On Rs, rhotacism and paleophony

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1 Introduction

In his R-tickle, William Barry (Barry 1997: 35) invites others who may have pondered along similar lines 'to offer additional complementary or alternative views'. In somewhat belatedly accepting his invitation, I would like to make some remarks on trills, on 'molar r', and on rhotacism, followed by some thoughts on the question of the historical primacy of trill, at least within Indo-European.

2 Trills

I have little to add to Barry's detailed discussion of the production of trills. As he says at the foot of page 35, there is good agreement in the literature that in order to produce a trill, a sufficient air-stream is necessary. This is true; with too little airflow a trill may degenerate into a fricative, and with a further decrease in airflow and/or slight increase in the cross-sectional area of the articulatory channel the fricative may become an approximant. However, the converse is not necessarily true. A uvular fricative may indeed become a uvular trill in response to increased airflow, but fricatives in the dentalveolar region do not easily become trills under increased airflow unless the articulatory posture is a precisely adjusted apico-alveolar or apico-postalveolar one. They can, however, become (or be reinterpreted as) approximant [ɹ].

On page 36, Barry refers to 'non-significant differences in the rate of trill vibration, whether lips, tongue tip or uvular'. Trill frequencies of around 30 Hz (or a little less) have been recorded for several languages. For example, the three trills of the Austronesian language Nias – bilabial, apico-alveolar and apico-postalveolar (slightly retroflex) – showed mean frequencies of 28.7, 28.5 and 25.5 Hz, respectively. As Barry says, trills are probably most commonly initiated by the Bernoulli effect, 'guaranteed', as he says, 'by the approximation of articulator and point of articulation'. In the case of Nias, however, this seems to be true only for the apico-alveolar trill. As pointed out in Catford (1988: 153), the bilabial and post-alveolar trills 'appear to start the vibratory cycle from a closed position, the organs being pushed apart, and the trill inaugurated by pressure build-up behind the stop'.

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3 Molar R

One variety of R not explicitly mentioned by Barry (though perhaps to be subsumed under approximant r's) is that common type of American English r that has been described, or labelled, as 'back r' in West & Kantner (1933) and Kantner & West (1941), as 'molar r' in Uldall (1958), as 'bunched r' in Hagiwara (1994, 1995), Lindau (1985), Alwan, Narayanan & Hakar (1997) and others, and as 'type 3' and 'type 4' in Delattre & Freeman (1968). I have adopted Uldall's term 'molar R' as a general name for this type of r because some form of molar or premolar contact appears to be characteristic of it, and can be observed in several palatographic records to be referred to below.

3.1 West & Kantner's (1933) and Kantner & West's (1941) 'back R'

The articulation of this kind of R, transcribed by the authors with reversed capital R, is described as follows:

> The sides of the tongue are in contact with the inner borders of the upper teeth and the corresponding lateral portions of the hard palate as far forward as the second premolar or first molar. (West & Kantner 1933: 35)

> The whole tongue is drawn backward and elevated, the front being elevated very little or not at all. Thus it is the back of the tongue that projects up into the mouth cavity in such a way as to produce the characteristic *r* resonance. (Kantner & West 1941: 158)

The authors claim that 'this type of r ordinarily occurs before or after [g] or [k]' (Kantner & West 1941: 158). This claim does not seem to be substantiated by later investigators, who generally find it to be particularly characteristic of the syllabic 'rhotic vowel' of words like *fur* and *curb*.

Kantner & West provide fairly detailed figures representing a sagittal section through the nasal and oral cavities and the oro-pharynx (presumably derived from X-rays, though this is not explicitly stated) showing tongue postures for numerous articulations including back r, retroflex r and uvular fricative and trill. These seem to show sulcalization (concavity of the tongue surface forming a shallow longitudinal median trough). The tongue shape of their back r is not dissimilar to X-ray pictures of 'molar r' and 'bunched r' provided by later authors.

3.2 Uldall's (1958) 'Molar' R

The term 'Molar R' was introduced by Elizabeth Uldall in her 1958 article 'American ''Molar'' R and ''Flapped'' T':

> 'Molar' r, for which I have seen the term 'velar' r, is articulated by contracting the tongue in a fore-and-aft direction and bunching it toward the upper back molars. The tip draws back into the body of the tongue, which presents an almost vertical surface toward the front of the mouth. Some sideways pressure is exerted by the sides of the tongue against the upper molars. (Uldall 1958: 103)

The palatograms provided by Uldall show this molar contact, specifically in the region of the second and third molars (and hence slightly further back than West & Kantner's back R, but clearly of the same type). Uldall continues: 'When unvoiced this r resembles [x]' – an important point, which confirms that between the lateral molar contacts there is a median velar articulatory channel, as for a velar fricative. She provides an X-ray tracing of her 'molar' r which is rather similar to later radiographic data, e.g. Delattre & Freeman's (1968) type 3 and Lindau's (1985) types 2 and 3.

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Uldall reports that she also uses an r pronounced 'with the tip of the tongue raised to a position behind the teeth ridge and the front of the tongue held concave to the palate' (Uldall 1958: 103), i.e. a more or less retroflex postalveolar approximant. The 'concavity' referred to here is no doubt the sulcalization visible in Kantner & West's r-articulations, which is most pronounced with the uvular trill, and which is also noted by Barry, who notes 'the need to form a channel in the tongue dorsum to funnel the air along the lower posterior part of the uvula' (Barry 1997: 37).

Though it is not explicitly mentioned by Uldall with reference to her molar r, a trough-like concavity in the tongue dorsum in the velar-uvular area is probably always present in molar r. It is mentioned, for example (apparently as present in both types of r), by Alwan et al. (1997: 1084) in their description of bunched r. Nevertheless, it seems particularly characteristic of molar r, and I have sometimes suggested that one way for non-English speakers to learn molar r, for use in American English, is to approach it from a uvular trill (or from gargling). The trick is to suppress the trill but carefully maintain the trough or furrow in the back of the tongue as one moves the tongue slightly forward (Catford 1987: 98) .

Uldall describes the distribution of her two instances of r. Molar r occurs when syllabic, as in *fur*, *Perth*, *furrow*, *hopper*; nonsyllabic after a stressed vowel as in *par*, *hair*, *harp* (tongue tip r not occurring in these environments). Tongue tip r is never syllabic and occurs initial in a breath-group, e.g. in *rap*, and in releasing groups with s, ʃ, t, d, e.g. *spry*, *shrub*, *trap*, *drop*. When non-syllabic after a syllable ending in a consonant, e.g. in *upright*, *buckram*, *Henry*, the two r's are in free variation, with the tip r more usual, but the molar r is more usual in other cases of free variation.

Uldall also provides acoustic spectra (Kay Electric sonagrams and sections) of both her molar R and tongue-tip r. These are on a small scale and difficult to read accurately, but, as she says, the two sounds have similar acoustic structure up to about 2500 Hz. There are small differences, however, and it appears that the Formant frequencies of the two types of r are roughly as follows:

	F1	F2	F3
Tongue tip r	550	1500	1900
Molar r	500	1600	1800

3.3 Delattre & Freeman (1968)

In their study, Delattre & Freeman (1968) identify and describe eight types of R (two of which are characteristic of British rather than American English). Of the American R's, what they call 'type 3', is, in general, the commonest. They describe its articulation as follows:

> The whole tongue is sharply withdrawn, the tip is kept down, the dorsum of the tongue is raised toward the palate-velar frontier to form a first constriction , and the root of the tongue is backed toward mid-pharynx to form a second constriction. (Delattre & Freeman 1968: 43)

In the Mid West, however, they find that their type 4 is the most common. This type exhibits a very marked dip (presumably deep sulcalization) between the palate-velum frontier area and the pharyngeal constriction.

3.4 Lindau (1985) and Hagiwara (1994, 1995) on 'bunched r'

Lindau provides X-ray profiles of 'bunched' (i.e. 'molar') R in her 1985 article, and a detailed discussion of American R-sounds is given in Hagiwara (1994, 1995). Hagiwara (1995: 61) presents average formant frequencies for syllabic r (usually bunched). These are in Hz (with SDs in parentheses).

	F1	F2	F3
Men	429 (40)	1362 (79)	1679 (91)
Women	477 (82)	1558 (170)	1995 (347)

3.5 Alwan, Narayanan & Hakar (1997)

This study presents MRI images of tongue shapes of r's, including 'bunched' r, which show similarities to other profiles of American Rs (including bunched or molar R) in Delattre & Freeman (1968), Lindau (1985) and Uldall (1958). They also provide electro-palatograms of some types of R, including 'bunched' R and syllabic R. From all these sources – West & Kantner (1933), Kantner & West (1948), Uldall (1958), Lindau (1985), Hagiwara (1994, 1995) and Alwan et al. (1997) – we have a pretty clear idea of the range of tongue shapes and molar contact areas characteristic of bunched or molar r.

Though molar types of r are often associated with American English they are not unique to America. As we shall see, sounds similar to molar R occur in Tamil and Burushaski, and no doubt elsewhere.

3.6 Tamil molar r

By a felicitous coincidence, the issue of *JIPA* in which Barry's article appeared also contained a description, by McDonough & Johnson, of the peculiar Tamil liquid, described there as a 'central retroflex approximant' (McDonough & Johnson 1997). The similarity of this sound to a molar r is obvious, and I have in fact sometimes suggested to Tamil speakers learning American English that it would be a better approximation to an American r than the trill or tap that they often use (Catford 1987: 98).

Firth (1934: xvi) describes the Tamil molar r as follows:

> ɹ A frictionless continuant having an obscure unrounded back vowel quality. ɹ is made by drawing back the whole tongue and spreading the blade laterally, making it thick, short and blunt, so to speak [this is reminiscent of Uldall's description of molar R – JCC] so that it approaches the middle of the hard palate. The result is a very retracted liquid sort of r-sound.

McDonough & Johnson (1997) provide a spectrogram, a palatogram and electro-palatograms of the Tamil R.

Figure 1 juxtaposes palatograms and electropalatograms of English molar or bunched R after Uldall (1958) and Alwan et al. (1997) and of the Tamil 'retroflex central approximant' after McDonough & Johnson (1997).

3.7 Burushaski molar R

Burushaski, the language isolate of the Karakoram, is another language with an approximant which is clearly of the 'molar r' type. This is the sound that Lorimer (1935: 6) transcribed as y with subscript dot, [y̰], and described as follows:

> y is a sound not shared by Shina, nor have I met it anywhere except in Burushaski. Its identification as a 'cerebral y' is tentative . . . With my principal informant IYB, I eventually recorded it as an indistinct variety of ɣ. He always wanted me to take it as 'y', but that did not seem to me to meet the case. Subsequent reflection and phonetic experiments, however, have now led me to think that it represents an attempt to pronounce y with the tongue in the cerebral position i.e. with the tip turned back to or towards the roof of the mouth, or at least with the tip of the tongue in some measure raised and retracted.

Berger (1998: 22) writes:

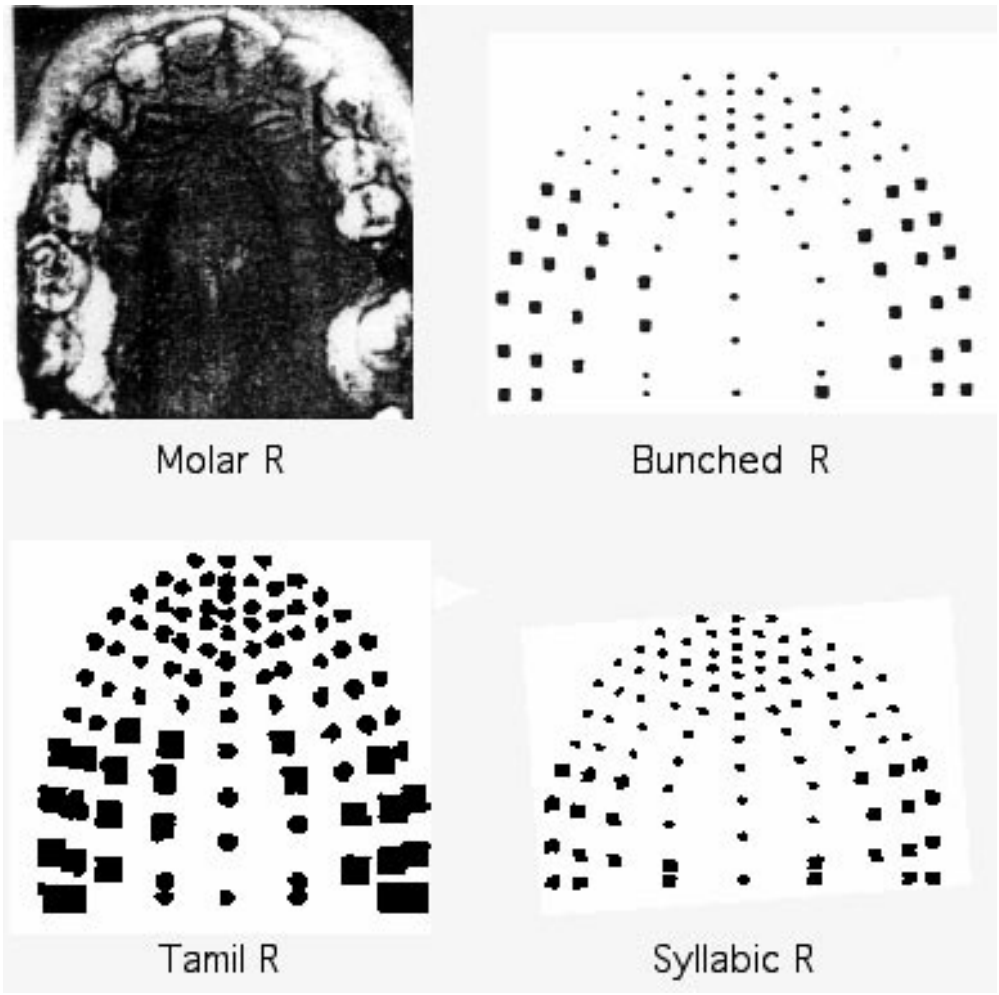

Figure 1 Palatogram of Uldall's (1958) molar R and electropalatograms of Alwan et al.'s (1997) bunched and syllabic R, and McDonough & Johnson's (1997) Tamil approximant R.

> ẏ is one of the spirants peculiar to Bur. It can be described as a voiced retroflex sibilant with simultaneous palatal-dorsal constriction, as it were, a voiced combination of ṣ with the German Ich-laut [my translation – JCC].

Berger's description of the sound as a 'sibilant' and as a voiced combination of retroflex s with ç is strange since it is quite certainly an approximant, but he correctly identifies the dorso-palatal tongue bunching by his reference to the ich-laut, just as Lorimer does with his 'attempt to pronounce y with the tongue in the cerebral position'.

Incidentally, commenting on the problem of describing ẏ Berger (1998) adds: 'Outside Bur. it seems to me that the sound transcribed in Tamil as l̤ is similar to the Bur. sound' (Berger 1998: 22 fn. 8). Presumably, the reference is to the Tamil molar R.

My own observations and recordings of two male speakers (father and son) of the Nagir dialect of Burushaski (made in 1957) confirm the tongue-bunching molar, or better, premolar, articulation of this sound. Spectral analysis of the Burushaski molar

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R in the words *aRa* 'my father' and *baRum* 'mare' give average frequencies, in Hz, of the formants in these words as follows:

	F1	F2	F3
aRa	590	1389	2338
baRum	450	1058	1814

The lower frequencies in *baRum* are no doubt due to anticipatory labialization of the R before u.

These Burushaski formant frequencies compare moderately well with formant frequencies for other molar or bunched Rs, as shown in table 1 below.

3.8 Tsaxur 'pseudo-molar R'

In a number of Caucasian languages, particularly in Dagestan, there is a prosody of pharyngealization, which may affect both consonants and vowels. The Lezgian languages Tsaxur and Udi provide good examples of this. Syllables containing pharyngealized vowels tend to be perceived by Americans as 'having an R in them' (S. Kodzasov, personal communication), which is the justification for mentioning them here. This may be particularly true of the Tsaxur pharyngealized ɤˤ which tends to sound somewhat like the American syllabic molar R. We might call these Dagestanian sounds 'pseudo-molar Rs'. (For more on Tsaxur and Udi vowels see Catford (1994: 57–59.)

Figure 2 shows X-ray profiles of two samples of bunched r (after Lindau 1985) alongside Uldall's (1958) molar r and Delattre & Freeman's (1997) types 3 and 4, accompanied by MRI profiles of 'bunched' and syllabic r (after Alwan et al. 1997), all to be compared with an X-ray profile of the Tsaxur pharyngealized schwa-like vowel (after Gaprindashvili 1966: 72).

All of these types of molar r have, as common features, a 'bunched' tongue, with the tip and blade somewhat retracted into the body of the tongue, and lateral contacts between the dorsal surface of the tongue and the premolar and/or molar teeth. There may be considerable sulcalization in the velar-uvular area and always some retraction of the tongue-root backwards into the pharynx (hence the 'pharyngealized' description of the Caucasian sounds). Table 1 summarizes the frequencies in Hz of the first, second and third formants of the various examples mentioned above.

Note the exceptionally high F2 of Tamil R possibly indicating that it is somewhat fronter than others. In the Burushaski examples the frequencies of all formants are

Table 1 Formant frequancies of 'Molar' type R's.

	F1	F2	F3
Uldall (Molar R)	500	1600	2000
Delattre & Freeman (type 3)	500	1400	1700
Delattre & Freeman (type 4)	500	1300	1500
Hagiwara (men)	429	1362	1679
Hagiwara (women)	477	1558	1995
Tamil R	500	1800	2300
Burushaski (*aRa*)	590	1389	2338
Burushaski (*baRum*)	440	1058	1814
Tsaxur (pharyngealized ɤˤ)	545	1425	1875

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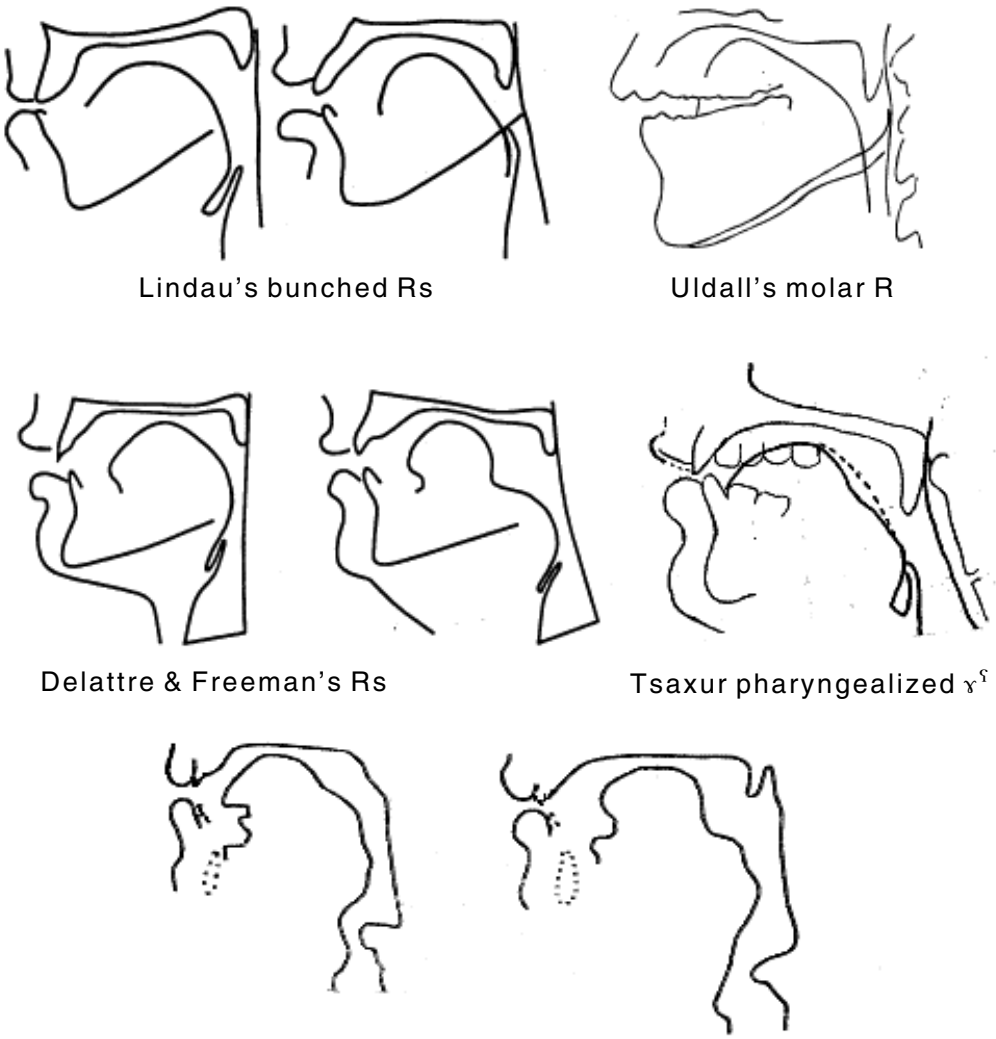

Figure 2 X-ray profiles of two of Lindau's (1985) bunched R's, Uldall's (1958) Molar R, two of Delattre & Freeman's (1997) R's and the Tsaxur pharyngealized vowel ɤˤ (after Gaprindashvili 1966); and MRI profiles of bunched and syllabic R (after Alwan et al. 1997).

considerably lower in *baRum* 'mare' than in *aRa* 'my father', presumably because of anticipatory labialization of the R before /u/ in *baRum*.

4 R sounds in paleophony – rhotacism

It is a curious fact that, although we have had a term ('palœography', later 'paleography') for the decipherment and study of ancient writings for nearly two centuries, there is no accepted term for the reconstruction and study of ancient pronunciation.

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The term PALEOPHONY is the obvious coinage for this, and one that I have been using in lectures and seminars for half a century, though I believe this is the first time I have used it in a publication.

Barry talks about the paleophonic status of trilled R is the following words:

> I should like to consider the trilled R in the first instance, since it appears to have long 'roots'. It is assumed to be the /r/ of Old High German and possibly of Proto-Indo-European . . . (Barry 1997: 35)

He develops this theme at greater length in the last section of the article (pp. 43-44) under the heading 'Conclusion: the primacy of the trill?' In the remainder of the present article I would like to examine this view.

In the paleophonic reconstruction of ancient pronunciations, the phenomenon of RHOTACISM – the replacement of a non-R sound by some form of R – has frequently been cited as a source of information about the nature of R-sounds. There are two well-known types of rhotacism, namely the n > r type and the s/z > r type, to which one might add the t/d > r type (as in *pottage* > *porridge*).

4.1 Rhotacism of type n > r

Barry (1997: 35) mentions one case of n > r – the diachronic substitution of /r/ for /n/ in French. Examples can be found in other Indo-European languages.

4.1.1 Romanian

Referring to dialectal Romanian, Nandris (1963: 255-258) says that the change of intervocalic *n* to *r* takes place only in words of Latin origin, for example, *bono* > *buru*, *bene* > *bire*, *pane* > *pare*, and he describes the process in the following words:

> Rhotacism is a consequence of the weakening of the intervocalic nasal consonant: instead of an apico-coronal closure in the dentalveolar zone the tongue merely touches it lightly; the soft palate having remained lowered, the result is a kind of nasalized r or fricative n. (Nandris 1963: 255; my translation – JCC)

4.1.2 Albanian

Another well-known example of n > r is found in the southern Tosc dialect of Albanian. It can be compared with the northern Gheg dialect.

Tosc	Gheg	
zëri	zâni	'the voice'
gjuri	gjuni	'the knee'
Shqiperi	Shqypni	'Albania'

4.1.3 Celtic

In Scottish Gaelic, we find kn + V regularly > kr + nasalized V, as in *cnoc* 'hill' pronounced [krɶ̃ɔxk], a development that has passed (in a denasalized form, as also in some Gaelic dialects) into at least one Scottish dialect of English, in the fishing village of Avoch [ɑ:x] in the Black Isle Peninsula north of Inverness, where we have [kri:] for 'knee', [kreif] for 'knife', etc.

It is easy to understand how the rather light oral contact of nasals (cf. the firmer contact of stops) can lead to n > ɾ (one tap) .The paleophonic assumption is that the acceptance of this this variant of /n/ as /r/ would be most likely to occur in a language which already had a tongue-tip tapped ɾ or a trilled r (of which tapped ɾ is a common variant).

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4.2 Rhotacism of type s > r

This is perhaps the best known form of rhotacism, among IE languages, exemplified particularly in Italic and Germanic.

4.2.1 Italic

In Italic the change of intervocalic s to r (i.e. V-s-V > V-z-V > V-R-V) occurs in Umbrian, Faliscan and early Latin, but not in Oscan. Latin examples include *mus*, gen. *muris* 'mouse'; *os*, gen. *oris* 'mouth'; *ama-re* 'to love', cf. *es-se* 'to be'; etc. It is generally assumed that the fact that intervocalic -z- (< -s-) came to be reinterpreted as an r implies that the /r/ of the language at that time must have been a fricative or approximant ɹ, or at least that such an r must have been an acceptable pronunciation of /r/.

Baldi (1994: 209) tells us that

> The evidence of Latin orthography suggests that rhotacism . . . was operative at least up to the mid-fourth century B.C.E. Cicero, for example, (Fam. 9, 21,2) comments that in 339 Papirius Crassus officially changed his name from Papisius. Further, Appius Claudius Caercus, censor in 312 and consul in 307 and 296, established the spellings of the names Valerii and Furii, both of which were formerly spelled with s.

Later Latin writers clearly described their /r/ as a trill. Thus, for example, Lucilius (c. 180-103 BC): 'This cacophonous R isn't much different from saying in dog's language "It's nothing to me" ', and Terentianus Maurus (2nd century AD): 'The next letter [(R) – JCC] shakes out a dry sound with rapid blows'. For these and other examples see Sturtevant (1940: 150).

4.2.2 Greek

From an early period, Greek writers describe r as trilled. Thus Plato (427-348 BC):

> The letter rho, as I say, appeared to the name-giver to be a fine instrument expressive of motion when he wanted to imitate rapidity; at any rate he often uses it thus . . . For he saw, I suppose, that the tongue is least quiet and most rapidly shaken in pronouncing this letter.

Dionysius of Halicarnassus (1st century BC):

> And r is pronounced by the tip of the tongue sending forth the breath in puffs and rising to the palate near the teeth. (Cited in Sturtevant 1940: 60)

According to Buck (1955: 56-57) rhotacism (implying the existence of a fricative or approximant r) can be observed in a few dialectal inscriptions. Mainstream Greek, however, seems to have had a trilled r since earliest times.

4.2.3 Germanic

In all Germanic languages, except Gothic, rhotacism occurred, implying the existence of sounds of the ɹ-type in early Germanic. With respect to English, it has usually been the practice of scholars to assume (gratuitously, as it seems to me) the existence of trilled r in Old and Middle English. Lass (1983) assembles convincing evidence suggesting the existence of untrilled, possibly even molar r, in English from early times.

4.3 Other types of rhotacism

Though rhotacism of the s > z > r type is probably the most common, there are other types. For example, we have the t/d > tapped ɾ type, exemplified by the regular pronunciation of intervocalic t/d as tapped ɾ in American English and not uncommonly in other varieties of English as well – note also the historical replacement of *potage* by *porridge*, etc.

In Central Scotland, rhotacism of the type ð > ɹ can be observed. In Edinburgh, for example, one may hear *All those things* (*A' thae things*) pronounced [ɔːɹɐː θɪŋz] or even [ɔː ɹɐː fɪŋz], and in Glasgow I have seen a populist buttonhole slogan reading WE AR RA PEOPLE (meaning 'We are the people!') where *ar ra*, pronounced [aɹ ɹə] with a sequence of two distinct fricative R's, means 'are the'! In these examples, the [ɹ] is virtually always a fricative, not an approximant.

Among Indo-European languages, Armenian and Sanskrit present particularly interesting cases of rhotacism. We discuss them in the following sections.

5 The case of Armenian

Classical (and at least some modern dialects of) Armenian have two r-phonemes – a trill and a fricative or, perhaps less commonly, a single tap. The untrilled r appears to be what Armenian normally inherited from Indo-European, the trill having various secondary sources. However, there is one paleophonically interesting piece of evidence suggesting that what is commonly regarded as a fricative was, at an early stage, an approximant – probably some kind of bunched or molar r, or at least that such a sound must have been a recognized variant of the fricative r.

This evidence is provided by the Armenian reflex of IE initial **dw*, as *erk*, in **dwo*(*u*) > *erku* 'two', **dwei* > *erki-ul* 'to fear', and a few other words. The change of **dw* to *erk* has given rise to varied speculations. Meillet (1903: 28-29) saw the r in *erku* as the result of rhotacism of the d > r type, the *w* having become *gw* and then (following the regular Armenian mutation), > *kw*, and subsequently *k*.

Meillet's rather artificial and improbable hypothesis was criticized by Pisani (1951: 54-55), who proposes his own theory, namely, that 'the **ku* which one would expect [i.e. from **dwo* > *gwo* > *kwo* > *ku* – JCC] has received r from the following number **trei̯es*' – a solution that I find almost as improbable as Meillet's.

I believe Grammont (1918) had already come close to the correct explanation thirty three years earlier:

> **tw*- and **dw*- became respectively *kh*- and *rk*- . . . The consonantal mutation, which is anterior to the oldest Armenian documents . . . made them into **thw*- and **tw*-. Then these groups became **khw*- and **kw*- by assimilation of the place of articulation, just as German *tw*- became *kw*- by assimilation, for example in German *quark* 'soft cheese', from MHG *twarc* (Grammont 1918: 251; my translation – JCC)

One might also compare the Scots dialect of Fisherrow (6 miles east of Edinburgh), where a phrase like *between two and twenty* is pronounced [əkwin kwɔ ən kwʌnte]. Grammont continues:

> As for *kw* . . . it retained the *w* but making it lose its post-palatal place of articulation by differentiation; in place of -*w*-, there was left a sonant articulation on the middle part of the palate, without possessing any of the specific characters of *y*, *l*, *m* or *n*, consequently particularly resembling *r*, with which it was confused. One thus had **kr*, which underwent the habitual interversion to -*rk*- (with vocalic prothesis in the initial position).

I have long believed that the course of events in this development must have been more or less as follows: **dwo*(*w*) > *twu* > *kwu*. Then the *w* between *k* and *u* is perceived and re-interpreted as r (*kwu* > *kru*). This *kru* then undergoes the usual Armenian interversion of stop + liquid (*kru* > *rku*), finally receiving the usual prothetic vowel, thus *erku*.

The reinterpretation of *w* between *k* and *u* as r implies the existence in pre-Classical Armenian certainly of an approximant r, possibly an r of the bunched or molar type.

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6 The case of Sanskrit

6.1 Ancient descriptions of Sanskrit R's

Sanskrit possessed both a consonantal *r* and a vocalic (syllabic) *r*, the latter usually transliterated with a subscript dot (ṛ). (The nature of the Sanskrit *r* sounds, particularly the vocalic one, has been the subject of much uncertainty among scholars).

In the ancient phonetic treatises of the first millennium BC, the *Çikshas* [ɕikʂaz] and the *Prātiśākhyas* [praːtiɕaː kʰjaz] consonantal r is variously described as *mūrdhanya* 'headic' or 'cerebral' – generally interpreted as retroflex – as *dantya* 'dental' or *dantamūlīya* 'tooth-rootic' – interpreted as alveolar or postalveolar.

Vocalic or syllabic *r̥* on the other hand, is described in most of the Prātiśākhyas as articulated at the *jihvamūla* 'tongue-root'. This term clearly indicaties a velar articulation since /k kh ɡh ŋ/ and also [x], the velar allophone of *visarga* (voiceless h), are assigned to the same place of articulation.

The description of syllabic ṛ as 'velar' has puzzled scholars. Not surprisingly, some have assumed that this might really mean 'uvular'. Whitney (1862/1962), in his translation and commentary on the *Atharva-Veda Prātiśākhya*, though not using the term 'uvular', remarks on the strangeness of what he calls the 'guttural' classification of *r̥*, and adds that this 'would point to a guttural pronunciation of the *r* in certain localities or among certain classes; a guttural *r* is a well recognized constituent of many modern alphabets' (Whitney 1862/1962: 22).

The distinguished Indian linguist, S. K. Chatterji, in an article on Sanskrit phonetics in *JIPA*'s predecessor, *Le Maître Phonétique* (1952) writes: 'r appears to have been always a tongue-tip trill. A guttural R was, however mentioned in the *Prātiśākhyas*. It was no doubt a dialectal variant'. As we shall mention below, however, Chatterji had earlier (1926) expressed a different opinion.

Varma (1961: 7) appears to accept the 'velar' classification without comment, but Allen (1953: 55) having described the 'velar' classification as 'problematic' concedes that 'It is just possible that in connection with ṛ we should interpret *jihvamūlīya* as uvular rather than velar'. Mishra (1972: 135) expresses the same sentiment in the same words.

Hock (1992) examines the question of the 'velar' classification of Sanskrit syllabic *r̥* in some detail, quoting many of the ancient sources. He finds it difficult to accept the 'uvular' interpretation of the 'velar' description of syllabic *r̥* as opposed to the postdental/alveolar description of non-syllabic *r*:

> Now, while the change of alveolar r to uvular [R] is not at all uncommon in the world's languages, I know of no case in which it has been confined to syllabic [r]. (Hock 1992:73)

He continues,

> the fact that syllabic ṛ serves just as much as a trigger for *n*-retroflexion as non-syllabic *r* . . . would be accounted for more easily by assuming that its *r*-element has the same apical and postdental articulation as non-syllabic *r* . . . Finally . . . no attested varieties of Indo-Aryan offer any evidence (such as a velar reflex) that would establish a uvular articulation of *r̥*.

Hock goes on to say,

> Under these circumstances, I believe Cardona (personal communication, 1980) is correct in arguing that the term 'velar' here refers to the fact that at some stage, these segments [i.e. both syllabic r and syllabic l] were pronounced as [ᵃrᵃ], [ᵃlᵃ], with an a-element preceding and following the liquid.

Incidentally, Chatterji had earlier made the same suggestion in these words: '[ṛ] has been described as a guttural sound by the '(ṛk-tantra-vyākaraṇa': perhaps it was due to the back sound of [ɑ] figuring in it [ᵃrᵃ] (Chatterji 1926: 243).

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As Hock points out, there seems to be little direct evidence that the vowel *a* was frequently classified as 'velar'. Of eight citations form the ancient texts (Hock 1992: 74–75) six describe *a* as articulated at the *kaṇṭha* (the throat or larynx) and only two suggest a velar articulation. In the remainder of the article Hock adduces evidence of the existence of a syllabic ṛ described as an r flanked by two very short a-type or ə-type vowels – $^{ɑ}r^{ɑ}$ or $^{ə}r^{ə}$.

6.2 The competence of the Indian phoneticians

The ancient Indian grammarians included remarkably competent phoneticians. Allen (1953: 4) correctly draws attention to their 'scientific curiosity, coupled with keen audition', to which I would add their remarkable skill at introspective analysis of articulations, and their experimental investigation of phonetic details.

Note, for example, the careful and correct attention to detail in the description of the c-series (the palatal plosives and nasal) and the semivowel y in rules ii.36 and ii.40 of the Taittirīya Prātiśākhya:

ii.36. tālau jihvā-madhyena ca-varge
on-palate by-tongue-middle in-c-series
'In the c-series, [contact is made] with the middle of the tongue on the palate.'

ii.40. tālau jihvā-madhya-antābhyām ya-kāre
on-palate tongue-middle-by-two-edges in-y-sound
'in the y-sound with the two edges of the middle of the tongue on the palate'

Note also the precise observation of sulcalization in rule i.23 of the Atharva-Veda Prātiśākhya concerning the retroflex sibilant,

i.23. sakārasya droṇikā
of the s-sound trough-shaped
'Of sh, the trough-shaped tongue [is the producing organ].'

or, again, the passing remark in rule xiii.19 of the Ṛk-Prātiśākhya:

xiii.19. soṣmasu çīghrataram prāṇam eke
in-aspirates quicker breath some [people say]
'Some authorities say that the breath is quicker in the aspirates.'

This is correct, as we know from modern instrumental records. The airflow at the release of a voiceless aspirated plosive generally has a higher velocity than in other sounds. This observation implies experimentation, perhaps by articulating sounds with the back of the hand held an inch or two in front of the mouth, a procedure that enables one to perceive differences in the air velocity.

It is inconceivable that these very competent phoneticians could have been so confused about their taxonomic categories that they allotted a sequence of brief vowel + trilled or tapped r + brief vowel [$^{ɑ}r^{ɑ}$] or [$^{ə}r^{ə}$] to the same category, *jihvamūlīya* ('tongue-root-ic' i.e. 'velar'), as the k-class of plosives and [x].

It seems clear that they were describing TWO DIFFERENT TYPES OF SOUND (a) a syllabic tongue-tip trill or tap, and (b) a genuine velar r. It is likely that this velar *r* was a variety of 'molar R'. It is reasonable to suppose that, in examining the sound, they experimentally devoiced it (they were familiar with at least three types of phonation – breath, voice and murmur (i.e. breathy voice) – and had technical terms for them). They would thus have discovered, as Uldall (1958) did (see section 3 above) that when devoiced, this syllabic ṛ resembled [x], the velar allophone of *visarga*.

It is probable that the Sanskrit syllabic ṛ was realized as velar (i.e. molar) and as the $^{ɑ}r^{ɑ}$ sequence at different periods in the history of the language. Hock's (1992: 73)

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problem concerning the coexistence of an alveolar NON-SYLLABIC r and a syllabic uvular R disappears if the 'velar' ɾ was, in reality, a molar r. This type of synchronic coexistence is described by Uldall for her molar and tongue-tip r's, and undoubtedly is valid for many speakers of American English. Moreover, in the production of molar r, the tongue-tip is somewhat raised and drawn back into the body of the tongue. This retracted and somewhat retroflexed tongue shape might well have induced the retroflex pronunciation of *n* referred to by Hock.

6.3 The evidence of sandhi and the Prakrits

Additional evidence for the existence of an approximant, molar-type *ɾ* in Sanskrit is provided by the sandhi rules relating to underlying final *-s* (actually realized in absolute final as *visarga*, i.e. voiceless [h]) . Before a voiced consonant, the endings *-is* [-ih] and *-us* [-uh] are replaced by *-ir* and *-ur*. Thus *agnis* 'fire' but *agnir dahati* 'fire burns', *gurus* 'teacher' but *gurur gacchati* 'the teacher is going'. These are typical examples of s > r rhotacism, implying the existence in Sanskrit of a fricative or approximant type of *r* .

But now compare the fate of final *-as*, which becomes not *-ar* but *-o*, thus *naras* 'man' but *naro gacchati* 'the man is going'. We know that Sanskrit *o* derives from an earlier diphthong *au* or *aw*. So the course of events with respect to *-as* > *-o* was presumably as follows: *-as* > *-ar* which was perceived, and reinterpreted, as *-aw* which > *-o*. But the re-interpretation of *-ar* as *-aw* implies close resemblance between vocalic *ɾ* and the *w* of *aw* (cf. the converse resemblance between *w* and *r* in Armenian, mentioned above). If final *-ir* and *-ur* in Sanskrit did not end up as *-iw* and *-uw*, that was because there were no diphthongs *iw* and *uw* in Sanskrit with which they could be confused: but the diphthong *aw* did exist and final *-ar* must have sounded somewhat like it.

Finally, the reflex of Sanskrit vocalic *ɾ* in the Prakrits is commonly the vowel *a* (often *i* and *u* in palatal and labial contexts). Sen (1960: 1) says: 'Middle Indo-Aryan started with certain definite phonetic changes and tendencies . . . From the very beginning the sonant *ɾ* was lost. Its earliest and most basic resultant in MIA was *a* (through *ar* from $^{q}r^{q}$)'. This, of course, seems to reflect Chatterji's (1926) suggestion. But it seems to me quite probable that an *a* vowel might be a direct reflex of a schwa-like syllabic molar r – cf. the English alternants *person*/*parson*, *Derby*/*Darby*, etc.

7 Conclusion

As Barry (1997) rightly says, on the first page of his R-tickle, trilled R 'is assumed to be the /r/ of Old High German and possibly of Proto-Indo-European'. But it is doubtful if this assumption is justified. Barry's discussion of the 'primacy of the trill' (pp. 43-44) is interesting, but I find his concluding argument less than convincing – namely, that the fact that various r-types are perceptually similar, though differing in articulation implies the existence of 'a perceptual, prototypical trilled R'. Other types of R besides trills tend to be included in the class of 'rhotics' – the possible acoustic/perceptual relationships between them are discussed, slightly pessimistically, in Ladefoged & Maddieson (1995: 244-245).

Incidentally, though perhaps irrelevantly, it is interesting to note that the concept of 'rhoticity' existed in India more than two millennia ago! Deshpande (1978: 282-283), discussing the problem of apparently very different r-sounds triggering retroflexion in following consonants, notes that

> there must be something in common between a strict retroflex sound and alveolars and velars . . . (all of these being terms used to describe Sanskrit R's). . . . Thus, this case of assimilation may be natural, not so much in terms of 'the point of articulation' but in terms of a somewhat

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> similar manner of tongue-raising producing a somewhat similar acoustic quality. . . .This common factor . . . is designated as *ra-çruti* 'sound heard as r 'by Patanjali [Indian grammarian and Pāṇinian commentator of about 150 BC – JCC].

It seems to me that the evidence of rhotacism in several branches of IE, as well as the special cases of Armenian and Sanskrit, strongly suggest that untrilled R-sounds certainly existed in early Indo-European (and probably also in late Proto-Indo-European).

We might perhaps rather tentatively suggest yet another possible piece of evidence for bunched or molar *r* in late Proto-Indo-European. This is the so-called RUKI or IURK rule. This is the 'rule' that, in Indo-Iranian and Balto-Slavic, Indo-European **s*, following the IE sounds *i*, *u*, *k* or *r* was retracted, becoming some form of [ʃ] (and [x] in Slavic). Now, three of the sounds triggering this *s*-retraction involve some degree of tongue-bunching – in the palatal zone for *i*, in the velar zone for *u* and *k*. This suggests that the IE *r* just might have also been a bunched-tongue sound.

In any case, it rather looks as if the once widespread belief in the primacy of Trill is somewhat akin to that other formerly fairly widespread belief in the 'myth of the primordial click' discussed in Catford (1997). But still, the question remains: Why did belief in the primacy of trill become so popular, particularly among Indo-Europeanists? I do not know the answer to this, but it may well have been that nineteenth century philologists, deeply versed in the Classics, were influenced by the fact that Classical Greek and Roman authors described trills as the norm for Greek and Latin, and their view was simply uncritically accepted by later scholars.

References

ALLEN, W. S. (1953). *Phonetics in Ancient India*. Oxford: Oxford University Press.

ALWAN, A., NARAYANAN, S. & HAKAR K. (1997). Toward articulatory-acoustic models for liquid approximants based on MRI and EPG data. Part II: The rhotics. *Journal of the Acoustical Society of America* **101.2**, 1064–89.

BALDI, P. (1994). Some thoughts on Latin rhotacism. *General Linguistics* **34.3–4**, 209–216.

BARRY, W. J. (1997). Another R-tickle. *Journal of the International Phonetic Association* **27**, 35–45.

BUCK, C. D. (1955). *The Greek Dialects*. Chicago: University of Chicago Press.

BERGER, H. (1998). *Die Burushaski-Sprache von Hunza und Nager* (vol. I). Wiesbaden: Harrassowitz.

CATFORD, J. C. (1987). Phonetics and the teaching of pronunciation. In Morley, J. (ed.), *Current Perspectives on Pronunciation Practices Anchored in Theory*, 87–100. Washington, DC: TESOL.

CATFORD, J. C. (1988). Notes on the Phonetics of Nias. In *Studies in Austronesian Linguistics* (Ohio University South-East Asia Series 76), 151–172. Athens, OH: Ohio University.

CATFORD, J. C. (1994). Vowel systems of Caucasian languages. In *Non-Slavic Languages of the USSR*, 44–60. Columbus, OH: Slavica Publications.

CATFORD, J. C. (1997). The myth of the primordial click. In Hegedüs et al. (eds.), *Indo-European, Nostratic, and beyond: Festschrift for Vitalij V. Shevororshkin* (*Journal of Indo-European Studies*, Monograph 22), 51–71. Washington, DC.

CHATTERJI, S. K. (1926). *The Origin and Development of the Bengali Language* (part I). London: Allen & Unwin.

CHATTERJI, S. K. (1952). The pronunciation of Sanskrit. *Le Maître Phonétique* (3e série) **97**, 1–9

DELATTRE, P. & FREEMAN, D. (1968). A dialect study of American R's by X-ray motion picture. *Linguistics* **44**, 29–68.

DESHPANDE, M. M. (1978). Genesis of Ṛgvedic retroflexion: a historical and sociolinguistic investigation. In Deshpande M. & Hook, P. (eds.), *Aryan and Non-Aryan in India*, 235–315. Ann Arbor, MI: Center for South and Southeastern Asian Studies, University of Michigan.

FIRTH, J. R. (1934). A short outline of Tamil pronunciation. Appendix to Arden's *Grammar of Common Tamil*. Christian Literary Society of India.

Gaprindashvili, G. (1966). Xmovanta paringalizaciis bunebisatvis c'axurulsa da udur enebshi [On the nature of pharyngalization of vowels in the Tsaxur and Udi languages]. In *Metq'velebis analizis da sintezis sak'itxebi* [Questions of the analysis and synthesis of speech], 28–80. Tbilisi: Mecniereba.

Grammont, M. (1918). Notes de phonétique générale. *Mémoires de la Société de Linguistique* **XX**, 251.

Hagiwara, R. (1994). Three types of American /r/: sex, syllabic [ɹ] and the American English Vowel space. In *UCLA Working Papers in Phonetics* **88**, 63–90.

Hagiwara, R. (1995). Acoustic realizations of American /r/ as produced by women and men. In *UCLA Working Papers in Phonetics* **90**, 1–187.

Hock, H. H. (1992). Were ṛ and ḷ velar in early Sanskrit? In *VIDYA VRATIN*, *Professor A. M. Ghatage Felicitation Volume*, 69–96. Delhi: Indian Books Centre.

Kantner, C. E. & West, R. (1941). *Phonetics: An Introduction to the Principles of Phonetic Science from the Point of View of English Speech*. New York & London: Harper.

Lass, R. (1983). Velar /r/ and the history of English. In *Current Topics in English Historical Linguistics*, 67–94. Odense: Odense University Press.

Ladefoged, P. & Maddieson, I. (1996). *The Sounds of the World's Languages*. Oxford: Blackwell.

Lindau, M. (1985). The story of /r/. In Fromkin, V. A. (ed.), *Phonetic Linguistics: Essays in Honor of Peter Ladefoged*. Orlando, FL: Academic Press.

Lorimer, D. L. R. (1935). *The Burushaski Language* (vol. 1). Oslo: Aschenboug.

McDonough, J. & Johnson, K. (1997). Tamil liquids: an investigation into the basis of the contrast among five liquids in a dialect of Tamil. *Journal of the International Phonetic Association* **27**, 1–26.

Meillet, A. (1903). *Esquisse d'une Grammaire Comparée de l'Arménien Classique*. Vienne: Imprimerie des pp Mékhitharistes.

Mishra, Vidhata (1972). *A Critical Study of Sanskrit Phonetics*. Varanasi: Chowkhamba Sanskrit Series Office.

Nandris, O. (1963). *Phonétique Historique du Roumain*. Paris: Klincksiek.

Pisani, V. (1951). Studi sulla fonetica dell armeno II. *Ricerche linguistiche* **II**.

Sen, S. (1960). *A Comparative Grammar of Middle Indo-Aryan*. Poona: Linguistic Society of India.

Sturtevant, E. H. (1940). *The Pronunciation of Greek and Latin*. Philadelphia, LSA.

Uldall, E. (1958). American 'Molar' R and 'Flapped' T. In *Bulletin of Laboritorio de Fonetica Experimental da Faculdade de letras da Universidade de Coimbra*, 103–106.

Varma, Siddheshwar (1961). *Critical Studies in the Phonetic Observations of Indian Grammarians*. Delhi: Munshi Ram Manohar Lal.

West, R. & Kantner, C. E. (1933). *Kinesiologic Phonetics*. Ms., Madison WI College Typing Co.

Whitney, W. D. (ed. and transl.) (1962 [1862]). *The Atharva-Veda Prātiśākhya*. Varanasi: Chowkhamba Sanskrit Series Office, Varanasi-1, India.

Whitney, W. D. (ed. and transl.) (1973 [1868]). *The Taittīriya-Prātiśākhya*. Delhi: Motilal Banarsidass.