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ON THE VOCALIZATION OF /r/ IN ATH-SIDHAR RIFIAN BERBER

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1. INTRODUCTION.

In Ath-Sidhar Rifian Berber (henceforth ASR)[1] /r/ is realized as r, a or ar depending on its location in the syllable and the phonological group. For instance /!zri/, /!zr-n/ and /!zr#it/ are realized as !zri, !zan and !zarit respectively. We present a systematic survey of the regularities involved. We then try to devise an analysis which would make the alternation between r and a in ASR an analogue of the y/i and w/u alternations found in many languages. Our attempt is unsuccessful to a large extent, but in the process we establish two results about ASR. First, syllabification operates in a cyclic fashion, and during the first cycle the domain of syllabification includes affixes but not clitics. Second, syllabification is sensitive, albeit in a limited way, to the position of consonants on the sonority scale.

Although this work is intended primarily as a contribution to the study of Berber phonology, it is written so as to be easily accessible to anyone with a general interest in syllable structure and in glides.

This article is organized as follows. Section 2 provides background information on the phonology and morphology of ASR. Section 3 presents a first set of regularities involving /r/. In section 4 we sketch an analysis according to which /r/ is syllabified as a syllable onset in some forms and as a syllable nucleus in others. In section 5 we present an overview of the phonology of /y/ and /w/ in ASR and point out various differences between their behaviour and that of /r/. In section 6, on the basis of alternations involving radical-final /r/, we show that ASR syllabification operates in a cyclic fashion. In section 7 we present evidence that /rG/ sequences (G a glide) do not syllabify in the same way as other /rC/ sequences, and suggest that this is due to a prohibition against rimes in which the nucleus has a lesser degree of sonority than the coda.

[1] We wish to thank the following persons, whose comments on drafts of this article greatly contributed to its improvement: Nick Clements, Mohamed Elmedlaoui, Morris Halle, Michael Kenstowicz, Marc Plénat, Elisabeth Selkirk, Jean-Roger Vergnaud and three anonymous reviewers for Natural Language and Linguistic Theory, whose criticisms of an earlier draft lead us radically to change our views on ASR /r/.

2. BACKGROUND INFORMATION ON ASR.

This section gives background information on ASR and on our presentation of the data.

The Berber dialect described here is spoken in the village of bagg˘ar in Morocco. This village belongs to the aθ siðar area. It is located about 20 kilometers to the north-west of the city of Nador, in Eastern Rif. One of us (OT) is a native speaker of that dialect. More information on its morphology and phonology is available in Tangi (1991) and Dell and Tangi (1992).[2]

2.1. THE SOUNDS OF ASR.

In this article all transcriptions not enclosed between slanted lines are phonetic representations given in a 'broad' transcription which glosses over the variations in vowel quality which are due to neighbouring pharyngeal or pharyngealized consonants and, in the case of shwa, to an adjacent glide or labiovelar. Unless indicated otherwise, the phonetic transcription of a form is meant to represent its pronunciation in isolation.

ASR has the following consonants.

[2] For recent discussions of nearby dialects with rather similar phonological systems, cf. Chami (1979), Cadi (1981), Chtatou (1982, 1993).

(1)

p		t		č		k	kʷ	q	
b		d		ǰ		g	gʷ		
x̄	f	θ	s	ʃ	ç			χ	ħ
		ð	z	ʒ				ʁ	ʕ	h
m		n				ŋ	ŋʷ		
w	r	l		y					

All are underlying segments except for x̄ and ç, which are realizations of /w/ and /y/. kʷ, gʷ, ŋʷ are labialized velars. χ and ʁ are uvular fricatives (voiceless and voiced); ħ and ʕ are pharyngeal fricatives (voiceless and voiced); h is a murmured glottal fricative ('voiced h'); except for kʷ and ŋʷ all consonants allow a contrast between simplex and geminate. Geminate consonants are longer than their simplex counterparts. Their stricture is steady-state, without any momentary relaxation at the boundary between the first half of the geminate and its second half.

When a word contains an 'emphatic' segment, emphasis is spread over the whole word at the phonetic level. For our purposes it is irrelevant which segment of a morpheme or word is the locus of emphasis at the phonological level. '!' indicates that all the segments in the next morpheme or word are emphatic.

The vowels of ASR are /a,i,u/ and shwa, which we transcribe as e. In non-emphatic environments /i/ and /u/ are realized as [i] and [u], and /a/ is intermediate between front [a] and [æ]. In emphatic environments /i,u,a/ sound like [ɛ], [ɔ] and [ɑ]. There are no length distinctions in vowels at any level of representation.

ASR furthermore possesses two diphthongs (i.e., two tautosyllabic vowel sequences) which are the phonetic reflexes of /ur/ and /ir/ in certain environments (cf. section 3). We shall represent them as oa and ea. oa stands for [ɔa] in non-emphatic contexts, and for [ɔɑ] in emphatic ones; ea stands for [ɛa] in both types of contexts.

2.2. MORPHOLOGICAL CATEGORIES.

In ASR verbs have five stems: 1 perfective affirmative, 2 perfective negative, 3 imperfective affirmative, 4 aorist (also used as an imperative perfective) and 5 imperfective negative. For the sake of brevity, the first three will respectively be called 1 perfective, 2 negative and 3 imperfective.

Verbs are inflected for the person, number and gender of their subject. The agreement marker may be a prefix, a suffix or a combination of both, e.g., /θ-/ 3fs[3]; /-ʁ/ 1s; /θ-...-ð/ 2s; /y-/ 3ms.

Nouns distinguish two numbers, singular and plural, two genders, masculine and feminine, and two states, free state and bound state. 'State' is a category akin to case.

Direct and indirect object pronouns will be referred to as clitics.[4] They immediately follow the verb unless it is preceded by a 'preverb', in which case they immediately precede it. For instance the 3fs direct object pronoun t follows the verb in ufi-n#t 'they (m) found her', and it precedes the verb in wa#t#ufi-n 'they (m) did not find her'.

By 'word' we mean a stem and the affixes attached to it, if there are any. The following are words: !θessʁarið 'teach impf 2s', from /θ-ss-!ʁari-ð/, θifunasin 'cows', from /θ-i-funas-in/, fus 'hand', from /fus/. By 'phonological group' we mean an inflected form and the clitics surrounding it, including certain preverbs like the negative. ufi-n#t and wa#t#ufi-n are phonological groups.

In our transcriptions, boundaries between morphemes are indicated by a hyphen when they are inside a word. Otherwise they are indicated by a blank. # indicates a word edge which is not also the

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[3] We shall use the following abbreviations: bs, bound state; dat, dative; dim, diminutive; do, direct object; f, feminine; fs, free state (in nouns) or feminine singular (in verbs and clitics); imper, imperative; impf, imperfective; m, masculine; neg, negative; p, plural; part, participle; pf, perfective; PNG (for Person Number Gender), verbal agreement marker; s, singular.

[4] For lists of the clitics and their contextual variants, cf. Tangi (1991), chap. I.

edge of a phonological group, and ## indicates the edge of a phonological group.

If it is necessary to indicate that two morphemes are components of a portmanteau, their glosses will be separated by a colon. For instance, the English words men and boys would normally be glossed as 'man p' and 'boy p', but if the need arises they could be glossed as 'man:p' and 'boy-p'.

When we cite a verbal form without giving any indication of its morphological make-up it is an imperative perfective in the second person singular. When we cite a verbal form without indicating which stem it is built on, it is built on the perfective stem. Nouns cited without indication of number are in the singular; those cited without indication of state are in the free state.

2.3. SYLLABLE STRUCTURE AND SHWA EPENTHESIS.

Syllabification and shwa epenthesis in ASR are discussed in detail in Dell and Tangi (1992). For the purposes of the present paper it will be enough to give the following outline.

In ASR the maximal syllable is CVC, i.e. all syllables belong to one of the four types: CVC, CV, VC and V. Onsetless syllables are allowed only at the beginning of words, i.e. words do not contain heterosyllabic vowel sequences. There are no syllabic consonants in ASR.[5] Besides the 'full vowels' /a,i,u/ which are already present in the lexical representations, ASR has an epenthetic vowel shwa. Shwa (ə) is the realization of an empty nucleus (Ø). Empty nuclei allow the syllabification of consonants which are not adjacent to an underlying vowel, e.g. /nudm-n/ 'they dozed' is syllabified as (nud)(mØn), hence nudmen, and /ʒbð-ʁ/ 'I pulled' is syllabified as (ʒØb)(ðØʁ), hence ʒebðəʁ. Except in certain sequences involving enclitics,[6] shwa occurs only in closed syllables. It never occurs

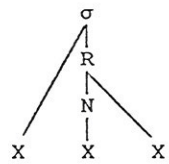
[5] Except, maybe, as a result of a very late process which would blend a shwa and an abutting consonant, cf. Tangi (1991, 100).

[6] These ill-understood cases seem to involve cyclic syllabification, cf. Dell and Tangi (1992).

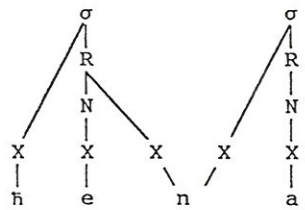
at the beginning of a phonological group. It would seem at first blush that the sonority hierarchy plays no role in the syllabification of consonant sequences. Only left-right precedence seems to matter.[7]

Before we move on, let us make some of our background assumptions explicit. We are assuming that the structure of representations is as proposed in Levin (1985). In Levin's framework CVC syllables are as in (2)a[8] and ħenna 'grandmother' would have the representation in (2)b.

(2) (a)



(b)



The melodic units (i.e. the bundles of distinctive features), which are represented by phonetic symbols in (2), are associated with a skeleton, which is a sequence of segment-sized timing units (X), and these timing units are associated with syllabic structure. A geminate is a single melodic unit associated with two adjacent timing units[9]: in ħenna, nn consists of a single occurrence of /n/, i.e. of the bundle of features which characterize a coronal nasal stop, linked to two timing units. The first of these is the coda of the initial syllable, and the second is the onset of the final syllable.

We assume that syllabic structure is not present at the most abstract level of representation[10]; it is introduced by a

[7] But we shall suggest otherwise in section 7.

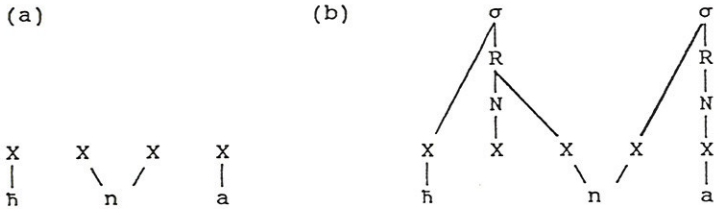
[8] We have changed Levin's labels for syllabic constituents, but this has no bearing on our discussion.

[9] On this conception of quantity, cf. Leben (1980), Prince (1984), Hayes (1986), Schein and Steriade (1986), and references therein.

[10] On the underlying difference between vowels and glides, cf. section 5.

syllabification procedure (henceforth SP) which groups timing units into syllables, inserting an extra timing unit in order to allow the syllabification of a consonant which would otherwise remain unsyllabified. In the case of ħenna, for instance, (3)a is the representation to which SP applies, and (3)b is the outcome.

(3) (a) (b)



The transcriptions ħnna and (ħØn)(na) are nothing but convenient shorthands for the objects displayed in (3)a and (3)b respectively. Whereas (3)a contains four timing units, (3)b contains five. Since a syllable must have a nucleus and since ASR disallows tautosyllabic consonant clusters, the first and second X in (3)a cannot be incorporated into a syllable unless there intervenes an X which can play the role of a nucleus. When it encounters such unsyllabifiable consonants, SP supplies an empty nucleus. An empty nucleus is a timing unit which is associated with a nucleus node in syllable structure, but which is not linked with any distinctive feature complex. Empty nuclei are later subject to the Default Shwa rule, a rule which associates to any empty nucleus the feature specifications characteristic of shwa.

SP operates iteratively; at each step it takes as its input the sequence of all the timing units that have not yet been syllabified and it builds a syllable over its right edge. Given the unsyllabified string /!i-nafð-n/ 'pancreas, p', for instance, SP operates in three steps starting from the end of the word: !inaf(ðØn), !i(naf)(ðØn) and !(i)(naf)(ðØn), hence finally !(i)(naf)(ðen) by the Default Shwa rule. During each step of the right-to-left scan, SP maximizes syllable size, that is, it groups together as many X slots present in the input as can be fitted into a syllable compatible with the maximal syllable of ASR, i.e. with (2)a.

When the input to the last step of the right-to-left scan contains a single unsyllabified consonant, SP syllabifies that consonant as the coda of a rime with an empty nucleus, cf., e.g., /xzn/ 'keep, imp 2s', which is syllabified as (Øx)(zØn). Empty nuclei not preceded by an onset are not realized phonetically. (Øx)(zØn) is pronounced xzen, not exzen.

Geminates cannot be broken up by epenthesis. When the right-to-left scan elects a geminate CC sequence for syllabification, we assume that the procedure moves on one segment to the left, ignoring the second half of the geminate. Consider for instance ðehhneʁ 'coat impf 1s', from /ðhhn-ʁ/. Starting from the end of the string, a first application of SP yields ðhh(nØʁ). The rightmost unsyllabified CC sequence is now hh. But since geminates cannot be broken up by epenthesis, the /h/ on the right is disregarded, and sequence /ðh/ is entertained as a candidate for syllablehood, hence finally (ðØh)h(nØʁ). Following a suggestion of J.-R. Vergnaud, Dell and Tangi (1992) propose that the timing unit represented by the second h in (ðØh)h(nØʁ) remains unsyllabified, and is licensed by the fact that the other half of the the geminate is properly associated with syllable structure.

In certain morphemes the last consonant, always a coronal obstruent, is extraprosodic, i.e. it must be excluded from the purview of the syllabification mechanisms. Such is for instance the case of /ns/ 'spend the night aor' and of /-θ/, the feminine suffix in nouns. /θ-ns/ 'spend the night aor 3fs' and /θ-i-ʁms-θ/ 'tooth' are pronounced θens and θiʁmest,[11] not θnes and θiʁemseθ as they would be if the final consonant was taken into account by syllabification. Extraprosodicity will be indicated by angled brackets: /n<s>/, /θ-i-ʁms-<θ>/.

3. THE ALTERNATIONS INVOLVING /r/.

For the purpose of presenting the data in this section, let us adopt the following provisional analysis as an expository

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[11] The feminine suffix /-θ/ is realized as t after a consonant.

convenience. There are two rules involving /r/ in ASR: one inserts a before /r/ and the other deletes /r/. Alternations illustrating the effects of the two rules are displayed in (4)II. (4) contains corresponding forms of two verbs with identical conjugational paradigms.

(4)

	I 'kill'		II 'see'		
a	/nʁi-n/	nʁi-n	/!zri-n/	!zri-n	pf 3mp
b	/nʁ-n/	nʁ-en	/!zr-n/	!za-n	aor 3mp
c	/nʁ#it/	nʁ#it	/!zr#it/	!zar#it	imper:2s+ do3fs
d	/nʁʁ-n/	neqq-en[12]	/!zrr-n/	!zarr-en	impf 3mp

a insertion occurs in (4)II-b,c,d and r deletion occurs in (4)II-b.

The regularities involving /r/ in ASR are somewhat obscured by the fact that in that dialect the same sound [r] is in some cases the realisation of /r/ and in others that of /l/. Before we can focus on /r/ we must discuss the phonological differences between /r/ and /l/.

3.1. /r/ vs. /l/.

In our phonetic transcriptions [r] represents a voiced alveolar flap, as in Spanish pero 'but', and [rr] represents a voiced alveolar trill, as in Spanish perro 'dog'. [r] is the surface reflex of two distinct phonemes, /r/ and /l/. Let us first summarize the facts about the phonetic realizations of /r/ and /l/. The justification for the /r/~/l/ distinction will become apparent below as the data unfolds.

Geminated /r/ is realized as [rr]. Simplex /r/ is realized as [r] before a vowel and is deleted elsewhere. Geminated /l/ is realized as [ǰǰ]. Simplex /l/ blends with /-θ/ (the feminine suffix

12 /ʁ/ regularly becomes qq when geminated to form an imperfective stem.

of nouns) to give [č] or [čč] and is realized as [r] elsewhere.[13] Although /l/ is realized as [r] in most contexts, the two phonemes nonetheless have distinct phonetic manifestations in most contexts. The distinction between /r/ and /l/ is neutralized only in prevocalic position, where both are realized as [r].

The table below displays the pronunciations of nouns in four contexts: (I) prepausally, (II) before the demonstrative clitic /a/ 'this', (III) before the plural feminine suffix /-in/ and (IV) before the feminine suffix /-<θ>/.[14] The four lines exemplify the behaviour of nouns (a) ending in /a/, (b) ending in any consonant but /r/ or /l/, (c) ending in /r/, and (d) ending in /l/.[15]

(5)

	I /ɴ##/	II /ɴ#a/	III /ɴ-in/	IV /ɴ-θ/
a /čamma/	čamma	čamma y a[16]		čamma-θ
b /funas/	afunas	afunas a	θifunas-in	θafunas-t
c /!kidar/	!akida	!akidar a	!θikidar-in	!θakida-θ
d /!ðaʁal/	!aðaʁar	!aðaʁar a	!θiðaʁar-in	!θaðaʁač

Line c illustrates the fact that simplex /r/ is pronounced [r] before a vowel and is deleted elsewhere. Line d illustrates the fact that

13 There are exceptional morphemes where /l/ is realized as [l], all of them loanwords, e.g. !llah 'Allah', plasa 'place', !a-liman 'Germany'. For others cf. Tangi (1991, 147).

14 The forms in IV-b,c,d are regular /θ-...-θ/ feminine singular forms; that in IV-a is the plural of čamma 'ball' (cf. čamma y a 'this ball'). /...-θ/ plurals are common in Arabic and Spanish loans.

15 The meanings of these nouns are (a) ball, (b) ox/cow, (c) horse, (d) blind person.

16 Yod is inserted between vowels in certain contexts, in particular between a nominal radical and a demonstrative clitic; anu y a 'this well', ifri y a 'this cave'.

simplex /l/ is pronounced [r][17] except before the suffix /-θ/, with which it blends into an affricate.

The data in the remainder of this section will be drawn mainly from verbal morphology. Each verb type will be represented only by a single example, but the data discussed below are representative of the most productive verb types.[18]

Let us first show the difference between geminated /r/ and geminated /l/. As a rule /CCX/ verbs have imperfective stems of the form /CC:X/ (C: a geminate C). Below we exemplify imperfective gemination in /CCa/ verbs and in /CCC/ verbs. For each verb type we give (a) a verb whose middle consonant is neither /l/ nor /r/, (b) a verb with /l/ as its middle consonant, and (c) a verb with /r/ as its middle consonant. The representation at the beginning of each line is the phonological representation of the perfective stem. In addition to the perfective and imperfective stem of each verb we give the negative stem, which allows us to observe the realization of the middle consonant before a vowel in /CCC/ verbs. The representation at the top of each column indicates how the stem in question is formed, e.g. putting '/CCi/' at the top of (6)II is our way of stating in a concise manner that verbs with a perfective stem of the form /CCa/ have a negative stem of the form /CCi/. For the sake of clarity the verbal forms given in the tables in this article often do not contain any person-number-gender marker. In such cases each form is in effect the phonetic representation of the stem in all the conjugated forms where the person-number-gender marker has no suffixal part. For instance fna in (6)I-a represents the set ye-fna (3ms), θe-fna (3fs), ne-fna (1p).

17 In some dialects /l/ gives rise to an r sound which is phonetically distinct from the realization of /r/, cf. Laoust (1927, 177), Elmedlaoui (1988). In ASR the r's originating from /r/ and /l/ are homophonous, as they were in the dialects described by Biarnay (cf. Biarnay 1917, 517).

18 More examples for each verb type may be found in section 6 of chap. III in Tangi (1991). This work also contains an appendix from which one can reconstruct most of the conjugation of close to 600 verbs.

(6)

		I	II	III	
		pf	neg	impf	
		/CCa/	/CCi/	/CC:a/	
a	/fna/	fna	fni	fenna	'adore'
b	/bla/	bra	bri	beǰǰa	'make trouble'
c	/ʃra/	ʃra	ʃri	ʃarra	'rent'

(7)

		I	II	III	
		pf	neg	impf	
		/CCC/	/CCiC/	/CC:C/	
a	/nqs/	nqes	nqis	neqqes	'decrease'
b	/xlf/	xref	xrif	xeǰǰef	'replace'
c	/frn/	fan	frin	farren	'sort'

In (6) and (7) the contrast between lines b and c illustrates the difference between radicals where [r] alternates with [ǰǰ] and those where it alternates with [rr]. This difference correlates with others to be presented below.

3.2. A-INS AND R-DROP.

An a occurs after the initial consonant in ʃarra (from /ʃrra/, cf. (6)III-c), in farren (from /frrn/, cf. (7)III-c), and in fan (from /frn/, cf. (7)I-c), and /r/ does not surface phonetically in the latter form. Let us posit the two rules below. These rules are only expository devices for the purpose of guiding the reader through the data until the end of this section. They will be discarded in the next section, where we take a rather different tack.

(8) A-INS insert a before any /r/ which does not immediately precede a full vowel.[19]

(9) R-DROP delete any nongeminated /r/ which does not immediately precede a full vowel.

Assuming that the distribution of /r/ in verbal radicals is similar to that of the other consonants, then by positing rules (8) and (9) we are able to account for the surface differences between the verbs whose radicals contain an occurrence of /r/ and those that do not contain /r/. We are also able to account for the peculiarities in the distribution of [r] in the phonetic representations. (8) accounts for the appearance of a in ʃarra and farren if one posits /ʃrra/ and /frrn/. (8) predicts that the sequence [Zrr] (Z any string but a) should not occur in the phonetic representations of words in ASR. This prediction is correct except for one counter-example.[20] It excludes in particular [err] sequences, hence it excludes imperfectives of the form [Cerra] and [CerreC] (cf. (6), (7)). More will be said below on the exclusion of word-initial [rr]. (8) also correctly excludes from phonetic representations those [Cre] sequences whose [r] has [rr] as its geminate reflex, hence it accounts for the fact that the same verb cannot have [CreC] as a perfective stem and [CarreC] as an imperfective stem.

Rules A-INS (8) and R-DROP (9), if they apply in this order, enable one to derive [fan] from /frn/ in (7)I-c: /frn/ → /farn/ → fan.[21] There exists independent evidence that a is an inserted vowel in (7)c and that the phonological representation of (7)I-c is not /farn/. There exist /CaCC/ verbs, and their imperfective stems are /tt-CaCaC/, whereas the conjugation of fan is analogous to that of the /CCC/ verbs, which is exemplified in (7) and (11). The following exemplifies imperfective stem formation in the /CaCC/ verbs. It is just a particular case of a general pattern which is described below, in the text above (18).

(10)	I pf /CaCC/	II impf /tt-CaCaC/	
a /samħ/	sameħ	tt-samaħ	'forgive'
b /ħawl/	ħawer	tt-ħawar	'watch over'
c /zawr/	zawa	dd-zawa	'insult'

Rules (8) and (9) account for the fact that verbs whose radicals end in /r/ always end in [a] before a pause. Here is an example of a /CCr/ verb, together with a /CCC/ verb and a /CCl/ verb for comparison.

19 Cf. Biarnay (1917, 512).

20 This counter-example is the verb /ruys^s/ 'shudder' (on ^ cf. below). This verb belongs to a class of verbs which have an initial geminate at the beginning of their perfective, negative and aorist stems, cf., e.g., the verb meaning 'to move', imperfective tt-gaʒa, perfective ggu ʒ. In those forms of /ruys^s/ where the stem has an initial geminate, no a occurs: rruyess-eʁ 'I shuddered', ye-rruyses 'he shuddered'. /s^s/ indicates a tautomorphemic sequence of two /s/ segments, in violation of the Obligatory Contour Principle. On such violations, cf. our other works on ASR.

21 In certain Rifian dialects of Berber the deletion of /r/ is accompanied by compensatory lengthening of the preceding vowel (e.g. Biarnay (1917, 513ss), Chtatou (1982, 47)). This is not the case in ASR, where those occurrences of a which precede the site of an underlying /r/ are no different from the others. Consider for instance the perfective stems !wɔ̈a 'fall' (from /!wɔa/) and !nda 'throw' (from /!ndr/). One does not hear any difference between the a in !ye-wɔ̈a 'fall 3ms' and that in !ye-nda 'throw 3ms' or between that in !wɔ̈a-θ 'fall imper 2p' and that in !nda-θ 'throw imper 2p'.

(11)		I	II	III	
		pf	neg	impf	
		/CCC/	/CCiC/	/CC:C/	
a	/xzn/	xzen	xzin	xezzen	'hide'
b	/!nðl/	!nðer	!nðir	!netter	'bury'[22]
c	/fsr/	fsa	fsea	fessa	'hang up washing'

The final /r/ of the forms in (11)c behaves like that at the end of nominal radicals (cf. (5)c): it obligatorily deletes before a pause or a consonant, it optionally deletes before a vowel occurring at the beginning of a phonological group, and it is obligatorily realized as [r] before a vowel-initial clitic: 0e-fsar#i0 'she hung it (m) up' (from /0-fsr#i0/ 3fs-hang do3ms), wa#ne-fsea(r)##!arruð 'we did not hang up the clothes' (from /war#n-fsir##!rruð/ neg 1p-hang:neg clothes), n-fessar#asen 'we are hanging up for them (m)' (from /n-fssr#asn/ 1p-hang:impf dat3mp).

Morphemes which end in [a] before a pause are of two types. Some end in /a/ at the phonological level whereas others end in /r/. Lines a and c in (5) illustrate this contrast in the case of nouns; fna (from /fna/, cf. (6)) and fsa (from /fsr/, cf. (11)c) illustrate it for verbs. Let us look more closely at the verbs.

Besides the fact that forms ending in /r/ may end in [r] at the phonetic level whereas those ending in /a/ may not, in verbs the contrast between radical-final /a/ and /r/ has another phonetic correlate: /a/, but not /r/, is subject to a morphologically-governed vowel alternation, as we shall now illustrate. Verbal radicals which end in [a] before a pause fall into two classes. In those of the first class, [a] alternates with [i], whereas it alternates with [ar] in those of the second class. Here is a verbal radical which belongs to the first class.

22 !ðð as a rule becomes [!tt] in imperfective gemination. The final r also appears in the noun !anðer 'grave', whose feminine (diminutive) form is [!0anðečč], with a final affricate, which confirms that in this morpheme r is the reflex of /l/ and not of /r/.

(12)		I	II	III	
		3ms	1s	3ms # do3fs	
a	/bða/	ye-bða	bði-ʁ	ye-bða t	'begin, pf'
b	/bðða/	i-bedda	beddi-ʁ	i-bedda t	'begin, impf'

(12) illustrates the fact that in verbs of the first class the radical ends in [i] when it immediately precedes the 1s and 2s person-number-gender markers; otherwise it ends in [a].[23] Below is a radical of the second class. The forms in (13) are the analogues of those in (12).

(13)	I	II	III[24]	
a /!ndr/	!ye-nda	!nda-ʁ	!ye-ndar it	'throw, pf'
b /!nttr/	!i-netta	!netta-ʁ	!i-nettar it	'throw, impf'

(13) illustrates the fact that in the verbs of the second class the last vowel of the radical is always a, never i.

[r] is the only consonant which alternates with zero at the end of verbal radicals in ASR.[25] Furthermore the alternations between [r] and zero always occur immediately after [a], as one should expect if, as predicted by (8) and (9), every /r/ which meets the conditions for deletion triggers a-insertion before disappearing.

23 Their radical also ends in [i] throughout the conjugation of the negative stems, e.g. (6)II.

24 Second and third person direct object clitics begin with i when they immediately follow a consonant-final verbal radical, cf. (27)II.

25 /y/ and /w/ are the only other segments which alternate with zero at the end of lexical morphemes; such alternations occur sporadically in nouns, cf., e.g., the following masculine/feminine pairs: [aʁenʒa] / [0aʁenʒaʃt] (from /0-aʁnʒay-0/) 'spoon', [!muʃʃ] / [!0muʃʃeʕt] 'cat' (from /!0-muʃʃw-0/). /y/ and /w/ are regularly realized as ʃ and ʕ before the feminine suffix, e.g. [0-uðaʃ-t] 'Jewish woman', from /0-uðay-0/, [!0-aʁʁraʕ-t] 'handle dim', from /0-!aʁʁraw-0/.

In the remainder of this section we will complete our survey of the behaviour of /r/ in various positions in verbal radicals. This survey is intended to provide the reader with the full range of evidence that the two following conclusions are unescapable: (i) [r] represents two distinct underlying segments, and (ii) while certain occurrences of [a] derive from /a/, others have been inserted before /r/. We will present along the way various facts which will become relevant when we attempt to replace A-INS and R-DROP.

Let us first finish looking at /r/ in final position. The verb fsa (from /fsr/ in (11)c) already exemplified those cases where /r/ is the last segment in a /CCC/ radical. In particular, fsea (from /fsir/, cf.(11)II-c) illustrates the fact that when /r/ is preceded by /i/, the epenthetic a combines with i to form the diphthong ea. zawa (from /zawr/, cf. (10)c) illustrates the case where /r/ occurs at the end of a /CaCC/ radical. The tables below illustrate the behaviour of /r/ at the end of radicals of the form /C:C/, /CC:C/ and /uCC/.

(14)

		I pf /C:C/	II neg /C:iC/	III impf /tt-C:C/	
a	/ddn/	dden	ddin	tte-dden	'call to prayer'
b	/!zzl/	!zzer	!zzir	!tte-zzer	'lie down'
c	/ddr/	dda	ddea	tte-dda	'live'

(15)

		I pf /CC:C/	II neg /CC:C/	III impf /tt-CC:aC/	
a	/qllb/	qeǰǰeb	qeǰǰeb	tt-qeǰǰab	'try'
b	/kmml/	kemmer	kemmer	tt-kemmar	'finish'
c	/zemmr/	zemma	zemma	dd-zemma	'be able'

(16)

		I pf /uCC/	II neg /uCiC/	III impf /tt-aCC/	
a	/uym/	uyem	uyim	tt-ayem	'draw (water)'
b	/uɦl/	uɦer	uɦir	tt-aɦer	'be tired'
c	/uðr/	uða	uðea	tt-aða	'lean'

/CCC/ verbs with a middle /r/ have already been exemplified in (7)c. In addition to the negative and imperfective stems, the underlying /r/ of the /CrC/ radicals also shows up at the phonetic level in the reciprocal stems and the deverbal nouns formed on template CCaC. For instance ʃaf 'bind', which derives from /ʃrf/, as shown by the fact that its negative and imperfective stems are ʃrif and ʃarref, has a reciprocal stem m-se-ʃraf 'bind one another', and a corresponding noun a-ʃraf 'binding'.[26]

We present below the case of /CCC/ verbs whose initial consonant is /r/. Column IV contains related nouns.[27]

(17)

		I pf /rCX/	II neg /rCi(X)/	III impf /rC:X/	IV nom /l-rCX/
a	/!rʒf/	!aʒef	!aʒif	!aʒʒef	!arrʒef
b	/!rʕb/	!aʕeb	!aʕib	!aʕʕeb	!arrʕeb
c	/!rða/	!aða	!aði	!atta	!arrða

[26] Compare these forms with fqeð 'take care of', m-se-fqað 'take care of one another', a-fqað 'care'.

[27] These verbs have the following meanings: (a,b) make noise; (c) gratefully accept. The names in IV have the following meanings: (a,b) uproar; (c) blessing.

As exemplified in columns I to III, /r/ is manifested as [a] throughout the conjugation of /rCX/ verbs. /r/ must be followed by a full vowel if it is to escape deletion by R-DROP (9), but the conjugation of /CCX/ verbs does not as a rule require a vowel to appear immediately after the initial /C/. However the initial /r/ shows up in the nouns of column IV. Here is how these nouns are to be accounted for.

The lexicon of ASR is replete with Arabic loans. Like most nouns borrowed from Arabic, the nouns in IV begin with an /l/ which is the reflex of the definite article in Arabic. As is the case in Arabic, the initial /l/ completely assimilates to the following consonant if it is a coronal. As a result of this assimilation, Arabic loans beginning with CC are of two types: either they begin with a geminate coronal (e.g. zzbib 'raisin') or they begin with rC, where C is not a coronal (e.g. rkas 'glass'; r < /l/). We have not found any noun beginning with an rC sequence where C is a coronal. This gap is accounted for if we assume that the assimilation rule also belongs to the grammar of ASR.[28] In (17)IV-a, for instance, underlying initial /l-r/ becomes [arr] through the following steps. In /l-!rʒf/ the initial /l/ first assimilates to the following coronal, hence /!rrʒf/. A-INS (8) then yields /!arrʒf/, where the geminate /r/ is immune to R-DROP (9).

The bound state forms of the nouns in (17)IV are identical with their free state forms, contrary to the regular pattern for nouns with an initial a, and our analysis accounts for this fact. As a rule, nouns with an initial a undergo two independent processes to form their bound state form: they lose their initial a and they take a w prefix , cf., e.g., !azru 'stone', whose bound state form is !wezru. Our analysis explains why the nouns in (17)IV fail to undergo either process. Bound state formation in ASR is discussed in detail in Tangi (1991)[29]. As explained there, (i) nouns lose their leftmost vowel in the bound state only if that vowel is a prefix, and

[28] For a detailed discussion of a similar situation in Imdlawn Tashlhiyt Berber, cf. Dell and Elmedlaoui (1992). On the fate of Arabic /l-/ in various Rifian dialects, cf. Biarnay (1917, 487ss., 519).

[29] The morphology of state in ASR is basically the same as in other Berber dialects, cf., e.g., Basset (1945).

(ii) the bound state prefix /w/ undergoes a special deletion rule when it precedes a consonant. But now note the following: (i) a at the beginning of the nouns in (17)IV is not a prefix but an epenthetic vowel; (ii) in the bound state form corresponding to (17)IV-a, for instance, which is /w-l-!rʒf/, before A-INS inserts the initial a, the bound state prefix meets the conditions of the special deletion rule since it precedes a consonant.

In the examples of (17) the geminated [rr] does not alternate with its nongeminated counterpart. There exist morphemes where it does, however. /rif/ is such a morpheme. Geminated r occurs in the noun arrif (/l-rif/) 'Rif', whose bound state form and free state form are identical. Simplex r occurs in a-rif-i 'Rifian'.[30]

Whereas /l-rZ/ nouns are realized as [arrZ], /l-lZ/ nouns are realized as [ǰǰZ]. This can be seen in [ǰǰewz] 'almond (nut)' (from /l-lwzy/) and in [ǰǰeft] 'turnip (collective)' (from /l-lfty/). The root-initial /l/ is realized as a nongeminated [r] in [θarewzeʃt] 'almond tree' (from /θ-a-lwzy-θ/)[31] and in [θarefteʃt] 'turnip (individuative)' (from /θ-a-lfty-θ).[32]

In verbs of the form /YVZCC/, where Y and Z represent arbitrary sequences (possibly null), the imperfective stem has the form /tt-YVZCVC/ where the second V is a copy of the first. This regularity is illustrated in table (10) and in the two first examples in the table below. The other examples in table (10) are a selection of those /YVZCC/ verbs where Z contains an occurrence of /r/.[33]

[30] E.g. !titwan 'Tetuan (a city)', !a-titwan-i 'Tetuanese'.

[31] Cf. zzitun 'olive (fruit)' (from /l-zitun/), θ-a-zitun-t 'olive tree'.

[32] The radicals /lwzy/ and /lfty/ are among those which lose their final glide before a word-boundary (cf. note 25).

[33] In the perfective in lines e,f and g the initial consonant undergoes the gemination mentioned in note ?. Form d-II shows the effects of another morphologically governed gemination.

(18)		I	II	
		pf	impf	
a	/nudm/	nudem	tt-nudum	'doze'
b	/!qʒiɜʒw/	!qʒiɜʒu	!tte-qʒiɜʒiw	'be numb'
c	/zugrθ/	zugaθ	dd-zugruθ	'grow'
d	/!surf/	!soaf	!ssuruf	'stride'
e	/!murð s/	!mmoað es	!tt-murðus	'choke'
f	/!furrʒ/	!ffoarreʒ	!tt-furruʒ	'watch'
g	/durry/	ddoarri	ddurruy[34]	'hide'

Forms d to g in column I illustrate the fact that the sequence /ur/ is realized as oa when it does not precede a full vowel.[35] The same realization is found in word-final position, as in the verbs !zoa 'visit' (from /!zur/) and uyoa 'walk' (from /uyur/) and in the nouns aðehʃoa 'deaf' (from /a-ðhʃur/) and aʕroa 'back' (from /a-ʕrur/).

All words which end in ea or oa before a pause end in ear or oar before a vowel.[36] We account for this fact by assuming that all occurrences of the diphthongs ea and oa are reflexes of /ir/ and /ur/. Note furthermore that there does not exist any word ending in [ir] or [ur] whose final [r] must be derived from /r/.[37] The latter fact indicates that rules A-INS and R-DROP are exceptionless, at least morpheme-finally. Rules (8) and (9) might lead one to expect that (18)II-e,f,g /tt-!murðus/, /tt-!furruʒ/ and /tt-durruy/ should

34 From /tt-durruy/ by regular phonological processes, on which cf. our other works on ASR.

35 Cf. also loanwords such as fraŋkfoat "Frankfurt", !a-mutoa "motor". On the phonetic properties of ea et oa, cf. Tangi (1991, 196-201).

36 The occurrence of r is mandatory if the following vowel belongs to the same phonological group, and optional otherwise.

37 The diminutives of ʁir "arm" and ur "heart", for instance, are θʁič and θuč (cf. (5)IV-d), and there are no [Zir] or [Zur] nouns whose final [r] does not combine with /-θ/ to give [č].

be pronounced !tt-moaðus, !tt-foarruʒ and ddoarruy. The failure of A-INS to operate in these forms could perhaps be seen as a consequence of the No-Crossing Constraint (Goldsmith 1976). Assume that in /YV$_1$ZCV$_1$C/ imperfective stems, the vowel on the left and its copy are a single melodic unit /V$_1$/ linked with two syllable nuclei. If an a were inserted after the first /V$_1$/, association lines would cross on the vowel tier. We have no explanation for the failure of R-DROP to operate in !tt-murðus.

There is good evidence that oa and ea are diphthongs and not CV sequences like wa and ya. Like Vu and Vi, and all VV sequences in general, Voa and Vea sequences are not attested word-internally. Furthermore, oa and ea behave like V-initial sequences with respect to the insertion of shwa, e.g. whereas /θ-!zwa/ 'cross 3fs' is pronounced !θe-zwa, /θ-!zur/ 'visit 3fs' is pronounced !θ-zoa, not !θe-zoa. Finally, oa[38] counts as a V-initial sequence from the point of view of the process which allows word-final /r/ to surface as [r] before a vowel (cf. section 6 on liaison r). Whereas the final consonant of the negation /wr/ cannot surface as r in wa#warrʃ-eʁ 'neg lean 1s', from /wr#wrrʃ-ʁ/, it must in war#oazu-ʁ 'neg find 1s', from /wr#urzu-ʁ/.

The table below recapitulates the various cases we have encountered. Its columns display (A) an underlying sequence, (B) the realization of /(V)r(r)/ in that sequence, (C) the phonetic representation of an example illustrating the case in question, (D) the corresponding phonological representation, and (E) the number of that example, or its meaning. # stands for a word boundary.

38 We have not found any word beginning with ea.

(19)

	A	B	C	D	E
a	Cr#	a	fsa	/fsr/	(11)I-a
b	CrC	a	fan	/frn/	(7)I-c
c	#rC	a	!aɜef	/!rɜf/	(17)I-a
d	CrrC	arr	farren	/frrn/	(7)III-c
e	#rrC	arr	!arrɜef	/!rrɜf/[39]	(17)IV-a
f	#rr#	arr	arr	/rr/[40]	'give back'
g	ur#	oa	!zoa	/!zur/	'visit'
h	urC	oa	!soaf	/!surf/	(18)I-d
i	urr	oarr	!ffoarreɜ	/!ffurrɜ/	(18)I-f
j	ir#	ea	fsea	/fsir/	(11)II-c

4. [a] AS A VOCALIZED /r/?

As was stated when they were first introduced, rules A-INS (8) and R-DROP (9) were only meant as a frame of reference to help readers steer their course through the data. We shall now sketch an analysis which avoids some of the arbitrariness inherent in these rules. This analysis will revolve around the idea that the alternation between r and a in ASR is an analogue of the y/i and w/u alternations found in many languages. It is the suggestions of an anonymous referee for Natural Language and Linguistic Theory which gave us the initial impulse to look in that direction.

A-INS and R-DROP were given as operating only in strings where /r/ does not immediately precede a full vowel. Clearly, whatever mechanisms are responsible for the alternations involving /r/ and

39 From a more abstract /l-!rɜf/, as explained earlier on.

40 Aorist stem. Compare with pf arra, neg arri, impf tt-arra. The conjugation of this verb is parallel to that of other /C:a/ verbs with a vowel-less stem in the aorist, e.g. the verb meaning "let", aor [ɜɜ], pf [ɜɜa], neg [ɜɜi], impf [tte-ɜɜa].

[a], these mechanisms must make direct reference to syllabic structure. One may ask two questions about A-INS and R-DROP.

The first question concerns the relationship between the inserted segment and the insertion site in rule A-INS. Is there any reason why the segment which triggers the appearance of a should be /r/ rather than, say, /b/ or /s/?

The second question concerns the relationship between A-INS and R-DROP. Why is it that the segment occurrences subject to deletion are a subset of those which trigger a-insertion, i.e., given that the language has a rule inserting a next to certain occurrences of /r/, why should deletion affect some of these occurrences rather than some occurrences of /z/ or /w/?

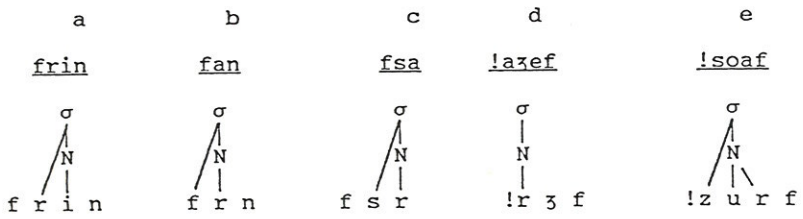
As an answer to the first question, we propose that in addition to its primary articulation, which is coronal, /r/ has a secondary articulation, which is pharyngeal. The appearance of [a] next to /r/ is an assimilatory process whereby r's pharyngeal component is spread to a neighboring segment. This process is analogous the rounding of a vowel adjacent to a labiovelar. We owe this idea to Lass (1983). Instances where a vowel lowers and/or becomes back next to an apical r are not rare in the languages of the world, cf. Howell (1987, 326) for references.

Our answer to the first question paves the way for answering the second. If /r/ contains a pharyngeal component which is able to give rise to the vowel a, we no longer need to assume that the derivation of fan from /frn/ is a two-step affair (insert a before /r/ and subsequently delete /r/). We can instead view [a] and [r] as two realizations of /r/: [a] is what remains when /r/ is stripped of its coronal constriction.

Let us furthermore assume that whether /r/ is realized as r or as a in ASR depends on its location in the syllable. /r/ is realized as r when it is an onset, i.e. when it immediately precedes an underlying vowel; in all other environments it is associated with a nucleus, and as a consequence it surfaces as a. The displays below illustrate how /r/ is to be syllabified in various environments, and how its location in the syllable determines its realization as r or

as a. Timing units are omitted and only those aspects of syllabification which are directly relevant are represented.[41]

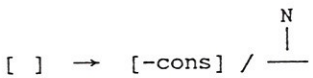
(20)



Let us spell out the various mechanisms needed in this account.

First, we assume that /r/ is unlike the other phonemes of ASR, in that it can be syllabified either as a nucleus or as a nonnucleus. Adopting the feature geometry expounded in Clements(1993), let us assume that in ASR /r/ has a Vocalic node which dominates the feature specifications of a, and that the rule responsible for the realization of nuclear /r/ as a rewrites as [-cons] any segment belonging to a nucleus.

(21) NUC-VOC



As a consequence of becoming [-cons], /r/ sets afloat the [coronal] specification dominated by its Cplace node, in effect becoming a.

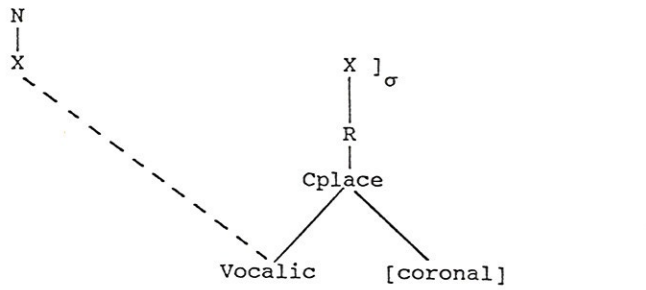
Recall that the syllabification procedure of ASR builds syllables from right to left, supplying empty nuclei when necessary. As stated in section 2.3, at each step of the right-to-left scan the procedure maximizes syllable size, i.e. it groups together as many X slots in the input as can be fitted into a syllable compatible with template (2)a. Syllable maximization guarantees that in (20)b, for instance, the rightmost syllable will be (frn) and not (røn). In order to make sure that /r/ will be syllabified as a nucleus (not as a coda) in /fsr/ and /!rɜf/ (cf.(20)c,d) we furthermore assume that

[41] For forms (20)a to (20)e, cf. respectively (7)II-c, (7)I-c, (11)I-c, (17)I-a and (19)h.

the syllabification procedure must introduce as few empty nodes as possible.

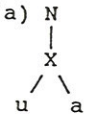
Rule NUC-VOC, which has the effect of changing /r/ into a, does not suffice to account for the data presented in the preceding section. 'a-insertion' and 'r-deletion' do not always go hand in hand. There are forms where a is inserted but r is not deleted. This happens whenever r is a geminate (e.g. !ffoarreɜ, from /!ffurrɜ/, in (18)I-f), and when a word-final /r/ surfaces as r before a vowel, e.g. !ye-ndar#it, from /y-!ndr#it/ in (13)III-a). In the case of geminate /r/ we consider 'a-insertion' to be the result of spreading the Vocalic node of a syllable-final /r/ onto the preceding nucleus:

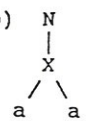
(22) A-SPREAD



Consider for instance farren, from /frrn/ (cf. (19)d) and assume that it is syllabified as (fØr)(rØn)[42] in the same way that in negges (cf. (7)III-a) /nqqs/ is syllabified as (nØq)(qØs). The first nucleus in (før)(røn) becomes a through assimilation to the following /r/, hence finally farren. Consider next !ffoarreɜ, from /!ffurrɜ/ ((18)I-f), which is !(øf)(fur)(røɜ) after syllabification. In this case the timing unit preceding r already has an associated melodic unit and rule A-SPREAD creates a sequence ua where u and a are associated with the same timing unit, as represented in (23)a.

[42] And not (fr)(rØn), which would yield *faren. In ASR geminate /r/ is never degeminated nor deleted; all occurrences of /rr/ surface as [rr]. We are leaving unanswered the question of how to prevent /frrn/ from being syllabified as (fr)(rØn).

(23) (a) 

(b) 

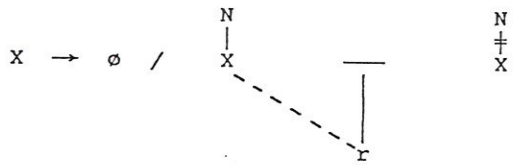
(c) 

u and a's sharing the same timing unit accounts for the tautosyllabicity of the two vowels in ɔa, which is the surface reflex of the structure displayed in (23)a. The operation of A-SPREAD on a tautosyllabic /ar/ sequence yields the structure displayed in (23)b, which we assume to be equivalent to (23)c on universal grounds. Recall that in ASR /ar/, /r/ and /a/ are homophonous when not preceding a vowel. This homophony is exemplified in (10)c.

A-SPREAD must be complemented by a lowering rule which applies in configurations such as (23)a, changing ua into ɔa and ia into ɛa.

We have yet to account for forms such as !soaf (from /!surf/, cf (19)h). In the same way as /haðf/ 'be delirious' is syllabified as (ha)(ðØf) (whence haðef), under our analysis in its present form the predicted syllabification for /!surf/ is !(su)(rØf), hence *!suref. Preconsonantal simplex /r/ never surfaces as an onset in ASR. All the problematic cases involve a /VrC/ sequence. Let us posit a diphthongization rule which operates on /VrC/ sequences, deleting /r/'s timing slot and associating /r/ with the preceding slot:

(24) DIPHT



In (24) the crossed out link between X and N indicates that the segment after /r/ must not be /a/, /i/ or /u/. As explained in the next section we are assuming that /a/, /i/ and /u/ are already associated with an N node in the lexical representations.

DIPHT must apply prior to syllabification. After DIPHT has deleted its timing slot /r/ can no longer be syllabified as an onset and the syllabification procedure will group the remaining three

slots in /!surf/ into a single syllable where the nucleus is a skeleton slot associated with /u/ and /r/. Being in a nucleus, /r/ will be changed into a by NUC-VOC (21), hence finally !soaf by the lowering rule.

Rules A-SPREAD (22) and DIPHT (24) are very similar, but they cannot be blended into a single rule, for A-SPREAD must follow syllabification while DIPHT must precede it. It is essential that DIPHT precede syllabification because the purpose of DIPHT is to make sure that at the point at which forms such as /!surf/ are subjected to syllabification, /r/ is no longer a possible candidate for onsethood. As for A-SPREAD, it must follow syllabification for it is fed by it: in /frrn/ (farren) it is syllabification which creates the empty nucleus to which /r/'s Vocalic node spreads. Not only do the two rules single out the same segment, namely /r/, but they perform similar operations and they operate in similar contexts. The conditions of A-SPREAD (22) require /r/ to be syllable-final. This is necessary to prevent spreading in forms where /r/ precedes a full vowel, e.g. in /θ-!uriw/ 'give birth neg 3fs', which is pronounced !θuriw, not *!θoariw. DIPHT too must be prevented from operating in forms such as /θ-!uriw/, and the conditions of DIPHT in (24) are in effect an attempt at mimicking those of A-SPREAD, using only the information already available in the representations at a time when syllabic structure has not yet been established.

The duplication between A-SPREAD (22) and DIPHT (24) is a telltale sign of serious flaws in our analysis and/or the theoretical framework in which that analysis is embedded. However we shall retain that analysis for the remainder of this article, for lack of a better alternative. We leave the search for a more satisfactory account as a challenge for future research.

We said earlier that the r/a alternations are reminiscent of the alternations between glides and high vowels found in many languages. ASR possesses such alternations, but as we shall see the mechanisms governing them are different from those accounting for the behaviour of /r/. Let us pause to present the basic facts about the phonology of the high vocoids in ASR.

5. /y/ AND /w/, AN OVERVIEW OF THEIR PHONOLOGY.

In this section we present a summary of the phonology of /y/ and /w/ in ASR. The reader is referred to our other works on ASR for more details.

In ASR the glides /y/ and /w/ contrast with the high vowels /i/ and /u/ in lexical representations. Like other consonants, glides allow a contrast between simplex and geminate. The contrast betwen glides and high vowels is illustrated in the table below.[43] The verb in line a is given for the sake of comparison. The forms in lines b to c' illustrate the contrast between glides and high vowels at the beginning of a radical, and those in lines d to e' illustrate that contrast in the environment /C__C/ where both consonants belong to the same morpheme.

(25)

		I imper 2s /√/	II pf 3fs /θ-√/	III pf 2mp /θ-√-m/	
a	/xzn/	xzen	θe-xzen	θ-xezn-em	'keep'
b	/wzn/	wzen	θe-wzen	θ-wezn-em	'weigh'
b'	/uðf/	uðef	θ-uðef	θ-uðf-em	'enter'
c	/yma/	yma	θe-yma	θe-yma-m	'grow'
c'	/ira/[44]	ira	θ-ira	θ-ira-m	'play'
d	/zwʁ/	zweʁ	θe-zweʁ	θ-zewʁ-em	'redden'
d'	/mun/	mun	θ-mun	θ-mun-em	'accompany'
e	/bys/	byes	θe-byes	θ-beçs-em[45]	'gird on'
e'	/ʕiʃ/	ʕiʃ	θ-ʕiʃ	θ-ʕiʃ-em	'live'

SP, the syllabification procedure outlined in section 2.3, accounts for the data presented above. If SP treats /y/ and /w/ as consonants, their distribution should be no different from that predicted for any other consonant. For instance, the data above illustrate the predicted phonetic contrast between CVC sequences and sequences of the form CeGC and CGeC (G a glide), and the fact that the distribution of the latter is as predicted by the right-to-left operation of SP.

We assume that /w/ and /u/ have the same set of feature specifications, and similarly for /y/ and /i/. For instance, let U stand for the feature bundle [-cons, +high, labial...] characteristic of [u] and [w]. U is realized as [u] when it is associated with a nucleus, and otherwise it is realized as [w].

If the difference between the glides and the high vowels does not involve their distinctive feature content and is only a

43 In order to make the alternations between shwa and zero as conspicuous as possible our transcriptions gloss over the contextual variations in the vowel quality of shwa when it is adjacent to a glide. When a glide precedes shwa, shwa is pronounced as a high lax vowel close to that in Eng. fit and foot. When the glide follows shwa, the contrast between shwa and the high vowels is neutralized; ey and ew are pronounced [iy] and [uw].

44 From a more abstract /ilr/.

45 In certain contexts /w/ and /y/ are realized as x̟ and ç before a voiceless coronal obstruent.

reflection of their different position in the syllable, how is that difference to be represented in strings which have not yet undergone syllabification? Adopting a proposal in Guerssel (1986), we assume that the difference between the vowels and the glides is that the former, but not the latter, are already associated with a nucleus node[46] in the lexical representations. Here are for instance the representations of the forms mun (from /mun/, cf. (25)I-d') and zwʁ (from /zwʁ/, cf. (25)I-d) before they are submitted to SP:

(26)

SP must operate in such a way as not to delete N nodes (underlying vowels never surface as glides), and except for /r/, it may not build an N node over a timing unit of the input representation which does not have an associated N: except for /r/, underlying consonants (i.e. segments with no associated N in the phonological representations) never become nuclei -- or rather, when they do, it is through the operation of a rule which applies after SP, as we shall now see.

Let us look at morpheme-final glides, the only ones whose syllabification in some cases differs from that of the other consonants. Here are forms illustrating the realizations of glides and high vowels at the end of a radical. The forms in the table below are (I) imper 2p, (II) imper 2s + do3ms, (III) imper 2s + dat3s, (IV) pf 3fs. For the sake of comparison, we give in lines a and a' verbs ending in a consonant and a vowel respectively. Since there are no verbal suffixes beginning with a vowel, the four columns in (27) exhaust the range of contexts relevant for the realisation of a radical-final segment.

[46] In Guerssel's proposal the preassociated node is a rime node.

(27)

	I /√-θ/	II /√#θ/	III /√#as/	IV /θ-√##/	
a /ðhn/	ðehn-eθ	ðehn iθ	ðehn as	θe-ðhen	'rub'
a' /bða/	bða-θ	bða θ	bða y as	θe-bða	'begin'
b /!qðw/	!qeðw-eθ	!qeðw iθ	!qeðw as	!θe-qðu	'snap'
b' /ʕðu/	ʕðu-θ	ʕðu θ	ʕðu y as	θe-ʕðu	'overtake'
c /fsy/	fesy-eθ	fesy iθ	fesy as	θe-fsi	'untie'
c' /ysi/	çsi-θ	çsi θ	çsi y as	θe-çsi	'take'

Taking each column in turn, we see exemplifications of the following regularities concerning the behaviour of radical-final glides: (I) like other consonants at the end of a verbal radical, glides are syllabified together with the initial consonant of a suffix;[47] (II) when immediately following a consonant-final radical, second and third person direct object clitics begin with a protective /i/, and the forms in II-b,c exemplify the occurrence of this protective /i/ after radicals ending in a glide; (III) an epenthetic yod occurs between a vowel-initial clitic and a radical ending in a vowel,[48] but not in a glide; (IV) the contrast between glides and high vowels is neutralized at the end of a phonological phrase: in that context a glide is realized as the corresponding high vowel if the preceding segment is a consonant.[49] Yet another case where the contrast between glides and high vowels is neutralized is that of the 3ms PNG prefix /y-/ and of the bound state prefix /w-/. In the table below, the forms in column I summarize the realizations of the prefix /y-/,

[47] The phonological make-up of suffixes is such that there does not exist any suffix whose initial consonant is an onset.

[48] Yod is also inserted between a noun and a demonstrative clitic, cf. note 16.

[49] That consonant may be a glide, e.g. awy-eθ (/awy-θ/) "take away, imper 2p", awi /awy/ "id. imper 2s".

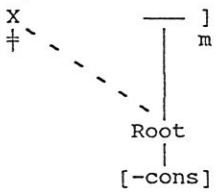
and those in column II do the same thing for word-initial occurrences of /y/ which are not morpheme-final.[50]

(28)

	I		II	
a #——V	y-iʁra	'be precious'	!yaziδ	'rooster'
b #——CC	ye-xzen	'keep'	yemma	'mother'
c #——CV	i-mun	'accompany'	yma	'grow'

The prefixal glide in /y-mun/ (cf. I-c) is realized as i, whereas SP would lead one to expect y, as in /yma/. In contexts other than those exemplified by (27)IV-b,c and (28)I-c, the phonological glides always have realizations which are in accord with the syllabifications predicted by SP; in particular they never show up as vowels. Let us posit the following rule, which reshuffles some of the glide-final rimes constructed by SP.

(29) FLIP: X → Ø / X ——]



When a morpheme-final glide is preceded by an empty nucleus, the FLIP rule deletes its associated X slot and reassociates its features to the preceding slot.[51] The crossed out association line beneath X indicates that X has no associated feature specifications. Consider

[50] The contrast between the bound state prefix /w-/ and the other word-initial occurrences of /w/ is exactly parallel to that in (28), cf. Dell and Tangi (1992). Prefixal glides cannot be preceded by other prefixes.

[51] We are assuming that /y/ and /w/ are the only consonants which are [-cons], i.e. we are taking h to be [+cons]. Dell and Tangi (1992) give reasons why FLIP cannot be collapsed with the rule which assimilates shwa to a following glide (cf. note 43).

/y-sw/ 'drink aor 3ms'.[52] SP yields (Øy)(sØw), whence the correct form isu by FLIP.

One feature of this account which is of special importance is that the behaviour of the morpheme-final glides is accounted for by a rule which applies to representations which have already undergone syllabification. This seems unexceptionable: it is true of all glides which are realized as vowels, and only those, that they meet two conditions: (i) they are morpheme-final, and (ii) they occur either in the environment C——## or the environment ——CV. What unifies the two environments is that SP syllabifies a consonant as a coda in both. Note furthermore that in the latter environment V may be a shwa, as in /y-xzn-n/ 'keep, part', which is pronounced i-xezn-en.[53] We have seen that shwas are by-products of the operation of SP.

Let us summarize the differences between the high vocoids and /r/ which are already apparent at this point.

1. There is an underlying distinction between syllabic high vocoids and nonsyllabic ones, whereas there is no such distinction for /r/.[54]

[52] E.g. sw-en "drink aor 3mp", from /sw-n/, and sw#iθ "drink imper 2s + do3ms", from /sw#iθ/ (imperatives are formed on aorist stems).

[53] The so-called participle is an impersonal form with the 3ms prefix /y-/ and the suffix /-n/.

[54] In section 3.1. we assumed from the outset that the difference between the two kinds of [r] was a reflection of an underlying contrast between /l/ and /r/, i.e. a contrast between two specifications of the feature [lateral]. E. Selkirk (p.c.) has suggested that this contrast may be reinterpreted as one between two underlying r's, call them $/r_1/$ and $/r_2/$, which differ only in their categorization with respect to syllabification. Under this interpretation, $/r_1/$ (our /l/) behaves like the underlying glides, i.e. SP never associates it with a nucleus. As for $/r_2/$, its behaviour is intermediate between that of /i,u/ and that of /y,w/, since SP associates it with a nucleus in some instances and with a margin in others. Notice another difference between $/r_2/$ and /i,u/. Like /y,w/ and $/r_1/$, and unlike /i,u/, $/r_2/$ allows a contrast between simplex and geminate.

2. SP treats the underlying glides like the other consonants; when, contrary to the predictions of SP, the underlying glides become nuclei, this is due to a special rule (FLIP (29)) which applies to the output of SP. On the other hand, under the analysis sketched in the preceding section, the mechanisms which associate /r/ with a nucleus in (20)b-e must precede SP or be part and parcel of it.

3. /r/ and the glides all spread onto a preceding empty nucleus, cf. (fØr)(rØn) → farren and (θØy)(ma) → θiyma[55] (cf. note 43), but rule A-SPREAD (22) cannot be generalized to cover both cases. The reason why is that glide spreading and A-SPREAD do not operate in the same way at the beginning of a phonological group. Just as group-initial empty nuclei are not realized as shwa (group-initially, /xzn/ is pronounced xzen, not exzen), glides do not spread onto group-initial empty nuclei: at the beginning of a phonological group /yma/ is pronounced yma, not iyma (cf. (28)II-c). A-SPREAD, on the other hand, must always affect word-initial empty nuclei, even when they are group-initial: words beginning with /rr/ always begin with arr at the phonetic level, no matter what the context.

Below we shall encounter yet another difference between the underlying glides and /r/: whatever mechanism is responsible for the realization of /r/ as a, this mechanism must apply in a cyclic fashion, whereas rule FLIP (29), which turns certain morpheme-final glides into vowels, must not.

6. LIAISON [r].

In the first part of this section we show that ASR syllabification operates in a cyclic fashion. In the second part we suggest an account of liaison r which would mesh with the analysis of the r~a alternations sketched in section 4, and we point out some problems with this account. Even if the analysis in section 4 must in the end be abandoned, the data which we present as evidence for cyclic syllabification in ASR are of much interest for the phonology of Berber dialects at large. These data show that in ASR, the

55 Cf. (25)II-c.

phonological behaviour of clitics differs from that of affixes. A common assumption in the literature on Berber is that as far as phonology is concerned, there is no need to distinguish clitics from affixes, c.f., e.g., Basset and Picard (1948, 69-70). This may indeed be true for some dialects of Berber, but it would be surprising if ASR were a unique exception in this respect.

As explained at the beginning of section 4 there are two cases where the surface reflex of /r/ is ar rather than a. The first case is that of /rr/, for which we have posited rule A-SPREAD (22). The second case involves certain instances of word-final /r/. Word-final /r/ is always deleted before a pause or a consonant, but not before a vowel. /r/ is always retained before a vowel-initial clitic, as in /y-!ndr#it/ (3ms-throw do3fs), which is pronounced !yendar#it. When /r/ and the following vowel belong to different phonological groups, on the other hand, the retention of /r/ is optional. r is for instance optional in !yenda(r)##asʁun 'he threw the rope', from /y-!ndr##asʁun/ (3ms-throw rope) and in yemʁa(r)##arrif 'the Rif area is large', from /y-mʁr##r-rif/[56]. The latter example illustrates the fact that the initial vowel which triggers liaison need not be an underlying vowel; it may have been introduced by NUC-VOC (21) at an earlier stage of the derivation.

Let us first discuss those cases where a word-final /r/ is followed by a vowel-initial clitic. Here are, for instance, the relevant steps of the derivations we propose for !yenda 'he threw' (prepausal) and !yendar#it 'he threw it (f)'. Capital R represents the [coronal] specification set afloat by the operation of NUC-VOC, as will be explained below.

56 /r-rif/ derives from a more abstract /l-rif/, as explained in the text below (17) in section 3.2.

(30)		/##y-!ndr##/	/##y-!ndr#it##/
Cycle I	SP	!(yØn)(dr)	!(yØn)(dr)
	NUC-VOC	(da)R	(da)R
Cycle II	SP		!(yØn)(da)(rit)
	NUC-VOC		
STRAY ERASURE		Ø	
other rules		[!yenda]	[!yendarit]

We assume that SP and NUC-VOC operate cyclically. The domain of application of the cyclic rules is the word in the first cycle, and the phonological group in the second cycle. The apparent resyllabification of /r/ across a clitic boundary in !yendar#it is just an effect of the operation of SP in its second pass. Assuming a two-pass operation of SP allows us to reconcile the following two observations: (i) the behaviour of word-final /r/ implies that during the derivation of a sequence comprised of a word followed by a clitic, the word must at some stage be syllabified independently of the following clitic, and (ii) clitics must belong to the same syllabification domain as the words they are attached to. Let us take these observations in turn.

To illustrate (i), consider again the derivation of !yendar#it in (30). No matter what its position in syllable structure in surface representations, /r/ must be a nucleus at some stage of the derivation, so as to allow NUC-VOC (21) to operate. The table below illustrates the difference in behaviour of prevocalic radical-final /r/, depending on whether the following vowel belongs to a suffix or to a clitic. The forms in I are plural nouns whose suffix begins with a vowel, and those in II are the corresponding singular forms followed by the demonstrative enclitic a 'this'. The examples in (31) are all nouns because there are no verbal suffixes which begin with a vowel at the phonological level.[57]

[57] The plural form in (31)A-d is that of feminine θaðbeaθ. The masculine plural is iðbean, from /i-ðbir-n/.

(31)		A	B	
a	/!ʁzr/	!i-ʁezr-an	!i-ʁzar a	'river'
b	/!zwr/	!i-zewr-an	!a-zwar a	'blood vessel'
c	/!ʁbr/	!i-ʁebr-an	!a-ʁbar a	'fencing wall'
d	/ðbir/	θ-i-ðbir-in	a-ðbear a	'pigeon'

On the first cycle /r/ is syllabified as an onset in A and as a nucleus in B, hence the operation of NUC-VOC in B but not in A.[58]

Turning now to observation (ii), consider for instance the word /y-ðhn/ 'rub 3ms'. Whereas it is pronounced yeðhen when it occurs at the end of a phonological group, as in yeðhen##!azru 'he rubbed the stone', it is pronounced iðehn before a vowel-initial clitic, as in iðehn#it 'he rubbed her', from /y-ðhn#it/. The location of shwa and the realization of the initial /y-/ as a vowel[59] are precisely what SP predicts if the verb and the following clitic are included in the same syllabification domain.[60] This assumption is also necessary to account for the fact that radical-final glides do not undergo FLIP (29) before a clitic: they become onsets before its initial vowel, as exemplified in (27)III.

When SP goes through its second pass it deletes empty nuclei and builds new ones afresh. Consider again iðehn#it 'he rubbed her', from /y-ðhn#it/. The output of SP's first pass is (yØð)(hØn)it; the empty nuclei are not retained in the second pass, which yields (Øy)(ðØh)(nit).[61]

[58] We have encountered a few nouns where a appears before /r/ immediately followed by the initial vowel of a suffix, e.g. θiðehʃoar-in "deaf women" (s θaðehʃoaθ, ms aðehʃoa), !θimeʕðoar-in "crippled women" (s !θameʕðoaθ, ms !ameʕðoa). These forms are exceptional in that the suffix is not syllabified until the second cycle.

[59] Through the operation of FLIP (29).

[60] Also, adding the dat3s clitic to items a, b, d and e in (25)II results in forms which are pronounced as θ-xezn#as, θ-wezn#as, θ-zewʁ#as and θ-beçs#as.

[61] We have encountered a few cases where SP seems to be unable to delete the empty nuclei it has introduced earlier (suite...)

If syllabification were not cyclic and if the smallest domain where SP operates were the phonological group, /y-!ndr#it/ would yield *!i-nedr#it instead of !ye-ndar#it.

In (30) and (31)B NUC-VOC operates on the first cycle. We shall deal later on with cases where NUC-VOC applies on the second cycle (cf. (36) below).

Cyclic syllabification accounts for the appearance of a in !yendar#it in (30), but how is one to account for the following r? This question breaks down into two. First: Where does the feature bundle [r] come from? We can only make the following suggestion: r is the surface reflex of the [coronal] specification which was set afloat by the operation of NUC-VOC (21) on the first cycle. This is admittedly rather vague, and we are not ready to spell out the mechanisms which enable a floating [coronal] node to regenerate into a full-blown feature tree.

In !yendar#it a single underlying segment (/r/) gives rise to two segments in a row (a and r) at the phonetic level, and /r/'s timing slot in the underlying representations is associated with a at the phonetic level. The second question is, then: What is the origin of the timing slot associated with [r]? A plausible answer is that [r] preempts an empty onset which is inserted anyway in order to break the vowel sequence a#i.[62]

ASR has an absolute prohibition against heterosyllabic vowel sequences inside phonological groups. Whenever a vowel-final word is followed by a vowel-initial clitic, yod epenthesis occurs (cf. (27)III and note 16). It is possible to adopt an analysis for ASR similar to the one Itô (1989, 236ss.) proposes for Axininca Campa, and to view yod epenthesis as a consonantal analogue of shwa epenthesis: in case the syllabification domain contains adjacent nuclei, an empty timing unit is inserted between them, which is syllabified as an onset. This empty onset is later provided with an

[61](...suite)
on. One such case is when a /CCC/ verb with a /-C/ suffix is followed by a vowel-initial clitic, as in /ðhn-ʁ#it/ "I rubbed her", which is not pronounced *ðhen-ʁ#it, but ðehn-eʁ#it. Cf. Tangi (1991, 75ff) for some (inconclusive) discussion.

[62] This is Chtatou's (1993) view on liaison r in Iharassen Rifian.

associated yod; this is done through the operation of the Yod Default rule, which associates yod with every empty onset, in the same way as the Shwa Default rule associates a shwa with every empty nucleus. Like the insertion of empty nuclei, the insertion of empty onsets is part and parcel of SP. An attractive solution to our problem, then, would be somehow to link the ghost r to the empty onset created between a and i by SP during the second cycle. The mechanism effecting this association would have to apply before the Yod Default rule.

Unfortunately the parallelism between yod epenthesis and liaison r breaks down in strings longer than a phonological group, and this robs the analysis we have just sketched of much of its appeal. Let us turn to liaison r and yod epenthesis at a ## boundary, i.e. a boundary between two phonological groups.

Whereas the appearance of liaison r or epenthetic yod is mandatory inside a phonological group, it is only optional at a ## boundary, e.g. in !ye-nda(r)##asʁun 'he threw the rope', from /y-!ndr##asʁun/, and in !ye-gðu(y)##asʁun 'he snapped the rope', from /y-!gðw##asʁun/.[63] Yod epenthesis is acceptable in some V##V sequences and not in others, and the conditions under which it is allowed have yet to be worked out. Liaison r, on the other hand, seems always to be acceptable, no matter how loose the connection between the two abutting words; we have not been able to find a /r##V/ sequence which could not be pronounced [arV]. Here are examples of two syntactic contexts where liaison r is acceptable, but not epenthetic yod.

[63] This example shows that optional yod epenthesis is fed by rule FLIP (29), which is responsible for the fact that /w/ surfaces as u. For evidence that the last segment is a glide in the underlying form of "snap", cf. (27)b.

(32) a aðbea(r) aħenʒa !ye-zri θ
pigeon boy 3ms-see do3ms
'the pigeon, the boy saw it'

b čamma(*y) aħenʒa !ye-zri t
ball boy 3ms-see do3fs
'the ball, the boy saw it'

(33) a nni-ʁ i w-ħenʒa(r) aðef
tell-1s to bs-boy enter:imper
'I told the boy to come in'

b nni-ʁ i xdiʒa(*y) aðef
tell-1s to Khadizha enter:imper
'I told Khadizha to come in'

There is yet another problem with the proposed analysis. This problem has to do with the claim that it is syllabification which provides the empty timing slots to which liaison r and epenthetic yod associate. In order to account for the fact that liaison r and yod epenthesis optionally occur at ## boundaries, one would have to assume that syllabification optionally operates on strings longer than a single phonological group; call this syllabification across ##. However syllabification across ## cannot simply be equated with SP. Unlike the second pass of SP, syllabification across ## does not affect the distribution of shwa. On the one hand, it does not cause the disappearance of empty nuclei introduced earlier on: /y-ðhn/ 'rub 3ms' has the same pronunciation in yeðhen##!azru 'he rubbed the stone' as it has before a pause. On the other hand, syllabification across ## does not create new shwas: the sentence /ttruysus##θfunast/[64] 'the cow shivers' can only be pronounced

64 From a more abstract /θ-tt-ruysus##θ-funas-θ/ "shiver impf 3fs, cow bs".

ttruysusθfunast. It cannot be pronounced ttruysuseθfunast, with a shwa between the two phonological groups.[65]

7. /r/-GLIDE SEQUENCES.

Our overview of syllabification in section 2.3 implied that in ASR, syllabification does not take into account the position of consonants on the sonority scale. The data to be presented in this section may be taken as suggesting that the sonority of consonants is after all relevant to syllabification in ASR, albeit in a limited way.

Taken together, template (2)a and the maximization of syllable size[66] exclude any syllable of the form (rØC), no matter what consonant C stands for. This is too restrictive. Some (rØC) syllables must actually be allowed, and in all of them C is either /y/ or /w/. For instance /##ħry##/ 'grind' is pronounced ħri, a pronunciation which can be derived only under the assumption that SP syllabifies /ħry/ as (Øħ)(rØy), whence ħri through the operation of FLIP (29). In the same way as template (2)a and maximizing syllable size compel one to syllabify /##frn##/ as (frn), whence fan, they predict that /##ħry##/ should be syllabified as (ħry), whence ħay.

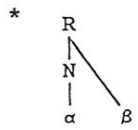
Why should syllables of the form (rØG) (G a glide) be allowed? We submit that it is because rimes of the form rG are disallowed. In the sonority scales which have been proposed for various languages (cf. Clements 1990 and references therein), r is the most sonorous of all [+cons] segments. Let us assume that in ASR too, r is less sonorous than vowels and glides, but more so than l and other consonantal segments. The rG rimes which our analysis must prohibit, then, are rimes where the coda is more sonorous than the nucleus.

65 The second pass of SP does in some cases cause the appearance of a shwa at a clitic boundary, e.g. /mlmi##θ#!zri-nt/ "when did they (f) see him?" (when, do3ms, see 3fp), is pronounced mermi!θezrint and is homophonous with /mlmi##θ-!zri-nt/ "when did you (fp) see?" (when, see 2fp).

66 On maximizing syllable size, cf. the text below NUC-VOC (21).

This prohibition actually holds for all rimes, since it is also met in closed syllables in which the nucleus is a vowel.

(34) Rising Rime Prohibition



(β more sonorous than α)

Line d in the table below exemplifies the realizations of the perfective and imperfective stems of /ħry/ at the end of a phonological group, before a suffix and before a clitic. For the sake of comparison, the table also contains parallel forms of (a) a run-of-the-mill /CCC/ verb,[67] (b) a /CCG/ verb,[68] and (c) a /CrC/ verb.[69]

(35)		I /ɻ##/	II /ɻ-θ/	III /ɻ#it/	IV /impf##/	V /impf#it/
a	/wzn/	wzen	wezn-eθ	wezn it	wezzen	wezzn it
b	/fsy/	fsi	fesy-eθ	fesy it	fessi	fessy it
c	/frn/	fan	fan-eθ	fan it	farren	farrn it
d	/ħry/	ħri	ħay-eθ	ħay it	ħarri	ħarry it

67 Compare with (7)a.

68 Compare with (27)c.

69 The meanings of the verbs in (35) are (a) weigh, (b) untie, (c) sort, (d) grind. The forms in each column are (I) imper 2s, (II) imper 2p, (III) imper 2s + do3fs, (IV) impf imper 2s, (V) impf imper 2s + do3fs. Lack of space prevents us from including in the table the imperfective analogues of the 2p forms in II. They are (a) wezzn-eθ, (b) fessy-eθ, (c) farrn-eθ, (d) ħarry-eθ.

Here are the relevant steps of the derivations we propose for ħri ((35)I-d) and ħay#it ((35)III-d). As in (30), R represents the [coronal] node set afloat by the operation of NUC-VOC.

(36)		/##ħry##/	/##ħry#it##/
Cycle I	SP	(Øħ)(rØy)	(Øħ)(rØy)
	R-VOC		
Cycle II	SP		(ħr)(yit)
	R-VOC		(ħa)R(yit)
FLIP		(ri)	
STRAY ERASURE			ø
		[ħri]	[ħayit]

To show that (rØw) syllables are possible, like (rØy) syllables, here are some forms of the verb /!urw/ 'give birth, beget', which conjugates like other /uCC/ verbs (cf. (16)): !θ-uru (/θ-!urw/ 3fs), !oaw-eʁ (/!urw-ʁ/ 1s), !θ-oaw#iθ (/θ-!urw#iθ/ 3fs + do3ms), !θ-uriw (/θ-!uriw/ neg 3fs), !tt-aru (/θ-tt-!arw/ impf 3fs), !tt-aw-eʁ (/tt-!arw-ʁ/ impf 1s). These forms are predicted by our analysis.

Violations of the Rising Rime Prohibition are uncommon in the languages of the world.[70] Two such violations which come readily to mind are found in those varieties of English and German where in codas /r/ is realized as a nonsyllabic nonhigh vowel, e.g. Eng. here [hiə̯], Germ. Uhr [u:ɐ̯]. The rules vocalizing /r/ in English and German are presumably rather late rules. One may speculate that all languages abide by the Rising Rime Prohibition in the early stages of the derivations and that there is consequently no need to consider the Rising Rime Prohibition as a language-specific component of the grammar of ASR. However some forms in ASR suggest otherwise. The

70 Cf. Dell and Elmedlaoui (1985: 126 note 13).

pattern exemplified in (35)d is the most prevalent in ASR, but we have found a handful of verbs which behave differently. /srw/ 'spin' is one of them. The forms in (37) are the analogues of those in (35).

(37)	I	II	III	IV	V
	/ɻ##/	/ɻ-θ/	/ɻ#it/	/impf##/	/impf#it/
/srw/	saw	saw-eθ	saw it	sarru	sarrw it

Column I is where the exceptionality of these verbs resides. Whereas a group-final /rG/ sequence with a simplex /r/ is normally realized as rV, as in ħri in (35)I-d, in saw and the like the maximization of syllable size seems to take precedence over the Rising Rime Prohibition, and /rG/ surfaces as aG. Certain verbs ending in /rG/ behave like ħri for some speakers and like saw for others, e.g. /y-fry/ 'tear 3ms' is ye-fri or i-fay depending on the speaker, but these verbs have the same forms for all speakers when the radical does not occur at the end of a phonological group, as in fay-eʁ (1s, from /fry-ʁ/) or when r is a geminate, as in i-farri (impf 3ms, from /y-frry/).

Let us finally mention an even more puzzling case, that of /frury/ 'be shattered', which is pronounced froari whenever it occurs at the end of a phonological group, e.g. in 3ms /##y-frury##/, ye-froari. The discussion above leads one to expect only ye-fruri or ye-froay. Elsewhere than at the end of a phonological group, /frury/ surfaces as froay as expected, e.g. froay-en (3mp, from /frury-n/). That the underlying form of this verb is indeed /frury/ is confirmed by the fact that its imperfective stem is fruruy (cf. the text immediately above (18)).

We have only come across one form (in note 20) in which /r/ occurs in an environment where it should give rise to a, yet unaccountably fails to do so. In all the other forms where /r/

behaves in an idiosyncratic fashion,[71] /r/ vocalizes in environments where it is not expected to. This asymmetry suggests that in ASR, some occurrences of a vocalized /r/ may be on the way to being reanalyzed as /a/. Why this should be the case is rather intriguing, given the alternations which unequivocally point to /r/ as the underlying source of these occurrences.

71 Cf. note 58 and (37)I). To these forms one must add the negative stem of certain /XrC/ verbs, where negative i insertion is only optional or fails to occur altogether. For instance the negative stem of /wrð/ "drink (of animals)" has a free variant wað alongside the regular wrið (cf. column II in (7) and (11)). The negative stem of /urf/ "grill" is oaf, not urif (cf. (16)II).

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