syllabification is simply achieved by repeated application of the coda rule and absence of the onset rule (as shown in (9b)), followed by a rule of stray erasure.

(9) a.	Input string	CVCV	VCCV	VCV	CVCCV
	Nucleus projection	C[V]C[V]	[V]CC[V]	[V]C[V]	C[V]CC[V]
	Onset rule	[CV][CV]	[V]C[CV]	[V][CV]	[CV]C[CV]
	Coda rule	—	[VC][CV]	—	[CVC][CV]
b.	Input string	CVC	VCC	VCV	VCCVC
	Nucleus projection	C[V]C	[V]CC	[V]C[V]	[V]CC[V]C
	Coda rule	C[VC]	[VC]C	[VC][V]	[VC]C[VC]
	Coda rule	—	[VCC]	—	[VCC][VC]
	Stray erasure	[VC]	—	—	—

The absence of underlyingly consonant-initial words in Arrernte can be seen as a natural consequence of the system in (9b) if a consonant must be syllabified in order to be a well-formed segment of a string. As discussed in section 2.3, Arrernte evolved from a typical CV language that underwent a regular loss of word-initial consonants. This loss can be seen as the long-term result of the stray erasure rule that prevented unsyllabified consonants from surfacing. Once the onset rule in (9a) was replaced by an application of the coda rule, the evidence for initial consonants was no longer available to the learner, and so the underlying form was reanalyzed as lacking this initial consonant.

3.2.2 Optimality Theory A constraint-based system appears to be better equipped than a derivational rule-based one for handling the Arrernte facts described in section 2 without recourse to

VC syllabification. One criticism of serial derivations raised by proponents of Optimality Theory (as developed, for example, in Prince and Smolensky 1993, McCarthy and Prince 1993, 1994; henceforth OT) is that they allow languages to syllabify as illustrated in (9b), which, it was claimed, no language does. Within OT the generalization that no language prefers closed syllables derives from the existence of two universal constraints on syllabification: ONSET (a syllable has an onset) and NO-CODA (a syllable does not have a coda).[13]

If the hypothesis presented in section 1 is correct, every Arrernte word underlyingly begins with a vowel. An alternative approach to the problem of apparent VC(C) syllabification might take this fact to be a restriction imposed by the grammar, a well-formedness constraint that may not be violated by the operation of morphological processes such as those discussed in section 2. Within the framework of OT, it might be suggested that ONSET and NO-CODA are dominated in Arrernte by the requirements that all morphemes begin with a vowel (embodied in the constraint ALIGN(Mrph, L, V, L)) and that morpheme and syllable boundaries cooccur (ALIGN(Mrph, L, σ, L)). In addition, faithfulness to the segmental melody of the input is always preferred to erasure (MAX-IO). The effect of such an approach is to force syllabification of consonants as codas at all and only morpheme boundaries.

Three more undominated constraints are needed to explain the reduplication facts presented in section 2.1. An undominated anchoring constraint (not illustrated in the tableaux) ensures that reduplicated material in suffixes is copied from the end of the base and that reduplicated material in prefixes is copied from the beginning. Various phonotactic constraints (expressed as a single constraint PHONOTACTICS in the tableaux, but including constraints on sonority sequencing and adjacency or sharing of place and manner features) rule out clusters of consonants that are not permitted in the language. The exact nature of the phonotactic constraints is not directly relevant, but permissible clusters are listed in appendix A.

Tableau (10) shows how this system works for a set of candidate outputs for the frequentative form in (5d). The symbol *R* in the input forms indicates material reduplicated from the base. Note that we assume that R does not constitute a morpheme in its own right in the frequentative and attenuative reduplications, but forms a morpheme in conjunction with the prespecified material (i.e., the frequentative morpheme is /ep-R/, the habitative morpheme is /R/, and the attenuative morpheme is /R-elp/).[14]

[13] As mentioned in footnote 7, reversing the effect of these constraints (i.e., ranking NO-ONSET and CODA above ONSET and NO-CODA) would derive VC(C) syllabification directly, or it could be derived indirectly by recourse to a constraint that aligned the left edge of every syllable with a vowel. However, these constraints are quite explicitly ruled out in OT, and our aim in this section is to explore a constraint-based system in which the basic syllable shape is CV(C).

[14] An *LI* reviewer suggests we consider R to be a morpheme in its own right. Although we respectfully decline the suggestion, preferring to use the term to refer to an element that has some morphosemantic role (so the attenuative is one morpheme, not two, for example), the analysis is not altered significantly by such an assumption. The major difference would be that, owing to the effects of ALIGN(Mrph, L, σ, L), there would be an even greater number of onsetless syllables in the winning candidate than indicated in our tableaux.

(10) Frequentative reduplication

/at̪er/+/ep-R/+/em/	Phonotactics	Max-IO	Align (Mrph, L, σ, L)	Align (Mrph, L, V, L)	Onset
a. ☞ a.t̪er.e.per.em	✓	✓	✓	✓	***
b. t̪er.e.per.em	✓	*!	✓	*!	**
c. at̪.er.ep.er.em	✓	✓	✓	✓	*****!
d. a.t̪e.re.pe.rem	✓	✓	*!*	✓	*
e. a.t̪er.ep.t̪er.em	*!	✓	✓	✓	***

The winning candidate, (a), has syllables that contain onsets everywhere except at the left edge of morphemes. Candidate (e) satisfies Onset to the same degree, but contains an illicit cluster. Two of the candidates, (b) and (d), satisfy Onset even better than the winning candidate, but each of these violates some higher-ranked constraint. Candidate (b) avoids violating Onset by failing to parse the initial vowel into a syllable, which means that the first syllable and prosodic morpheme of the word begin with /t̪/. The cost of this, however, is to violate the alignment of morphemes' left edges with vowels (as well as violating Max-IO). Candidate (d) incurs minimal violations of Onset by syllabifying the last segment of the base as an onset to the syllable that begins the reduplicant suffix and the last segment of the reduplicant suffix as an onset to the syllable containing the tense marker. In so doing, however, this candidate twice violates the alignment of morpheme edges with syllable edges. The candidates that violate these alignment constraints are indistinguishable as phonetic strings from the winning candidate, but the importance of these constraints will become more apparent as later tableaux are discussed.

The candidate that would be expected under a VC(C) syllabification, candidate (c), satisfies all constraints except Onset, having no onsets on any of its syllables. It differs from the winning candidate only in the syllabification of consonants in morpheme-internal positions.

Note that there is a word /at̪erem/ 'are grinding' (/at̪/ 'to grind' + plural subject marker), which is homophonous with /at̪erem/ 'is laughing' but, because it has a morpheme boundary between /at̪/ and /er/, would lead to a winning candidate for the reduplicated form /at̪.er.e.per.em/ as compared with /a.t̪er.e.per.em/ for the winning candidate in (10).

Tableau (11) illustrates how the constraints select the output form for the habitative form of the same stem (6d). Once again, the candidate predicted by VC(C) syllabification, candidate (c), is rejected only on the grounds of violating the Onset constraint. The winning candidate, (a), has onsetless syllables at each of the three morpheme boundaries in the word and nowhere else. Other candidates have fewer Onset violations, but they all violate higher-ranking constraints. Candidates (b) and (d) both trade Onset violations for misalignments between morpheme and syllable boundaries. Candidate (e), which manages to align morpheme boundaries with syllable boundaries and minimize Onset violations by copying more of the base than the winning candidate does, violates Align(Mrph, L, V. L). Note that the winning candidate syllabifies the first /ere̪n̪/ sequence differently from the second (/er.e̪n̪/, then /e.re̪n̪/) because a morpheme boundary falls between the /r/ and the /e/ of the first sequence but not of the second.

(11) Habitative reduplication

[/ater/+/en/+/R/	PHONOTACTICS	MAX-IO	ALIGN (Mrph, L, σ, L)	ALIGN (Mrph, L, V, L)	ONSET
a. ☞ a.ter.en.e.ren	✓	✓	✓	✓	***
b. a.te.ren.e.ren	✓	✓	*!	*!	**
c. at.er.en.er.en	✓	✓	✓	✓	*****!
d. a.te.re.ne.ren	✓	✓	*!*	*!	*
e. a.ter.en.te.ren	✓	✓	✓	*!	**

Candidates for the attenuative form in (7f) are considered in tableau (12). Yet again the winning candidate, (a), and the candidate that adheres to VC(C) syllabification, (b), differ only in that the winning candidate lacks onsets only at the left edges of its constituent morphemes.

(12) Attenuative reduplication[15]

/R-elp/+/itir/+/em/	PHONOTACTICS	MAX-IO	ALIGN (Mrph, L, σ, L)	ALIGN (Mrph, L, V, L)	ONSET
a. ☞ i.telp.i.tir.em	✓	✓	✓	✓	***
b. it.elp.it.ir.em	✓	✓	✓	✓	*****!
c. i.tel.pi.ti.rem	✓	✓	*!*	✓	*
d. i.tel.pi.tir.em	✓	✓	*!	✓	**
e. telp.i.tir.em	✓	*!	✓	*!	**

The candidates with fewest violations of ONSET (candidates (c), (d), and (e)) avoid ONSET violations by failing to align morpheme and syllable boundaries or by deleting segmental material.

The system makes the correct predictions for the reduplication facts with the following effects: winning candidates contain onsetless syllables at all and only morpheme boundaries, and candidates with exclusive VC(C) syllabification differ from the winning candidates only in that they have onsetless syllables in all other (morpheme-internal) positions as well.

To account for the Rabbit Talk facts, we need to posit an additional constraint relating to the nature of the transposition. The correct Rabbit Talk outputs are obtained by high ranking of a cross-anchoring constraint (ANCHOR(RT, R, Base, L)).[16] This constraint requires the segment at the right edge of the Rabbit Talk output to correspond to the segment at the left edge of the base that forms the input. Constraints of the form ANCHOR(output, X, input, Y), originally formulated by Itô, Kitagawa, and Mester (1996) to account for the transposition phenomenon of the Japanese

[15] For many speakers there is a morpheme boundary between [it] and [ir] in this word, in which case the winning candidate would be [i.telp.it.ir.em].

[16] *RT* here stands for *Rabbit Talk*, not *root*.

zuuja-go argot, register a mark for every segment that occurs between the X edge of the output and the element in the output corresponding to the Y edge of the input. Thus, a violation is incurred for each segment that intervenes between the segment in the Rabbit Talk form corresponding to the left edge of the base and the right edge of the Rabbit Talk form. These constraints, when ranked as in tableau (13), ensure that minimal nonvacuous transposition occurs, and the higher-ranking ALIGN(Mrph, L, V, L) constraint ensures that enough of the word is transposed so that the output form is vowel-initial. Only the relevant constraints are shown in tableau (13), which considers candidates for the Rabbit Talk form in (8d).

(13) Rabbit Talk[17]

/$i_1t_2i_3r_4e_5m_6$/→ RT	MAX-IO	ALIGN (Mrph, L, V, L)	ANCHOR (RT, R, Base, L)	ONSET
a. ☞ $i_3.r_4e_5.m_6i_1t_2$	✓	✓	*	*
b. $i_3r_4.e_5m_6.i_1t_2$	✓	✓	*	***!
c. $t_2i_3.r_4e_5.m_6i_1$	✓	*!	✓	✓
d. $i_3.r_4e_5.m_6i_1$	*!	✓	✓	*
e. $i_1.t_2i_3.r_4e_5m_6$	✓	✓	*****!	*
f. $e_5.m_6i_1.t_2i_3r_4$	✓	✓	***!	***

The winning candidate, (a), is the one that transposes the minimal amount required to satisfy ALIGN(Mrph, L, V, L) without eliminating any material. Candidate (b) is rejected only on the grounds that all of its syllables, and not just the initial syllable, lack onsets. Candidate (c) satisfies ONSET and best satisfies the cross-anchoring constraint (transposing only the element at the left edge of the base to the right edge) at the cost of violating the higher-ranked ban on morpheme-initial consonants. Candidate (d) fails to include all of the elements of the input. Candidate (e) is the most faithful to the input; however, this faithfulness can only be achieved at the cost of failing to transpose any elements of the input, thus grievously violating the cross-anchoring constraint. Candidate (f) transposes too many elements, resulting in more violations of ANCHOR than the winning candidate.

It would appear, then, that a constraint-based analysis of the Arrernte facts is viable without accepting VC as Arrernte's basic syllable shape. Such an analysis is at least able to predict the correct results for each of the morphological constructions examined, unlike the serial-derivation approach sketched in section 3.2.1. Under such an analysis, we can continue to uphold as universal the observation that all languages that have codas also allow onsets. Consider, however, the effect of the interactions of these constraints. The generalization that can be made regarding all the winning candidates in tableaux (10) through (13) is that they have canonical CV(C) syllables everywhere except where the morphology and prosody interact. In other words, in all and only

[17] We treat the output of Rabbit Talk as lacking internal morpheme boundaries. If /em/ constituted a morpheme, candidate (b) would win.

those cases where there is any evidence of where syllable boundaries lie, syllables are vowel-initial. Under these terms, the claim that CV is a universal syllable shape is unfalsifiable. Whenever there is any kind of evidence that a language uses VC as its basic syllable shape—evidence coming from morphophonological phenomena such as those presented in this article, the same kinds of phenomena that every introductory phonology textbook uses to show where syllable boundaries lie—an adherent of the universal CV approach need only respond that VC syllables are present everywhere that evidence for syllabification exists, but that all other syllables, whose syllable boundaries cannot be determined, are CV(C).[18]

Furthermore, the requirement that all words are vowel-initial and consonant-final has to be stipulated in the CV analysis as independent of syllabification, whereas in our approach these facts follow automatically from VC(C) syllabification.

In the absence of any evidence from Arrernte that CV(C) syllables exist, and faced with strong evidence that VC(C) syllables exist, logic and Ockham's razor dictate that all syllables in Arrernte are vowel-initial. Thus, the preference to syllabify consonants as onsets rather than codas is not universal.

4 Why Is the Arrernte Pattern So Rare?

Now that we have shown that CV is not the unmarked syllable shape in all languages, and that languages may in fact prefer to syllabify consonants as codas rather than as onsets, it is reasonable to ask why there is such an overwhelming preference for languages to uphold CV as the unmarked syllable, not VC. This preference is so overwhelming, in fact, that it was thought to be an inviolable phonological universal (explicitly stated by at least Jakobson (1962)). However, the existence of a language like Arrernte means that we cannot merely pass the preference off as a phonological universal and explain it by recourse to universal and nonparameterized constraints on syllabification (such as OT's ONSET and NO-CODA); rather, we must seek an explanation of it in other terms.

We believe that the answer to this puzzle lies in the realm of acoustic phonetics. We should note that the ideas in this section are highly speculative and await investigation by phoneticians, which we cannot claim to be. However, we feel justified in claiming that one property of the phonetic output is that distinctions that are relevant to a language (such as phonemic contrasts) must be available to the hearer. Work in phonetics (e.g., Ohala and Kawasaki 1984) and on the phonetics-phonology interface (e.g., Steriade 1989, 1991) has identified the "right edge" (release) of consonants—in particular, stops, affricates, and fricatives—as the more salient edge perceptually. It follows that the transition from a consonant to a following vowel is more acoustically

[18] One *LI* reviewer disagrees with our conclusions on this point, saying that although Arrernte does not provide the evidence necessary to determine which of the two analyses is superior, a language might conceivably require all morphemes to be vowel-initial but prefer onsets morpheme-internally. The kind of evidence required to decide between the analyses, the reviewer points out, would come from whether consonants not syllabifiable as codas are elided (evidence for the onsetless-syllable hypothesis) or not (evidence for onsets). However, we fail to see how such cases could ever arise morpheme-internally. Historical evidence would be inadmissible on the grounds that it would merely serve as evidence for a change in the input over time. If a language really has no onsets, then there will never be consonants unable to be syllabified as codas that could be syllabified as onsets, since all of the phonemes in the language's inventory will be syllabifiable as codas.

salient than the transition from a vowel to a following consonant. This phonetic fact gives rise to a preference for associating consonants with following vowels in the phonology, and thus to the preference for CV as the unmarked syllable shape. There is nothing inherent to the phonological component itself that makes this so. It is instead a result of interactions between phonetic requirements and phonological structure.

In support of this hypothesis, note that Arrernte is unusual not only in having VC as the unmarked syllable shape in its phonology, but also in having a series of prestopped nasal consonants.[19] It becomes clear that these two facts are not unrelated when one considers that the acoustically significant edge of a prestopped nasal, which allows it to be distinguished from a simple nasal, is the left edge (or closure). Since Arrernte lacks phonemic fricatives and affricates, the right edge of consonants may not be quite as important in this language as in others, whereas the left edge is considerably more important. Of course, the vast majority of Australian languages also lack fricatives and affricates and have straightforward CV(C) syllabification, though these languages also lack prestopped nasals. We speculate that association of consonants with preceding vowels is therefore made less undesirable in Arrernte by the absence of phonetic considerations that might otherwise militate against such VC syllabification. Recall from section 2.3 that the appearance of these segments preceded changes that we attribute to the advent of VC(C) syllabification.

This should not be taken as saying that the right edge of consonants is unimportant. After all, place of articulation for stop phonemes is usually identified by release properties of the stop. The point is simply that the reduced importance of the right edge with respect to the left edge in Arrernte, when compared with other languages, makes it viable for the language to associate consonants with preceding nuclei (as codas) rather than with following ones (as onsets).

Appendix A: Consonants

The (unrounded) consonants of Arrernte, according to the phonemic transcription used in this article, are as follows:[20]

(14)

	Peripheral		Coronal			
			Laminal		Apical	
	Bilabial	Velar	Dental	Alveolar	Alveolar	Retroflex
Stop	p	k	t̪	t'	t	ʈ
Nasal	m	ŋ	n̪	n'	n	ɳ
Prestopped nasal	M	G	N̪	N'	N	Ɲ
Lateral			l̪	l'	l	ɭ
Tap					ɾ	
Glide	w	h		y		ɻ

[19] Prestopped nasals are also found in some languages of Cape York, and it is some of these languages that Sommer (1970, 1981) argued lacked onsets. In the absence of a full instrumental study of these segments, prestopped nasals are best described as stops with a nasal release.

[20] Laminal-alveolar is more accurately laminal postalveolar, as pointed out by an *LI* reviewer (see Ladefoged and Maddieson 1996). The "retroflex" series includes pre-palatal allophones as indicated in footnote 10.

The following consonant clusters are attested in all of the Arrernte varieties covered by Henderson and Dobson (1994) (with one exception noted below).[21] Superscripted /w/ represents rounding, which is associated with a consonant position (filled by C or CC), rather than with an individual consonant.

(15)	mp	ŋk	n̪t̪	n't'	nt	n̪t̪
	mp^{w}	ŋk^{w}	n̪t̪^{w}	n't'^{w}	nt^{w}	n̪t̪^{w}
			l̪t̪	l't'	lt	l̪t̪
			l̪t̪^{w}	l't'^{w}	lt^{w}	l̪t̪^{w}
				nt'		
				nt'^{w}		
				lt'		
	np	nk	n̪p	n̪k		
	np^{w}	nk^{w}	n̪p^{w}	n̪k^{w}		
	lp	lk	l̪p	l̪k		
	lp^{w}	lk^{w}	l̪p^{w}	l̪k^{w}		
	nm	nŋ	n̪m	n̪ŋ		
		nŋ^{w}				
	lm	lŋ	l̪m	l̪ŋ		
	lm^{w}	lŋ^{w}	l̪m^{w}	l̪ŋ^{w}		
	rp	rk	r̪t̪	rt'		
	rp^{w}	rk^{w}	r̪t̪^{w}	rt'^{w}		
	rm	rŋ		rn'		
	rm^{w}	rŋ^{w}				

This list can be condensed into the following sets, each divisible into rounded and unrounded subsets:

(16) homorganic nasal or lateral + stop
apical nasal or lateral + peripheral stop
apical-alveolar nasal or lateral + laminal-alveolar stop
apical nasal or lateral + peripheral nasal[22]
tap + nonapical stop or nasal

A number of the attested clusters are quite rare; for example, there is only one root with /rn'/. We feel justified, then, in supposing that gaps, such as /rn̪/ and /rn'^{w}/, are probably accidental. Rounded clusters of tap and (prestopped) nasal do not occur on the surface; the few examples

[21] We use the term *variety* to refer to the speech of one or another of the five areas named in Henderson and Dobson 1994:9 and *dialect* to refer to other named Arandic varieties, other than the two that are classified as separate languages.

[22] In fact, the second members of the lateral-nasal and tap-nasal clusters are phonetically prestopped and have been analyzed as phonemically prestopped nasals (e.g., in Wilkins 1989). However, they are not opposed to plain nasals in this environment. In some other dialects the prestopping of nasals in such clusters occurs only in certain environments.

that belong underlyingly to this category all have the roundness transferred to a preceding /e/ and so occur on the surface as a rounded vowel followed by a not perceptibly rounded cluster. Of the four possible rounded nasal-nasal clusters, only one has been attested, and that by only one word in one variety.

Considering now the occurrence of clusters in particular environments, we find some systematic gaps. Notable among these is the prohibition of tap-initial clusters and nasal-nasal clusters in surface-initial position (i.e., following unrealized underlying initial /e/). This is attributed to a high-level (phonetic) constraint against such clusters. This also constrains the dropping of initial /a/ (a common phenomenon in Arrernte) when such clusters follow. The fact that this dialect has no initial tap seems not to be relevant; the neighboring dialects Western and Southern Arrernte, in which initial tap is not uncommon, have the same constraints against initial clusters.

For some speakers, Rabbit Talk forms may begin with clusters not normally found in initial position in their dialect. Some speakers add a vowel so that certain clusters will not be initial in Rabbit Talk words (e.g., /iŋkʷelp/ becomes /alpiŋkʷ/, not /lpiŋkʷ/; /akɳert'/ becomes /irt'akɳ/); but one Eastern Arrernte speaker produced Rabbit Talk forms with initial /rk/ (e.g., /rket'ʷ/ from /t'ʷerk/ 'fig' and /rkint/ from /interk/ 'termite'), although initial /r/ does not exist in this dialect of Arrernte. Note also that initial /rV/ seems to be allowed in Rabbit Talk by all speakers.

Initial apical-alveolar nasal or lateral + laminal-alveolar stop clusters are not attested either, but these are quite rare anyway, and also would be difficult to distinguish from the corresponding homorganic clusters in this position. Apical nasal + peripheral stop clusters almost never occur initially; there is one example with stop *p* and one with stop *k*, neither attested for all varieties, although at least one of them is attested for each variety.

Although Arrernte does not contrast the two apical series in surface-initial position, this contrast does occur in rounded apical-initial clusters following underlying /e/. In these cases the rounding, which tends to be realized on the onset of such clusters, spreads to the /e/ and gives it features that enable it to surface as a vowel [u]. Utterance-initial [u] is thus in complementary distribution with zero (no surface-initial vowel). Surface [u] occurs only before rounded coronal consonants and coronal-initial clusters; /e/ is realized initially as zero in all other environments. Thus, for example, there is a contrast between the words /lpw/ 'fine, powdery' and /l̪pw/ 'red ochre' ([ulpə] and ul̪pə], respectively) but no possible contrast between /lp/ and /l̪p/ in surface-initial position.

Following initial /a/ or /i/ the only set that is not attested at all is the rounded tap + nasal set, but given its overall rarity, this may not be significant. Following a primary stressed vowel, there seem to be no systematic gaps (involving complete rows in the table in (15)).

In word-final position the only set with no members attested is the almost nonexistent rounded nasal + nasal cluster set.

Appendix B: Vowels

The dialects of Arrernte on which this study is based are currently analyzed as having three vowels, /a/, /e/, and /i/. This is regarded, not as a system of three vowels differentiated by height, but as a two-vowel system comprising the featureless vowel /e/ and the long vowel /a/ and

augmented by a fairly marginal third vowel /i/. Breen (1977) analyzed the closely related Anteker-repenh as having two vowels, corresponding to our /e/ and /a/ with the distinction one of length rather than height. This analysis has now been abandoned for this dialect, but it is maintained for another dialect of this language, Western Anmatyerr (Breen 1988), and for Kaytetye, another language of the same group (Koch 1980:n. 2).

The quality of /e/ is determined by the nature of the surrounding consonants. In a ''palatal'' environment (i.e., preceded or, especially, followed by a laminal-alveolar, especially /y/), it is raised and fronted; examples are /aṯet'/ [aṯʊ́t'ə] 'mulga', which can be contrasted with /aṯit'/ [aṯí:t'ə] 'teeth', and /awey/ [awí:ə] 'boy'.

In a rounding environment it is raised and rounded, to a degree that is determined by whether it is following a consonant with rounded release or preceding one with rounded onset and, in the latter case, whether it is stressed or not. An example of the first situation is /ek^{w}eteṛ/ [kʊ́təɹə] or [kʊ́tʊɹə] 'nulla-nulla (a weapon)'. The latter pronunciation illustrates spreading of the rounding. An example of an unstressed /e/ before a consonant with rounded onset is /et'^{w}en/ [ʊt'ə́nə] 'sore'; an example of a stressed one is /eken'^{w}/ [kɔ́:n'ə] 'poor thing'.

The rounded vowels [ʊ] and [ɔ:] are therefore regarded as resulting from the effect of rounding of a contiguous consonant on /e/. Nonfinal /e/ following a consonant with rounded release is realized usually as [ʊ], as in /ek^{w}en'/ [kʊ́n'ə] 'without'; a notable exception is when /y/ follows, thus /ek^{w}ey/ [k^{w}i] 'oops'. /e/ preceding a consonant with rounded onset is [ɔ:] if stressed, as in /eken'^{w}/ [kɔ́:n'ə], or [ʊ] or [ɔ] if unstressed, as in /en'^{w}er/ [ʊn'ʊ́ɾə] 'mountain devil (type of lizard)'. Thus, utterance-initial /e/ appears at the surface only when followed by a consonant or cluster with rounded onset. Also, as noted in appendix A, certain clusters can follow initial /e/ only if they are rounded; that is, they cannot occur word-initially on the surface. So, for example, /erŋ^{w}/ is a possible (and real) word; /erŋ/ is not.

This analysis depends on there being a complementary distribution of onset rounding and release rounding. Peripheral (i.e., labial and velar) consonants are rounded only on the release (although they may appear as the second member of clusters that have onset rounding, when this is permissible for the first member). Other consonants can be rounded on the release only if they precede a stressed vowel and are preceded by (surface or underlying) /a/ or /i/. Elsewhere they are rounded only on the onset.

Any departure from this complementary distribution in the idiolect of any speaker is marginal. However, some linguists (see, e.g., Wilkins 1989:74–82) prefer to postulate a fourth vowel phoneme, /u/, instead of rounding on the onset of a consonant or consonant cluster. Further details of the case for and against this fourth vowel are presented in Breen 1990. Where appropriate, we have given examples both ways—that is, using /uC/ as well as /eC^{w}/. The former spelling makes it clear to the reader that the initial vowel appears on the surface.

Before a retroflexed consonant, /e/ is retroflexed, as in /ipeṭ/ [ipə́ʈə] 'deep'. In a ''neutral'' environment (involving none of the foregoing consonant types), it is mid central and unrounded, as in /akeṯ/ [akə́ʇə] 'outside'.

Younger speakers (of perhaps all Arandic communalects) are replacing word-initial preround-

ing (or a [u] vowel) with rounding associated with the release of the consonant. For example, /et'ʷen/ is pronounced [t'ʊn].

Like most Australian languages, Arrernte does not permit contiguous underlying vowels.

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