

## Liquids: Laterals and Rhotics or Much More?

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### 1. Introduction

In phonology the classic division within the sonorant consonants is between nasal and liquid.<sup>1</sup> Nasals by the nature of their articulation are easy to define and have generated a substantial literature (Piggott 1987, 1992; Huffman & Krakow 1993 among many others). Liquids have received far less attention and are more difficult to define because they demonstrate greater phonetic variability (but see Dixon 1972; Bhat 1974; Walsh Dickey 1997 for discussion on these segments). Liquids are often defined in general terms as ‘non-nasal sonorant consonants’ (Walsh Dickey 1997). In this paper, we consider this definition of liquids.

Our paper has three sections. In the first section we focus on the place of liquids in the broader category of sonorant consonants. Here, we define our basic categories, consider the distribution of different types of sonorants cross-linguistically, and touch on how phonetics provides little justification for this classification. This discussion points to the existence of a class of liquids, consisting primarily of rhotics and laterals. The second section examines the phonological criteria for membership in the class of liquids, none of which is based on the phonetic form of the segment. Our justification for questioning the traditional view of liquids as comprised of rhotics and laterals is based on the patterning of a Woods Cree interdental segment which patterns as a non-nasal sonorant but has the phonetic form of a dental fricative. In our final section, we consider whether the patterning of this segment in Woods Cree can advance our understanding of the definition of liquids as a category. On the basis of this discussion, we introduce a number of research questions that we feel need to be explored.

### 2. The category of liquid

The definition of a liquid as a ‘non-nasal sonorant consonant’ refers specifically to qualities that liquids possess or lack in terms of how they are articulated. They are classified as consonants because their articulation involves some constriction in the oral cavity; they are classified as sonorant as their production involves a type of constriction open enough to permit a voiced airstream to pass through without friction (Kenstowicz 1994); and they are classified as non-nasal because air is expelled through the *oral* cavity rather than the nasal cavity.

Depending on one’s theoretical perspective non-nasal sonorants can either be interpreted as consisting solely of liquids or as a class subdivided into liquids and glides. In the standard

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<sup>1</sup> Nasals and liquids are considered to be sonorant consonants while glides are not considered to be true consonants under the standard view (see Halle 1992; Kenstowicz 1994).

view, glides are classified as vocoids, leaving liquids as the only type of non-nasal sonorant consonant (Halle 1992; Kenstowicz 1994; Walsh Dickey 1997) but in typological studies (Maddieson 1984) and other research (Clements & Hume 1995) glides can be classified as consonants and are then grouped together with the liquids to form a class of approximants all of which are non-nasal sonorants. Under this latter view glides can still be differentiated from liquids in terms of their non-turbulent air flow (Laver 1994: 269; Ladefoged & Maddieson 1996: 322-326).

Regardless of whether glides are counted as consonants or as vocoids, liquids appear to be a residual category consisting of the consonants left over after the classes of obstruents, nasals and glides have been phonetically defined. As a consequence, the class of liquids includes any oral sound made with any stricture open enough to avoid turbulence or obstruction, but still closed enough to produce a consonant. In practice this typically leaves the *l*-like laterals and *r*-like rhotics making up the class collectively called 'liquids'. It is however important to note that this class is not defined in terms of any phonetic similarity *between* laterals and rhotics. In fact each group is a phonetically disparate group with a wide range of phonetic realizations ranging from approximant-like segments, to stop-like flaps or taps and even including some fricatives.

Within the group of liquids, the lateral segments are produced for the most part (but not exclusively) in the dental/alveolar region and share only their lateral articulation. The most common variety of lateral is the lateral approximant [l] occurring in 79.7 per cent of languages documented in the UPSID database (Maddieson 1984). The non lateral members (the rhotics) have no shared phonetic attribute. The overall unity of rhotic segments lies on historical connections between subgroups of rhotics and on the choice of the letter <r> to represent them all (Ladefoged & Maddieson 1996: 245). Within the several well-defined subsets of rhotics the most common variety across languages is the trill [r] (47.5 per cent), followed closely by taps/flaps<sup>2</sup> [ɾ] (38.3 per cent). Approximants [ɹ] occur in only 9.9 per cent of languages while the rhotic fricatives (3.5 per cent) are even less frequent (Maddieson 1984). Fricatives classified as rhotic range from the voiced uvular fricative [ʁ] of French through to the post alveolar trill fricative [r̥] of Czech. Note that as voiced fricatives, these rhotics involve stricture close enough to create friction, so they are *phonetically* more obstruent-like than sonorant. Nonetheless these fricatives are classed as sonorants in both French (Tranel 1987) and Czech (Kučera 1961) because they pattern phonologically as sonorant consonants in most cases for these languages.

In short a consideration of the phonetic status of liquids shows them to be a class defined in terms of articulatory features that they *lack* rather than by features that they share. In some cases at least, phonological patterning, that is, the way they contrast or alternate with other segments is the only reason for their classification as liquids.

## 2.1 Typological evidence for liquids as a class

In spite of the phonetic disparity between sounds classified as liquids cross-linguistically, there is still substantial evidence for maintaining liquids as a distinct class in contrast to the other sonorant consonant categories: nasals and glides. Table 1 summarizes the frequency of these three classes based on their occurrence in the UPSID database of 317 languages

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<sup>2</sup> Taps are articulated by moving the tongue tip to a point of contact in the dental or alveolar region of the mouth while flaps are made by retracting the tongue tip behind the alveolar ridge (see Ladefoged & Maddieson 1996: 230-232).

(Maddieson 1984). The majority of languages in this database (87 per cent) have all three sonorant consonant types. The most widespread sonorant consonant type in this database is the nasal with 97 per cent of all languages having at least one nasal segment. Liquids (laterals and rhotics) are almost as frequent, occurring in 96 per cent of the languages and glides, while the least frequent, are still evident in 90 per cent of the languages. The high frequency of liquids in the database would suggest that liquids are a category of sonorant consonant distinct from nasals and glides. Their status as a distinct category is further confirmed by the fact that they occur as the sole type of sonorant consonant in some languages (e.g. Rotokas).

**Table 1:** Frequency of Nasals, Glides and Liquids (UPSID database of 317 languages: Maddieson 1984)

TYPES	NASALS	GLIDES	LIQUIDS	FREQUENCY	Example
A	-	-	-	1	Mura
B	-	+	-	1	Puget Sound
C	-	-	+	2	Rotokas
D	-	+	+	4	Quileute
E	+	-	-	2	Amoy
F	+	+	-	8	Sentani
G	+	-	+	19	Nubian
H	+	+	+	280	English

### 3. Liquids: a phonological perspective

The distribution of sonorant consonants in typological studies, such as that of Maddieson (1984), suggest that liquids should be a category despite the lack of a common phonetic basis to the class. In the absence of clear phonetic evidence the strongest evidence for laterals and rhotics forming a natural class comes from phonology in the form of phonotactic restrictions and their patterning in a variety of segmental phenomena (Walsh Dickey 1997). English is an example of a language with phonotactic evidence for liquids. The occurrence of /l/ and /r/<sup>3</sup> as the second consonant is permitted in onset position (e.g. plant, prey), however neither a nasal (\*pneumonia) nor an obstruent (\*psoriasis) can occur here. In short the patterning of the lateral /l/ and the rhotic /r/ indicates that they form a class of consonants distinct from nasals and obstruents.

In other languages *l*- and *r*-like segments pattern together in contrast to other consonants in a number of phonological processes. A noted example is that of liquid dissimilation in Latin where /l/ in the adjectival suffix *-alis* is dissimilated to [r] when the root already contains a lateral e.g. *nav-alis* 'naval' but *lun-aris* 'lunar'. Dissimilations of this type are not found with other segments. Another example comes from Korean where [r] and [l] are in allophonic variation, [r] occurs in the onset as in *muri* 'of the water' and [l] occurs in coda position as in *mul* 'water' (Demers & Farmer 1991).

Other sources of data that are discussed in the literature to support a natural class of liquids include diachronic studies into the development of segments and child language acquisition research. The development of *Cl*- clusters from Latin into *Cl*- in Spanish and *Cr*- in Portuguese is an illustration of the former (van der Torre 2003) while the late

<sup>3</sup> We follow the practice in phonology of representing the rhotic approximant of English as /r/ phonologically although phonetically the IPA symbol is [ɹ]. The phonetic symbol [ɹ] will however be used when discussing the specific phonetic qualities of this segment in English.

mastery of the production of both /l/ and /r/ but not nasals in English speaking children is an example of the latter (Dinnsen 1992).

The strongest evidence for classifying laterals and rhotics together as a class of liquids rests then primarily on the patterning of these two subgroups of segments together as distinct from other consonants within a phonological system. Given that these same consonants are relatively unrestricted in terms of stricture, it follows that any consonant that patterns phonologically in a similar fashion, that is patterning with sonorant consonants in some processes but remaining distinct from those same consonants in other processes, can be legitimately classed as a liquid. Under this interpretation such a consonant need not possess any particular phonetic features associated with laterals or rhotics.

Anomalous segments that belong to a class in terms of phonological patterning but do not possess the phonetic features traditionally associated with that class are not only possible in principle, they are attested in practice. Rice (1993) argues convincingly that voiced obstruents can be defined phonologically as sonorant consonants in a range of languages while Hall (2003) makes a similar case for the Czech /v/. In the section below we discuss Woods Cree /ð/ as a further case.

### 3.1 Woods Cree /ð/

Woods Cree is one of several dialects of Cree spoken across Canada. This dialect, spoken in Manitoba and Saskatchewan has approximately 10,000 speakers, many of whom are elderly. The majority of middle aged speakers are bilingual while younger speakers have varying degrees of proficiency in Cree. Almost all members of the community have a high level of competence in English.

Woods Cree differs from many other North American languages in that it has a simple phonological inventory. A quick overview of the consonantal inventory in Table 2 shows there to be three glides (w j h), two nasals (m n), five voiceless obstruents (p t  $\bar{t}$  s k) and three other segments (l r ð). /l/ and /r/ shown in brackets are marginal, appearing only in a limited number of loan words (e.g. words for certain everyday objects such as *ti:lipo:n* ‘telephone’ and first names ‘Larry, Linda’). These two phones have a limited function in Woods Cree, and they do not appear to align readily with other segments apart from /ð/. Woods Cree /ð/ is a voiced dental fricative that has a wide range of phonetic realizations [ð̥, r, j, l, ð, θ, t].

**Table 2:** Woods Cree Consonantal Inventory

p	t	ts̄	k
	s		
	ð		
m	n		
	(lr)		
w	j		h

Historically /ð/ is reconstructed as a sonorant consonant Proto-Algonquian \*l (Goddard 1980) and it has cognate forms that have a sonorant realization in the neighbouring Cree dialects, in Plains Cree as the glide /j/, in Swampy Cree, the nasal /n/ and in Moose Cree, the liquid /l/ (see Wolfart 1973).

Synchronically there is a range of phonological evidence to suggest that /ð/ still patterns as a sonorant rather than an obstruent in Woods Cree (see Starks and Ballard 2005). Although each piece of evidence may be inconclusive in its own right, the four pieces of evidence together present a strong argument that /ð/ patterns as a sonorant in this dialect.

The first piece of evidence comes from stylistic variants associated with the segment /ð/ by bilingual members of the Woods Cree community. When code switching or speaking English the voiced dental fricative in words such as ‘the’ or ‘mother’ is rendered as a fricative or perhaps more frequently, as a stop [d] or an affricate [tð]. In English /ð/ is clearly interpreted as an obstruent. In Woods Cree, /ð/ exhibits a different pattern suggesting that /ð/ in the English system of these Cree speakers is categorized differently from /ð/ in their Cree system. [ð] is the most frequent and unmarked realization of /ð/ in Woods Cree but one possible and common realization for this segment in naturally occurring discourse is the tap [r], a variant that Cree speakers never use for English /ð/. Since taps are often classified as sonorants and they alternate with rhotic segments in many languages (Laver 1994) this association suggests that /ð/ could well be classified as sonorant in Woods Cree.

A second piece of evidence that strengthens this view comes from allophonic variation. /ð/ surfaces as the glide [j] in the environment of high vowels as in *it:ithihtam* /iti:ðihtam/ [iti:jih̥tam] ‘s/he thinks about it’. If /ð/ were assumed to be a sonorant, an association with an allophonic variant such as [j] would not be surprising.

Additional evidence for the classification of /ð/ as a sonorant comes from child language. In language acquisition mothers often talk to their children using a form of child-directed speech, labelled here as caregiver speech. In studies of caregiver speech it is common for substitutions or simplifications of certain segments to occur, and such simplifications or substitutions are not random (see Laughren 1984). In Laughren’s work on Warlpiri baby language, obstruents are simplified to obstruents while sonorant consonants are consistently substituted with other sonorant consonants. For example *ramarra* ‘ribs’ where *rr* represents an apico-alveolar flap is rendered as *ramaja* with a lamino-palatal glide [j] in

caregiver speech. Thus, the simplifications appear to reveal the caregiver's intuitions about the class membership of both the adult and the substituted phone. In the caregiver speech of Woods Cree /ð/ is replaced with [l] and not with an obstruent such as [s] or [t]. Words like *ka:tha* /ka:ða/ 'don't' and the first person pronoun *ni:tha* /ni:ða/ 'I/me' are pronounced respectively as [ka:la] and [ni:la]. This strongly suggests that caregivers who speak Woods Cree consider [ð] and [l] to be members of the same class while [ð] and [s] or [t] are not.

A final piece of evidence relates to loan word phonology (see Paradis & LaCharité 1997, 2001; Rose 1999) where it has been argued that segments in loanwords that do not occur in the borrowing language are adapted according to the contrastive phonological features already present in the phonology of the borrowing language rather than by altering these segments to the closest phonetic match in that language. Under this view the English voiced dental fricative /ð/ would be borrowed as [z] in a language that uses the features [continuant] [voice] in its phonology but does not use [distributed] contrastively in the system. The same segment would be borrowed as [d] in a language where the feature [continuant] is not contrastive.

In Woods Cree, English loan words with [ɹ] such as 'train', 'truck' and 'bread' are realized with a rhotic [r], [ɹ] or [ð]. The fact that words from English with the rhotic [ɹ] are adapted as [ð] in Woods Cree suggests that these two segments share features in the phonological system of Woods Cree speakers. Moreover it is interesting to note that the English rhotic is not adapted to [j] which in terms of phonological features would seem to be a closer match [coronal +sonorant + approximant]<sup>4</sup> than [ð]. The choice of [ð] over [j] as an equivalent for English [ɹ] can only be accounted for if [ð] is assumed to be an oral sonorant with features [coronal +sonorant +approximant +continuant] and not an obstruent.

In sum, an analysis of the Woods Cree segment /ð/ suggests that this fricative like segment functions as a sonorant consonant in Woods Cree and not as an obstruent. All the evidence presented above suggests fairly directly that /ð/ is more likely to be a non-nasal sonorant consonant than a nasal one since the data show alternation between /ð/ and glides, laterals and rhotics, but not with nasals. An analysis of /ð/ as a sonorant is further supported by the fact that bilingual members of the community interpret Woods Cree /ð/ as being somewhat different from English /ð/. In the English of Cree speakers /ð/ patterns with obstruent variants while in Cree this segment is clearly associated with very different variants.

#### 4. Discussion

From our discussion of the Woods Cree data it is clear that /ð/ patterns as a non-nasal sonorant because it alternates with [j] and has an association with lateral [l] and rhotic [ɹ]. As discussed earlier, consonants that are non-nasal and sonorant either form a distinct class traditionally termed liquids or a class of approximants consisting of two subclasses of liquids and glides. Under the one view (Halle 1993; Kenstowicz 1994; Walsh Dickey 1997) where non-nasal sonorant consonants are defined as liquids and liquids as non-nasal

<sup>4</sup> These features are based on those from Clements & Hume 1995.

sonorant consonants /ð/, by definition, has the status of a liquid in Woods Cree. This conclusion may be difficult to accept since liquids are most often phonetically realized as lateral or rhotic. However, laterality or rhoticity are not sufficient grounds for membership into the class of liquids. As we discussed earlier, specific phonetic features are *not* part of the definition of the class of liquid, rather the definition of liquids is based on phonological patterning. Given this, the fact that Woods Cree /ð/ is a liquid is not outside the realm of possibility.

Our conclusion is no different with the alternative view (Maddieson 1984; Clements & Hume 1995). Under this view non-nasal sonorant consonants can either be liquids or glides. These two subclasses can be distinguished from each other if there is evidence within a language that they do not pattern uniformly as a class but exhibit different phonological patterning. In Woods Cree /ð/ is differentiated from the glides since there are processes that occur with the glides but not with /ð/. One example of such a process occurs in rapid speech. Here /w/ alternates with [j] but not with [ð] as with *awina* 'who' where /awina/ becomes [ajina] but not \*[aðina]. The fact that /ð/ patterns differently to the glides indicates that two subclasses of non-nasal sonorants are required in Woods Cree. This leads us once again to conclude that /ð/ in Woods Cree is classified on phonological grounds as a liquid despite its phonetic status as an obstruent.

The idea that Woods Cree /ð/ functions as a liquid raises a number of issues that need to be explored in further research. One issue concerns the phonetic characteristics of segments that can be considered liquid. The earlier discussion on the lack of a phonetic basis for this subclass, taken together with the evidence from segments such as Woods Cree /ð/, casts doubt on the commonly held view that liquids are *restricted* to rhotics and laterals. What the phonetic limitations may be on segments that function phonologically as liquids but are neither lateral nor rhotic can only be ascertained with a full review of languages that on the surface have no evidence of liquids.

A second but related issue concerns the relationship between phonetic detail and phonemic inventory. In our discussion of Woods Cree we found that the phonological patterning of /ð/ as a liquid in Cree came in tandem with the lack of underlying laterals and rhotics in the language. We may wonder then whether anomalous segments (where the phonetics and phonological classification do not match) only occur with certain phonemic inventories. Perhaps an analysis of languages that lack specific classes of segments in their inventory would serve to elucidate this issue.

A third and final issue concerns the relationship between fricatives and approximants. This is an issue we have observed in passing while surveying the phonetic and phonological evidence for liquids. In considering the phonetic characteristics of liquids these segments display a range of constriction types. Moreover it was noted that the fricative and approximant stricture types seem to display a close affinity since lateral approximants (Maddieson 1984: 74), and possibly some rhotics when voiceless, are phonetically realized as fricatives. This observation may also have some phonological implications. From a phonological perspective, when analysing inventories for sonorants, we uncovered an interesting correlation. Although most languages have one or two liquids in their inventory, the inventories of those few languages which appear to have more than two liquids tend not to have many fricatives (Australian languages in particular). Given that the difference

between a fricative and an approximant is slight as both stricture types involve continuous airflow, there may be many more relationships here than previously considered. If this is the case, then perhaps it is time not only to contemplate the phonetic and phonological representation of liquids as a category, but also the patterning and relationships amongst other types of segments.

## 5. Conclusion

In this paper we have raised the possibility that liquids as a subclass of non-nasal sonorant consonants need not be restricted to laterals or rhotics as has been traditionally assumed. Given that the phonetic basis for liquids is weak and has limited use as a criterium for identifying a segment as a liquid, a more critical indicator for membership into the class of liquids is the patterning of segments in contrast to other perhaps more clearly defined classes of segments such as nasals or glides.

Although the category liquid needs to be explored in more detail than in the present paper, we hope that our discussion and suggestions for further research underline a need to more fully consider the form, the definition of the category traditionally labelled as liquid, and its relationship to other segments.

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