Chapter 2

Phonological Characterization of the Class of Liquids

In this chapter, the phonological behavior of liquids will be examined from a cross-linguistic perspective. The groups of rhotics and laterals which function as a class in different languages will be identified, and the different ways in which they pattern together will be described. Based on the results of this survey, three fundamental properties which characterize the class of liquids will be proposed. Finally, some asymmetries in the phonological behavior of rhotics and laterals will be addressed.

2.1 Distributional Behavior of Liquids

Rhotics and laterals share many distributional properties, within and across languages, that suggest that they form a phonological class. Some word-level phonotactics involving rhotics and laterals will first be identified, before constraints on the distribution of liquids in the syllable are examined.

2.1.1 Distribution within the Word

Word-Initial Constraints

In some languages, laterals and rhotics are together subject to word-level distributional restrictions which do not always apply to other approximants. Walsh Dickey (1997) cites eight languages in which there exists a word-initial prohibition on all liquids. Her survey has been augmented with another nine languages and language families in which liquids are (or were) prohibited word-initially (Table 2.1). Although many of these languages are Australian, this phenomenon cannot be simply dismissed as an isolated areal feature, because the same constraint applies also in the Turkic languages, Kuman and Nii (New Guinea), Dizin (Afro-Asiatic) and Tamil (Dravidian).

LANGUAGE	LIQUID CONSONANTS
Nii	/l/
Korean	/l/
Dizin	/l/, /r/
Mongolian	/l/, /r/
Turkic	/l/, /ɾ/
Djabugay	/l/, /r/, /ɹ/
Guugu Yimidhirr	/l/, /r/, /ɻ/
Warrgamay	/l/, /r/, /ɹ/
Yidiŋ	/l/, /r/, /ɹ/
Mbabaram	/l/, /r/, /ɻ/
Kuman	/l/, /ʟ/, /ɾ/
Tiwi	/l/, /r/, /ɹ/, /ɻ/
Mayi	/l/, /ɭ/, /r/, /ɹ/
Tamil	/l/, /ɭ/, /r/, /r̲/, /ɻ/
Diyari	/l/, /l̪/, /ɭ/, /ʎ/, /r/, /ɹ/
Panyjima	/l/, /l̪/, /ɭ/, /ʎ/, /r/, /ɾ/
Pitta-Pitta	/l/, /l̪/, /ɭ/, /ʎ/, /ɽ/, /ɻ/

TABLE 2.1: **Constraints on liquid distribution**: *word-initial.

In some cases, the prohibition on word-initial liquids is a historical constraint. Al-

though the lexicon of Modern Turkish, for example, contains hundreds of liquid-initial loan words, these all originate from non-Turkic languages, and are greatly outnumbered by words beginning with other classes of consonants.[1] Likewise, there are no liquid-initial words indigenous to Tamil, but the modern language uses some loan words violate which this constraint: rūpāy [ruːbaːj] *'rupee'*, rācā [raːʃaː] *'long'* (Kuno 1958). No liquid-initial words are attested in Korean (isolate) before the influx of Chinese vocabulary into the language in the 5th Century, and the resistance against initial liquids can be seen in the nativized forms of some of these early borrowings (Cho 2001, Table 2.2).

CHINESE	KOREAN	GLOSS
/lok/	/nok/	'green'
/lampi/	/nampi/	'pot'
/ljuk/	/nuk/	'six'
/latjən/	/nacən/	'Latin'

TABLE 2.2: **Korean Nativization of Liquid-Initial Words**.

Walsh Dickey (1997) observes that Kuman (Trans New-Guinea) uses three liquids – including the rare velar lateral /ʟ/ – none of which may occur word-initially (Pfantz & Pfantz 2005), so this phenomenon cannot be explained cross-linguistically as a constraint on the distribution of coronal segments.

Some languages that prohibit rhotics and laterals word-initially, tolerate word-initial glides, demonstrating that liquids have a distinct status from other approximants in the word-level phonotactics of Mongolian, Pitta-Pitta[2] and Mbabaram. A similar phenomenon can be observed in Yaygir (Pama-Nyungan): words may begin with stops, nasals, glides or vowels, but never rhotics (Table 2.3).

/baginaj/	'small'	/daːbaj/	'dog'	/ɟaːɲaɲ/	'ant'	/gaːbi/	'wallaby'
/maɟa/	'boss'	/nagar/	'chest'	/ɲaːgi/	'see'	/ŋaːbi/	'drink'
		/jaːgaj/	'shark'			/waːgaj/	'fire'
		/ina/	'foot'	/alina/	'wind'	/uːlun/	'rain'
*#/l/-, *#/r/-, *#/ɾ̥/-, *#/ɽ/-							

TABLE 2.3: **Constraints on word-initial consonants**: Yaygir (Crowley 1979).

[1] Johanson & Csató (1998) note that prothesis is commonly used as a repair strategy with loanwords to avoid initial liquids in Turkic, e.g. Kazakh: *orïs* 'Russian'.

[2] Blake (1979) cites two clan names which are rhotic-initial: ɻiŋuɻiŋu and raŋwa, but asserts that liquid-initial words are not generally found in Pitta-Pitta.

Along with the three rhotics, Yaygir also uses a lateral /l/ which is distinctive in medial positions, but neutralizes with /d/ in word-initial positions (/duwa/ *'boomerang'* → [duwa] ∼ [luwa]), so Crowley lists no words as underlyingly lateral-initial. Yaygir is another language with a rich inventory of liquids which are subject to constraints which do not apply to the other approximants, suggesting that rhotics and laterals together constitute their own subclass of sonorants within the phonotactic domain.

Word-Final Constraints

Rhotics and laterals are found word-finally in languages which prohibit other word-final consonants. In most varieties of Modern French, consonants generally delete in word-final position unless undergoing liaison in pre-vocalic environments. Uniquely amongst the French consonants, neither the rhotic /ʀ/ nor lateral /l/ are deleted in word-final non-liaison environments. The examples in Table 2.4 are adapted from Carton (1974).

les̲ camarades	[le.ka.ma.ʀad]	'the friends'	(/s/ → ∅ | _ #)
peti̲t̲ camarades	[pe.ti.ka.ma.ʀad]	'small friend'	(/t/ → ∅ | _ #)
che̲r̲ camarades	[ʃeʀ.ka.ma.ʀad]	'dear friend'	(/ʀ/ → [ʀ] | _ #)
nu̲l̲ camarades	[nul.ka.ma.ʀad]	'no friend'	(/l/ → [l] | _ #)

TABLE 2.4: **Preservation of word-final liquids**: French.

In other languages, laterals and rhotics pattern amongst a larger set of segments licensed at the end of words: Literary Tamil disallows word-final consonants except for {/m/-/n/-/ɳ/; /l/-/ɭ/-/r/-/ɻ/; /j/} (Schiffman 1999); Yaygir allows only word-final vowels, nasals, /j/, /l/ and /r/ (Crowley 1979); Fante allows only word-final nasals and [l]∼[r] (Abakah 2005).

In the languages surveyed above, liquids constitute a (sometimes maximal) subset of the segments which distribute word-finally. In other languages, both laterals and rhotics are prohibited from word-final position. In Thai, possible final consonants include all three nasals {/m/,/n/,/ŋ/}, both glides {/j/,/w/}, and a set of stops produced at all places of articulation {/p/,/t/,/k/,/ʔ/}. Missing from this inventory are all fricatives and the two liquids /l/ and /r/ (Iwaski & Ingkaphiron 2005). Similar constraints apply in the Burmese language Shan, which prohibits only the liquids and glottal obstruents from word-final position, while allowing stops and glides (Matisoff 2003).

These examples serve to illustrate that laterals and rhotics can pattern together

either by their collective presence or absence from certain environments, often as a subset of larger groups of segments, rather than a uniquely distributed class. Nevertheless, the data illustrate that laterals and rhotics distribute in similar ways across a diverse range of languages, suggesting that a class of liquids has legitimacy in word-level phonology.

2.1.2 Distribution within the Syllable

Laterals and rhotics display strong cross-linguistic tendencies to pattern together within the domain of the syllable. In this section, some common patterns of distribution, and constraints upon the syllable-level organization of liquids will be reviewed.

Syllabicity of Liquids

In some languages, both laterals and rhotics may act as syllabic consonants; other than nasals, these are commonly the only non-vocoids which may appear in a syllabic nucleus. This is the case in rhotic dialects of English which allow pronunciations such as *bottle* ['bʌt.l̩], *butter* ['bʌt.ɾ̩], *bottom* ['bʌt.m̩], *button* ['bʊɾ.n̩]], and in Berlin German, in which the words *Scheitel* 'parting' and *besser* 'better' may be produced as ['ʃaɪt.l̩] and ['bɛs.ɾ̩] (Wiese 2001b).

29 (16%) of 182 languages surveyed by Bell (1978) were found to use at least one syllabic consonant classified as a liquid, while only six languages (3%) use non-liquid, non-nasal syllabic consonants.

Although many languages allow sonorant consonants to become syllabic in reduced syllables or in rapid speech, there is an important distinction to be made between truly syllabic phonemes and 'trapped' consonants, which become syllabified in place of reduced vowels. Scheer (2004) develops a variety of tests, according to which the sonorants in English and German examples do not qualify as true syllabic consonants. Nevertheless, the fact that laterals and rhotics pattern with nasals in their capacity to fill nuclei in these languages indicates that these segments differ from obstruents in some fundamental respect.

In Czech, only /l/ (*vl̩.na* 'wool'), /r/ (*hr̩b.lo* 'throat') and /m/ (*sed.m̩* 'seven') may function as syllabic consonants. Unlike in Germanic languages, Czech liquids (but not the nasal) may function as nuclei of stressed syllables: *prst* 'finger'; *hrb* 'hunch'; *vlk* 'wolf' (Scheer 2004). In Slovak, laterals and rhotics are the only syllabic consonants (excluding trapped consonants). Along with the short lateral /l/ and rhotic

/r/ found in other Slavic languages, Slovak contrasts two additional liquid segments /lː/ and /rː/, all four of which may be syllabic: *dlh* [dl̩h] 'debt', *klb* [kl̩ːb] 'joint', *krčma* [kr̩ʃm.a] 'inn', *krč* [kr̩ːʃ] 'cramp' (Rubach 1993; Kenstowicz & Rubach 1986).

It appears that laterals and rhotics pattern together in these languages because, unlike obstruents, they share some phonological property with vocoids which allows them to function as syllabic nuclei. The data also suggests that liquids have a different status in many Indoeuropean languages, compared to some Semitic and Athapaskan languages, for example, which allow a greater variety of segments to act as syllabic. In Chapter 9 the role of liquids in syllabification will be examined in further detail, and the case will be made that their potential to act as nuclei derives from the presence in both rhotics and laterals of an intrinsic tongue body gesture.

Consonantal Organization in Onsets

In languages with consonant clusters, liquids tend to occur closer to the syllable nucleus than other types of consonant. In many cases, there are strict phonotactic constraints on the onset which restrict the distribution of liquids with respect to other segments.

A common type of onset cluster is that found in Boro (Tibeto-Burman), consisting of maximally two consonants, the second of which must be the alveolar trill /r/ or the lateral /l/ (Basumatārī 2005). Onset clusters in Hatam (West Papuan) can consist only of an initial stop or /s/ followed by a liquid: /pri/ 'jump', /bri/ 'clamber', /tri/ 'sell', /kri/ 'tie', /sra/ 'cut along the grain' (Reesink 1998). Onsets in many other languages conform to the same template: /C(L)-/, where C is one of subset of consonants, and L is a lateral or rhotic: Portuguese (Romance), Turkish (Turkic), Kammu (Mon-Khmer), and Tarao (Tibeto-Burman) all follow this pattern, as do Acehnese, Rade, and most other languages in the Chamic (Austronesian) family (Thurgood 1999).

In languages which allow even more complex onsets, the phonotactics often dictate that the cluster is liquid-final. While Dutch allows up to three consonants in an onset cluster /$C_1C_2C_3$-/, C_3 may only be the lateral /l/ or rhotic /r/ (Table 2.5).

The same constraints apply to three-consonant onsets in Swedish (Engstrand 2001), Irish (Ní Chiosáin 1999) and Romanian (Chitoran 2002). Onset clusters in Ega (Kwa) can begin with any of the 22 obstruent consonants, but must end with the single phonological liquid – prototypically a lateral /l/, which is realized in free variation with [r] (Connell et al. 2002). Considering the extensive combinatorial possibilities of consonant clustering in each of these languages, it is remarkable that

/spr-/	*spreeuw*	'starling'
/str-/	*stroom*	'stream'
/skr-/	*skriba*	'scribe'
/spl-/	*splinter*	'splinter'
/skl-/	*sklerose*	'sclerosis'
/sxl-/	*schreeuw*	'cry'

TABLE 2.5: **Dutch three-consonant onset clusters** (Booij 1995).

the set of onsets observed in each language is so small. Of the 6840 three-segment clusters which could potentially be created from the 20 consonants of Dutch, for example, only six combinations (0.09%) are found in onsets. In these languages rhotics and laterals share some special phonological property, distinct from obstruents, which licenses complex onset clusters, and dictates that the liquid must appear as the final element.

Liquids sometimes pattern with a larger set of sonorants as the consonants which are tolerated in cluster-final position. Characteristic of the phonology of Niger-Congo languages such as Dschang (Cameroon) is that onset clusters are either glide-final, or else they conform to the template #(N)OL-, where L represents a liquid (Maddieson 1981). All onsets in Chamorro end with one of the three approximants {/l/,/r/,/w/} (Topping & Bernadita 1973). In other languages, liquids cluster between the obstruents and other approximants: in Eastern Kayah Li (Burma, Sino-Tibetan) onsets may be described by the template #CLG-, where only a liquid may appear in the second slot before a glide (Solnit 1997).

The special status of liquids as cluster-enabling segments can be seen when clusters emerge in languages with a preference for simple onsets. Trask (1989) observes that historically, no complex onsets of any form were permitted in Basque; Hualde (1991) notes that they are still rare and often simplified or repaired in loanword phonology: *luma* < *pluma* 'feather', *liburu* < *libru* 'book'. Despite the strong preference for simple onsets in Basque, a number of clusters have survived in loanwords, all of the form #CL-: *prakak* 'trousers', *andre* 'woman', *fruitu* 'fruit'.

Tamil syllabic structure overwhelmingly conforms to the template (C)V(ː)(C(C)), but Karunakaran (2000) gives examples of five different word-initial clusters which have emerged in some varieties of spoken Tamil (Table 2.6). Other than the single example of an obstruent-glide onset, all of these clusters are facilitated by liquids. The Tamil orthography indicates that each of these words originally began with a CV syllable, which suggests that the clusters arose as the result from vowel deletion: /palaː/ → [plaː], /teɭaː/ → [tɭaː], /kiɭaː/ → [kɭaː], /vijaː/ → [vjaː], or metathesis: /paru/ → [praː].

ONSET CLUSTER	EXAMPLE	PRONOUNCED	GLOSS
/#pl-/	பலா மரம்	[plaːmarom]	*'jack tree'*
/#pr-/	பருந்து	[praːntu]	*'eagle'*
/#tɭ-/	சொள்ளாயிரம்	[tɭaːjrom]	*'nine hundred'*
/#kɭ-/	கிளாக்காய்	[kɭaːkkaːj]	*'a carissa fruit'*
/#vj-/	வியாழன்	[vjaːɭen]	*'Thursday'*

TABLE 2.6: Tamil word-initial consonant clusters (Karunakaran 2000)

Consonantal Organization in Codas

Syllable codas too, are often subject to phonotactic constraints which can be formulated more succinctly by appealing to the class of liquids, since rhotics and laterals share similar distributional properties in the rhyme.

Laterals and rhotics are commonly found together amongst a larger set of consonants which are licensed in the rhyme. In Portuguese, the only coda consonants are liquids or /s/ (Azevedo 2005). Syllable codas in Kuman are formed only from {/m/,/n/,/ɾ/,/l/,/ʎ/} (Pfantz & Pfantz 2005). Kanuri (Nilo-Saharan) and Mandarin Chinese (Sino-Tibetan) also restrict their codas to a single nasal or liquid (van Dam 2004), and Diyari (Pama-Nyungan) allows only word-medial codas consisting of a single nasal, rhotic or lateral segment (Austin 1981).

Although liquids and nasals often cooccur in coda position, this cannot be universally explained in terms of sonority (Blevins 2004), because asymmetries in the coda phonotactics of sonorants can also be observed: nasals, but neither /l/ nor /r/ may occur in codas in Manam (Northern New Guinea), while liquids alone ({/l/,/r/}) may follow the nucleus in word-medial codas in Michif (Manitoba).

When languages allow complex codas, laterals and rhotics are frequently found amongst the segments – typically sonorants – licensed in the first post-nucleic slot. All complex codas in Tiwi (Melville Is) are rhotic-intial, e.g. /aɹn.ˈtu.ma/ *'head ornament'*, /kaɹn.tu.ˈku.ni/ *'ironwood'* (Osbourne 1974). All root-final two-consonant clusters in Gooniyandi (Western Australia) begin with one of the three segments {/ɾ/,/l/,/ɭ/} (McGregor 1990), and in Warray (Northern Territory), liquids are the only segments which may occur as the first member of a coda cluster (Borowsky & Harvey 1997).

As coda complexity increases, liquids are increasing likely to factor amongst the smaller subset of consonants which can occur closest to the nucleus. Two-consonant codas in Romansch, for example, can begin with one of the consonants {/m/,/n/,/ʃ/,

/l/,/r/}, but only liquid-intial three-consonant codas are attested: /-rms/ and /-lts/ (Montreuil 1999).

Dutch allows complex codas in which only /s/, /l/ and /r/ may precede a final obstruent. Comparing the codas in Table 2.7 with the onsets in Table 2.5, an important phonotactic phenomenon involving liquids can be observed: the asymmetrical organization of complex onsets and codas. In Germanic languages, a liquid will invariably appear closer to the nucleus than any obstruents, resulting in onset clusters of the form #OL- (*pry*, *fly*, *spry*, **rpy*, **lfy*, **rpsy*), and coda clusters with the reverse structure -LO# (*surf*, *kelp*, *carps*,**sufr*,**kepl*,**caspr*). Although this asymmetry does not hold universally (no such constraints apply, for example, in Georgian, Berber or Mongolian), it is a common phonotactic property of clusters that laterals and rhotics are found closer to the nucleus than other consonants.

/-sp/	*wesp*	'wasp'	/-lp/	*help*	'help'	/-rp/	*harp*	'harp'
			/-lm/	*helm*	'helmet'	/-rm/	*arm*	'arm'
			/-lf/	*elf*	'elf'	/-rf/	*amorf*	'amorphous'
			/-lv/	*elf*	'eleven'	/-rv/	*korf*	'basket'
/-st/	*astma*	'asthma'						
						/-rn/	*karn*	'churn'
/-sk/	*obelisk*	'obelisk'	/-lk/	*melk*	'milk'	/-rk/	*kerk*	'church'
						/-rx/	*monarch*	'monarch'
			/-lɣ/	*alg*	'alga'	/-rɣ/	*erg*	'very'

TABLE 2.7: **Dutch two-consonant coda clusters** (Booij 1995).

Summary

In this section, the distributional behavior of liquid consonants has been reviewed. It has been shown that laterals and rhotics pattern together in word-level and syllable-level phonologies through shared phonotactic constraints, a mutual ability to act as syllabic consonants, and shared ordering asymmetries in onsets and codas. These cross-linguistic trends suggest the first, and most important characterization of the class of liquids: a set of consonants sharing properties which dictate their position in the organization of the syllable.

2.2 Phonological Processes Involving Liquids

Evidence for the class of liquids can be found not only in distributional phenomena, but also in the active phonology of languages. Laterals and rhotics pattern together both as triggers and targets of the same phonological processes. Most importantly, laterals and rhotics often alternate with each other, in historical changes and in allophonic variation. Examples of all of these phenomena – both diachronic and synchronic – are briefly surveyed here.

2.2.1 Assimilation

Laterals and rhotics can pattern together in triggering assimilation of adjacent segments. In Latin, for example, the negative prefix /iN-/ place assimilates to a stop-initial stem (Table 2.8b); when the same prefix attaches to liquid-initial stems, the nasal is totally assimilated to the lateral or rhotic Table 2.8c).

a.	[in]-V:	*inaequetus*	'unequal'
b.	[im]-[p]:	*imperceptus*	'unknown'
	[in]-[t]:	*intemptatus*	'untried'
	[iŋ]-[k]:	*incultus*	'uncultivated'
c.	[i]-[l]:	*illectus*	'unread'
	[i]-[r]:	*irruptus*	'unbroken'

TABLE 2.8: **Total assimilation of nasals**: Latin liquid-initial stems.

A similar process occurs in Hausa (Chadic), where syllable-final nasals generally place-assimilate to a following consonant (Table 2.9a), but totally assimilate to the following lateral or either of the rhotics {/r/,/r̃/} (Table 2.9b; Newman 2000). In Bardi (Pama Nyungan), the extra-action marker /n/ undergoes total progressive assimilation when it appears before any of the consonants {/l/,/ɭ/,/ɽ/,/ŋ/} in the present or immediate perfect tenses (Metcalf 1975). In Oromo (Cushitic), all sonorants regressively assimilate with preceding liquids: *kofol+ne* > [kofolle] 'we have laughed', *dèger+ne* > [dɗègerre] 'we have seen' (Fallon 2002).

In the examples above, liquids behave as a class of consonants which trigger assimilation of an adjacent segment. In other cases, a class of liquids may be defined over a set of segments which pattern together as the target of assimilatory processes. In some varieties of Cuban Spanish, for example, coda laterals and rhotics both undergo total assimilation with a following obstruent. Yoruba (Niger-Congo) liquids

a.	*sun bi*	[sumbi]	'they followed'
	gidansù	[gidansù]	'their house'
	gidankù	[gidaŋkù]	'our house'
	hanyà	[haɲ jà]	'road'
b.	*Dan Lādì*	[ɗalllādì]	(proper name)
	sôn râi	[sârrâi]	'selfishness'
	watàn Ràmàlàn	[watàr̃r̃àmàlàŋ]	'the month of Ramadan'

TABLE 2.9: **Total assimilation of nasals**: Hausa liquid-initial syllables.

pattern with the approximants {/l/,/r/,/w/,/j//} in that they undergo (sometimes total) nasalization before nasal vowels: /lũ/ → [nũ] 'to feed', /rũ/ → [r̃ĩ] 'to walk', /jũ/ → [j̃ĩ] 'to dispense', /wũ/ → [w̃ĩ] 'to lend', and with the nasals in triggering place assimilation of syllabic nasals: /N̩/ → [αplace] | {+cons αplace} _ (Akinlabi 2003).

2.2.2 Dissimilation

Evidence for a class of liquids may also be found in a variety of dissimilatory phenomena. Segments which dissimilate do not do so randomly – they become differentiated from neighboring segments in some respects, while retaining other characteristics in common – offering useful insights into phonological relationships and class membership.

In Tashlhiyt Berber, for example, labial prefixes de-labialize when combining with a root which also contains a primary labial consonant: [m-xazar] *'scowl'*, but [n̲-f̲ara] *'disentangle'* (Alderete & Frisch 2007). Grassman's law affects classes of aspirated and non-aspirated consonants in Indoeuropean; Thurneyson's Law involves classes of voiced and obstruent consonants in Gothic (Chomsky and Halle 1968); sibilant dissimilation in Iban affects obstruents which share the same values for voicing, oral place and stricture; while dissimilation in Eastern Polynesian affects only the class of labials (Blust 1996). The importance of these examples is to demonstrate that the segments which result from dissimilation typically belong to the same natural class as the segments which were affected. When laterals dissimilate, the result is often a rhotic, and vice versa.

Liquid dissimilation has occurred throughout the history of the Romance languages. In the Latin adjectival suffix [-aːlis], the lateral dissimilated to a rhotic when suffixed to a stem which already contained a lateral (Steriade 1987; Table 2.10). The examples *vulgaris* and *militaris* demonstrate that the dissimilation was not just a lo-

cal process, but could occur over non-adjacent syllables.[3] Maiden (2000) observes that the sequence [l-l-] is almost completely banned in Italo-Romance clitic morphology. Standard Italian, for example, has *lo dico* 'I say it' and *le parlo* 'I talk to her', but instead of the expected *le lo dico* we find *glielo dico* [ʎelo diːko] 'I say it to her'.

ann-al̲is	'yearly'	*singul̲-ar̲is*	'alone'
capit-al̲is	'capital'	*sol̲-ar̲is*	'solar'
nav-al̲is	'naval'	*vul̲g-ar̲is*	'common'
infiti-al̲is	'negative'	*mil̲it-ar̲is*	'soldierly'

TABLE 2.10: **Dissimilation of laterals**: Latin suffixation.

Dissimilation in the opposite direction from Latin may be seen in Georgian: the rhotic in the suffix /-uri/, denoting nationality, dissimilated to a lateral if the root already contained a rhotic: *asur̲-ul̲i* 'Assyrian', *p'r̲us-ul̲i* 'Prussian', *ungr̲-ul̲i* 'Hungarian'; but *dan-ur̲i* 'Danish', *p'olon-ur̲i* 'Polish', *som-ur̲i* 'Armenian' (Fallon 1993). In Sundanese (Austronesian), rhotic dissimilation may be observed in the behavior of the infixing plural morpheme: /-ar-/ → [-al-] | _ r#: *k-ar-usut* 'messy', *t-ar-iis* 'cold', but *d-al-ahar* 'eat',*k-al-otor* 'dirty' (Cohn 1992).

Liquid dissimilation is not only triggered by morphological processes such as suffixation and encliticization – it is also found in sound changes affecting uninflected lexical items. Old Javanese /rVr/ sequences became /lVr/ in Modern Javanese (Austronesian): *roro* > *loro* 'two'; *rara* > *lura* 'virgin'; *rereb* > *lereb* 'to rest'; *rurub* > *lurub* 'covering, sheet' (Blust 1996), and again in Romance we find Latin: *ar̲bor̲* > Spanish: *àr̲bol̲* 'tree'; L: *r̲ebur̲* > Sp: *r̲ob̲le* 'oak' (Colantoni & Steele 2005). Diachonic liquid dissimilation is also attested in Yidiny (Pama Nyungan; Crowhurst & Hewitt 1995), Sabaot, and Endo (Nilo-Saharan; Larsen 1991), and dissimilated variations on standard forms occur in many Romance languages, including non-standard Catalan: *ar̲mari* → [al̲mari] 'wardrobe' and *jul̲iol* → [jur̲iol] 'July' (Lloret 1997).

2.2.3 Harmonization

Another phenomenon which can affect liquids occurring in proximity is harmonization. Like dissimilation, consonant harmony generally occurs between segments which are members of a natural class: Gafos (1999) illustrates that proximal coronal obstruents are prone to harmonize in Apache (Na-Dene), as are fricatives in Tahltan (Athabskan), Basque (Isolate) and Tzeltal (Mayan).

[3] Many relics of this phenomenon survive in modern Romance languages, and in English, in the liquid alternations in *angular*, *velar*, *polar*, *regular*; cf. *papal, total*, *temporal*, *dental*.

Rose & Walker (2004) found that, cross-linguistically, liquid agreement is one of five types of long-distance consonant harmony phenomena commonly observed in languages, along with nasal, laryngeal, and coronal and dorsal agreement. In the Bantu language Bukusu, for example, the lateral in the benefactive morpheme -/ila/ harmonizes when it is suffixed to a stem containing a rhotic (Table 2.11; Odden 1994).

UNDERLYING LATERAL		HARMONIC RHOTIC	
/teex-el̲a/	'cook for'	/r̲eeb-er̲a/	'ask for'
/lim-il̲a/	'cultivate for'	/kar̲-ir̲a/	'twist'
/iil-il̲a/	'send thing'	/r̲esj-er̲a/	'retrieve for'

TABLE 2.11: **Harmonization of liquids**: Bukusu suffixation.

No word in Toba Batak (Austronesian) contains dissimilar liquids, so in order to maintain liquid harmony, words borrowed into the language have undergone either rhoticization of the lateral: [rijar] < Portuguese/Malay /rijal/, or lateralization of the rhotic: [pulaŋbuli] < /pulaŋburi/ (no glosses given). Some loan words have harmonized in different directions in different dialects, e.g. Menangkabau: /selawal/ > [selawal] (Dairi) > [sarawar] (Sub Toba). Liquid harmonization is a highly productive phonological process in Toba Batak, applying even over adjacent words, whether or not they are compounds: /mal̲ampis/ + /bibir̲na/ > [mar̲ampisbibir̲na] 'his lips are thin' (van der Tuuk 1971).

2.2.4 Metathesis

Cross-linguistically, metathesis processes often target liquids. Canonical examples of vowel-liquid metathesis can be seen in the development of Southern and Western Slavic languages. In many words which originally contained vowel-liquid sequences, the coda laterals and coda rhotics metathesized with the preceding vowel, resulting in liquid-vowel sequences in the modern languages (Blevins & Garrett 1998; Table 2.12).

In a typological survey of metathesis, Ultan (1978) observes that liquids feature in a disproportionate number of metathesis phenomena, in languages as diverse as Breton (Celtic), Eastern Eskimo (Eskimo-Aleut), Tagalog (Austronesian), Mandaic Aramaic (Semitic), Persian (Indo-Aryan) and Zoque (Mixe-Zoque). He argues that liquids are especially susceptible to metathesis by virtue of their higher sonority, citing evidence from Armenian, in which there appears to have been "a chronological hierarchy in the introduction of metathesis of original clusters of the type con-

PROTO-SLAVIC	BULGARIAN	POLISH	GLOSS
*olkŭtĭ	lákot	łokieć	'elbow'
*orbota	rábota	robota	'work'
*gordŭ	grad	gród	'city'
*melko	mléko	mleko	'milk'

TABLE 2.12: **Slavic Liquid Metathesis** (Blevins & Garrett 1998).

sonant + semivowel. The first to metathesize were clusters containing semivowels, followed by the liquids, nasals, spirants, stops and possibly the affricates, in that order." (Ultan 1978: 375).

The majority of the metathesis phenomena observed in these languages involve the simple transposition of a liquid with an adjacent segment, as in the Armenian *elbajr* < **brājr* 'brother' (in which the original rhotic has dissimilated to a lateral during the process of metathesizing) and *erkan* < **kran* 'millstone' (Hayes et al. 2004). van der Tuuk (1971) gives numerous (unglossed) examples of vowel-liquid metathesis in Malayo-Polynesian languages: [arsam] ∼ [ransam] (Menangkabau); [ursa] ∼ [rusa] (Malay); [gaol] ∼ [galu] (Dairi); [alpis] ∼ [lapis] (Toba Batak).

Another type of metathesis which commonly affects both laterals and rhotics, involves the dislocation of a liquid to an adjacent syllable, typically to the syllabic position from which it was displaced. This type of metathesis can be observed in the diachrony of the Bagnéres-de-Luchon words *trende* < **tendro* < Vulgar Latin: *tenuru* 'tender' and *espilingo* < **espingla* < VL: *spinula* 'pin' (Ultan 1978); and in synchronic alternations in Dairi: [limaŋ] ∼ [bilaŋ], and Javanese: [laba] ∼ [bala], [derem] ∼ [redem] (van der Tuuk 1971).

Of special interest is the rarer phenomenon of reciprocal metathesis, which tends to involve members of the same phonological class. In Marathi (Indo-Aryan), for example, the participants in the metathesis [kʰaːmk] < [kaːmkʰ] 'armpit', are both voiceless stops, and in Agde French reciprocal metathesis occurs between sibilant fricatives: [ʃes] < *seche* 'dries' (Ultan 1978). In Chamorro (Austronesian), when a morpheme of the form /-VN-/ is infixed into a word, the nasal can metathesize with a sonorant in the preceding syllable (Klein 2005). The segments which participate in this process are {/m/,/n/,/ŋ/,/r/,/l/} (Table 2.13), suggesting that the two liquids constitute a subset of sonorants in Chamorro.

Diachronic reciprocal metathesis phenomena involving exchange of lateral segments with rhotics are attested in Gayo (Austronesian: *terul* < **telur* 'egg'), Spanish (*milagro* < Old Spanish *miraglo* 'miracle'), Telegu (Dravidian: *rôlu* < Proto-

BASE	-IN- INFIX	-UM- INFIX	GLOSS
li'e'	i) *lini'e'* ii) *nili'e'*	i) *lumi'e'* ii) *muli'e'*	'to see'
risibi	i) *rinisibi* ii) *nirisibi*	i) *rumisibi* ii) *murisibi*	'to receive'
na'i	*nina'i*	i) *numa'i* ii) *muna'i*	'to give'
nginge'	i) *ngininge'* ii) *ninginge'*	i) *nguminge'* ii) *munginge'*	'to smell'

TABLE 2.13: **Reciprocal Metathesis of Sonorants**: Chamorro (Klein 2005).

Dravidian **ural* 'mortar'), and Mandaic Aramaic (Semitic: [Salwa:ra] ∼ [Sarwa:la] 'trousers') (Hume 2008).

2.2.5 Merger

Evidence for a class of liquids may be found in a number of languages where distinctions between rhotics and laterals have been neutralized as a result of historical mergers. Many cognate forms may be found among Polynesian languages which vary primarily in the identity of the liquid consonants (Table 2.14). If Proto-Polynesian originally used two liquids, then the data suggests a number of historical developments within the class: *l,*r > /r/ (Maori), *l,*r > /l/ (Samoan), and *l > /l/, *r > ∅ (Tongan). In the development of Latin to Campidanian Sardinian (Frigeni 2005), /l/ and /r/ neutralized to /r/ in onset clusters, resulting in a one-liquid system in the modern language (Table 2.15).

MAORI	TONGAN	SAMOAN	GLOSS
[kere]	[kele]	[ʔele]	*'black'*
[kura]	[kula]	[ʔula]	*'red'*
[taro]	[talo]	[talo]	*'taro'*
[riki]	[iki]	[liʔi]	*'small'*
[rama]	[ama]	[lama]	*'torch'*
[ŋaru]	[ŋalu]	[ŋalu]	*'wave'*

TABLE 2.14: **Liquid correlations in Polynesian cognates** (Tregear 1969).

LATIN		SARDINIAN	GLOSS
PLUS	>	['prus]	'more'
PRIMUS	>	['primu]	'first'
FLAMMA	>	['fraða]	'flame'
FRATER	>	['fradi]	'brother'

TABLE 2.15: **Liquid neutralization**: Latin > Sardinian.

2.2.6 Neutralization

In the examples in Section 2.2.5, the neutralization of contrasts between liquids has ultimately resulted in structural change to the languages' phonologies through merger of originally distinct segments. Liquid neutralization can also be observed in languages which retain the phonological contrast between the segments involved.

In some Carribean and Andalusian dialects of Spanish, the tap-lateral contrast is neutralized in syllable codas: e.g. *verdad* → [bel.da] 'truth', *comprar* → [kom.pral] 'to buy' (Willis 2006).[4] Although the Spanish examples might be viewed as a special case of the very common cross-linguistic phenomenon of neutralization in coda position, liquid neutralization can also be observed in more phonologically prominent environments. The two liquids of Tukang Besi (Austronesian) neutralize in intervocalic environments, where they are realized as either allophone: /r/,/l/ → [r ∼ l] | V_V (Donohue 1999).

2.2.7 Alternation

Just as distinctions between liquids can be lost as a result of merger or neutralization, the phonetic realization of liquid segments can change over time. The outcome of this change is often another liquid segment.

Historical Liquid Alternation

In the Karnic languages Arabana, Wangkangurru and Wangkayutyuru (Central Australia), the rhotic-initial ergative suffix appears to have evolved from a lateral-initial proto-form: */-la/ > /-ra/ (Bowern 2001). Amongst the languages of the Moru-Madi group (Nilo-Saharan), many cognate forms can be found in which alternations occur between the three liquids /r/-/l/-/ɽ/: 'water rat' [talú] (Logo) ∼ [taɽú]

[4] The details of the neutralization process vary considerably, and are reviewed in Chapter 3.

(Miza); ‘knife’ [ílí] (Madi) ∼ [íɽí] (Miza); ‘body’ [lúmvú] (Kediru) ∼ [rúmvú] (Wadi); [ɔlí] ‘wind’ (Keliko) ∼ [ɔɽí] (Tucker 1940).

Rhoticization of Laterals

Rhoticization of coda laterals is attested in a number of Romance varieties: Florentine Italian (Walsh Dickey 1997); Cuban, Canarian and Andalusian Spanish (Quilis 1999); and Caipira Portuguese (Azevedo 1981). In some dialects of Modern Greek, /l/ is rhoticized in preconsonantal positions (Newton 1972). Although speakers of these dialects learn the ‘standard’ pronunciations [álfa], [délta], these are more commonly realized as [árfa] and [dérta]. In Sphakiá Greek (Crete), laterals are realized as a retroflex rhotic approximant ‘like the English itar in tomorrow’ when they occur before back vowels (Trudgill 1989).

Lateralization of Rhotics

Rhotic lateralization affects liquid clusters which form at the boundary between a verb stem and a derivational suffix in Jamsay (Mali, Niger-Congo). This process can be observed in the behavior of the ‘reversive’ suffix /-rV-/: when added to a (C)VrV verbal stem, the suffixing liquid dissimilates to a lateral, which regressively lateralizes the stem rhotic (Table 2.16; Heath 2008).

VERB	GLOSS	REVERSIVE	GLOSS
[pá?á-]	‘tie’	[páɣá-rá-]	‘untie’
[pɛ́gɛ́-]	‘insert’	[pɛ́gɛ́-rɛ́-]	‘remove’
[náŋá-]	‘forget’	[náŋá-rá-]	‘remember’
[gòró-]	‘cover’	[gòl-ló-]	‘uncover’
[kɔ́rɔ́-]	‘hang up’	[kɔ́l-lɔ́-]	‘take down’
[pírɛ́-]	‘get stuck’	[píl-lɛ́]	‘become unstuck’

TABLE 2.16: **Rhotic cluster lateralization**: Jamsay (Heath 2008).

For some speakers of Modern Hebrew, rhotics may be partially lateralized in word-final position, despite the fact that the rhotic and lateral are contrastive in this environment: /til/ [til] ‘rocket’, /saʁ/ → [saʁˡ] ∼ [saɺ] ‘minister’. This phenomenon warrants further investigation: since the rhotic is not coronal (for the speakers in which this was observed), it would not seem to be a natural candidate for lateral-

ization.[5]

2.2.8 Post-Vocalic Liquids

When liquids appear in the immediately post-vocalic position, they can enter into a variety of phonological process which involve the syllable nucleus. Postvocalic liquids can lengthen or alter the preceding vowel, or disappear all together – phenomena frequently observed across a variety of languages.

In many Commonwealth Englishes, post-vocalic rhotics and laterals have disappeared from many words which contain a low or back vowel (*a̲l.mond*, *pa̲lm*, *fa̲rm*, *a.la̲rm*). In each case, the originally pre-liquid vowel has been lengthened. For speakers of Australian English, this has resulted in a loss of contrast between many words which once contained post-vocalic liquids (*arms/alms*, *karma/calmer*), as well as the creation of a number of minimal pairs differentiated primarily, or entirely, by vowel length (Table 2.17).

putt	[pʰɐt]	*part*	[pʰɐːt]
cut	[kʰɐt]	*cart*	[kʰɐːt]
cuff	[kʰɐf]	*calf*	[kʰɐːf]
hut	[hɐt]	*heart*	[hɐːt]
huff	[hɐf]	*half*	[hɐːf]
pot	[pʰɑt]	*port*	[pʰɔːt]
cot	[kʰɑt]	*court*	[kʰɔːt]
pump air	[pʰɐmpʰɛː]	*palm pair*	[pʰɐmpʰɛː]
his arm and	[hɪzɐːmənd]	*his almond*	[hɪzɐːmənd]

TABLE 2.17: **Nucleic lengthening and deletion of post-vocalic liquids**: Australian English.

In Dyirbal (Pama-Nyungan), both the rhotic (Table 2.18a) and the lateral (Table 2.18b) triggered compensatory lengthening after deleting from coda position in the Ngajan dialect – a phenomenon which can be observed by comparing cognates in the related language Mamu (Kavitskaya 2002).

Examples of compensatory lengthening accompanying the loss of post-vocalic liquids may also be found in Komi (Uralic), Onondaga (Iroquoian), Turkish, Uyghur

[5] Laufer (1999) gives the canonical Hebrew rhotic as /ɾ/, but observes that different speakers use an uvular approximant rhotic /ʁ/. As with German, Modern Hebrew presents another interesting case in which the two primary rhotic allophones would appear to be fundamentally disconnected, both articulatorily and acoustically. See Chapter 9 for a further discussion of this dilemma.

	MAMU	NGAJAN	GLOSS
a.	/marbu/	/maːbu/	'louse'
	/ŋamir/	/ŋamiː/	'hungry'
	/murŋgal/	/muːŋgaː/	'cockatoo feather'
b.	/gulgu/	/guːgu/	'brought together'
	/bulal/	/bulaː/	'firefly'
	/dʒalgur/	/dʒaːguː/	'meat'

TABLE 2.18: **Vocalic Lengthening and Deletion of Coda Liquids**: Nganjan.

and Salar (Turkic): /varɣar/ [va(ː)ʁɑ(ː)] '(S)he will go', /gɛlmiʃ/ [kɛːmɪʃ] '(S)he reportedly came' (Johanson & Csató 1998). Kavitskaya (2002) demonstrates that the phenomenon can provide important insights into the phonological properties of the deleted liquid – rhotic approximants, for example, are more likely to trigger compensatory lengthening than taps or trills. Phonological asymmetries in the behavior of post-vocalic liquids will be addressed in more detail in Chapter 9.

Vocalization of Liquids

When post-vocalic liquids do not delete completely, they will often vocalize and/or color the preceding vowel. Speakers of both 'rhotic' and 'non-rhotic' dialects of English may realize post vocalic /ɹ/ as something more akin to a schwa, with varying degrees of rhoticization: *burr* [bɜr] ∼ [bɜˠ(ɹ)] ∼ [bɜəˠ] ∼ [bɜə] ∼ [bɜː]. In some northern dialects of England, post-vocalic laterals vocalize to a mid back vowel: *milk* [mɪɤk] ∼ [mɪʊk] (Hardcastle & Barry 1989), and in the south west, may be realized as a glide: *Bristol* [bɹɪ.stʊw].

Green (2002) cites post-vocalic liquid vocalization as a common mechanism in African American English, affecting both laterals and rhotics: *bear* [bæə], *bell* [bɜə]; *tore* [to], *cold* [koː], and Hancock (1974) notes that syllabic and postvocalic liquids are vocalized in Liberian English: *little* [lito], *people* [pipo], *care* [keː], *kill* [kiu]. In Lithuanian (Baltic), the combination of a short vowel and a liquid {/l/,/r/} can also function as a diphthong (Levin 2001).

The widespread occurance of these types of liquid vocalization suggests that liquid consonants share some fundamental phonetic similarities to the vowels which they become. In Chapter 9, building on observations by Giles & Moll (1975) , Hardcastle & Barry (1989) and Sproat & Fujimora (1993), the case will be made that vocalization results from the loss of the coronal gesture in segments which are intrinsically composed of coordinated tongue tip and tongue body gestures.

2.3 Liquid Allophony

Perhaps the most convincing evidence for the existence of a class of liquids, after their shared phonotactics, is the widespread phenomenon of allophony within the class. A variety of allophonic behaviors involving rhotics and laterals will be surveyed here.

2.3.1 Phonologically-Conditioned Liquid Allophony

In languages with a single liquid, this segment may be variously realized either as a rhotic or a lateral, sometimes in free variation, and sometimes in a phonologically conditioned manner.

Toaripi (Trans New Guinea) uses a single liquid, which generally surfaces as a lateral in initial position, and intervocalically as a tap: *lauai* 'eat'; *auri* 'metal' (Brown 1973). The single liquid of Gonja (Niger-Congo) is realized [ɽ̩ʷ] when syllabic, and [l] elsewhere (Zec 1995).

Gbeya (Central African Republic, Niger-Congo) uses two phonological liquids, contrasted in the minimal pair [bolo] 'tree'/[boɾo] 'iron'. The rhotic has four allophones – two oral and two nasal – each of which is phonologically conditioned. Despite the phonemic contrast between the two liquids, two of the allophones of the rhotic are 'lateral flaps', which appear word-initially: /ɾɔk/ [ɽɔk] 'to be smooth', /ɾɔ̃k/ [ɽ̃ɔ̃k] 'to be good' (Samarin 1966).

In Korean, the liquid allophony is determined by syllabic phonology, surfacing as a flap in onsets and a lateral in codas (Table 2.19; Iverson & Sohn, 1994).

/mʌ.li/	[mʌ.ɾi]	'hair'
/sa.li/	[saː.ɾi]	'side dish'
/pal/	[paʔ]	'foot'
/p'al.kan/	[p'a[̚.gã̚n]	'red'

TABLE 2.19: **Phonological Conditioning of Liquids**: Korean.

2.3.2 Free Variation of Liquids

In other languages which use only a single phonemic liquid, this segment may be realized as any of a variety of rhotics and laterals in free or idiolectal variation.

Reesink (1999) observes that the single phonological liquid of Hatam (West Papuan) "is realized as an alveolar flap or a lateral approximant in free variation ... Indonesian *selalu* 'always' can be given as [selaru], [seraru], [selalu]". Sentani (Cowan 1966) is typical of many Papuan languages, in which the realization of the single liquid varies freely between taps, trills and laterals (Foley 1986).

In some languages, the identity of the liquid is specified in some environments, but not in others. Jita (Tanzania, Niger-Congo) is a single-liquid language in which, morpheme-initially, only the coronal lateral [l] is found. Elsewhere the same phoneme surfaces in free variation, either as the lateral or as an apical tap [ɾ] (Downing 2001).

More remarkably, free variation is also found in languages with multiple liquid phonemes. Kikongo Kituba (Congo, Bantu) uses two phonological liquids {/l/-/r/} which neutralize in many environments. In these cases, both phones are used in free variation so that *bilo* is realized [biro] ∼ [bilo] (Mufwene 2001). Hausa has a three-liquid inventory /l/-/r/-/r̃/, all contrastive in initial and medial positions. In final position the two rhotics are variously realized as the lateral. In some dialects all allophones appear in free variation in syllable final position; for others the rhotics are interchangeable in this environment (Newman 2000).

Both free variation and phonologically-conditioned allophony can be observed amongst rhotics and laterals in languages with even richer liquid inventories. Only one of the three liquids of Lardil may occur in word initial position, where it can also be realized as either of the other two phones: /ɽ/ → [ɽ] ∼ [r] ∼ [l] | # _ (Round, p.c.)

The fact that rhotic-lateral allophony is observed so frequently, across such a variety of languages, seems to provide some of the best phonological evidence for a the existence of a class of liquids in these languages. Futhermore, these data suggest that the liquid consonants which pattern together in these languages are sufficiently closely united by some phonetic property that allophony of this type is possible. In Chapter 9, it will be argued that this common phonetic factor is the common presence of a dorsal gesture amongst laterals and rhotics.

2.4 Asymmetries in the Behavior of Liquids

Laterals and rhotics do not always pattern together in the ways surveyed so far in this chapter. In this section, some important asymmetries in the distribution and behavior of laterals and rhotics will be discussed – differences which must be taken into account when considering the extent to which they constitute a class.

An illustrative example may be found in the phonology of Koyra Chiini, a Nilo-Saharan language spoken in Timbuktu, Mali. In most respects, the lateral /l/ and rhotic /r/ of Koyra Chiini behave as a prototypical class of liquids. They pattern together in the phonotactics of the syllable: both are restricted to coda position. Both segments can geminate. The lateral and rhotic participate in many of the same phonological processes as a subclass of sonorants: blocking morpheme-final nasalization of vowels, and providing an environment in which the voiced velar stop is deleted (*farga > [faraa] 'tired'). Both diachronic (*malqaa 'meeting place' > [maraa] 'assemble') and synchronic (kul > [kur] 'all'; hal > [har] 'until') alternations are attested between laterals and rhotics (Heath 1999).

In one important phonological process, however, there is a significant asymmetry between the liquids in Koyra Chiini. The rhotic undergoes total progressive assimilation to a following alveolar stop (Table 2.20), but no such process affects the lateral, which can appear freely before alveolars (except for the rhotic, to which it is assimilated).

/a gar-ni/	> [aganːi]	's/he found you(sg)'
/njeer-di/	> [ndʒeːdːi]	'the antelope'
/yer-ta/	> [jetːa]	'we'
/yer-si bey/	> [jesːibej]	'we don't know'

TABLE 2.20: **Total Assimilation of Rhotics**: Koyra Chiini (Heath 1999).

The situation in Koyra Chiini is typical of that found in many languages – rhotics and laterals will pattern together in many significant ways, which collectively indicate that they form a class, but they will also demonstrate asymmetries in distributional or active phonology, which suggests that the class of liquids is not monolithic. By examining some of these differences in more detail, we can gain further insights into the phonological characterization of liquids.

2.4.1 Word-Level Distributional Asymmetries

It is not always the case that laterals and rhotics occur in the same phonotactic environments. In Section 2.1.1, it was shown that in some languages, laterals and rhotics are subject to distinct distributional constraints at the word level. In other languages, such constraints apply only to a subset of liquids.

In Humburi Senni Songhay, for example, a two-liquid language of Mali (Nilo-Saharan), the lateral occurs in word-initial and word-final position, but the rhotic does not occur in either of these positions, other than in a few loan words (Heath

2007). Bolognesi (1998) describes a similar constraint in the Sestu dialect of Campidanian Sardinian, which prohibits word-initial rhotic and glide onsets, but tolerates laterals word-initially. The data in Table 2.21 demonstrates that Sestu has systematically resorted to vowel epenthesis to avoid initial rhotics, while lateral-initial words have been inherited relatively unaltered from Latin.

SESTU	LATIN	GLOSS	SESTU	LATIN	GLOSS
[arɔːza]	< *rose*	'rose'	[luʒi]	< *lucis*	'light'
[arːana]	< *rana*	'frog'	[ledʒu]	<	'ugly'
[arːiu]	< *rivus*	'river'	[latːi]	< *lactis*	'milk'
[arːɔda]	< *rota*	'wheel'	[luðu]	< *lutum*	'mud'

TABLE 2.21: ***Rhotic-Inital: Sestu Campidanian Sardinian**.

Smith (2003) argues that these types of asymmetries are reflective of the higher sonority of rhotics compared to laterals, and motivates the preference for word-initial laterals as an example of a broader cross-linguistic preference for low-sonority onsets. The issues of sonority and phonotactic ordering or liquids with respect to other segments will be addressed at length in Chapter 9.

2.4.2 Clustering Asymmetries

Further insights into the differential characteristics of liquids may be gained by looking at organization within the syllable. At this level, there are asymmetries in the ways in which laterals and rhotics may combine in clusters, and in the types of liquids that can fill syllable nuclei.

It was shown in Section 2.1.2 that obstruent-liquid clusters are commonly found in onsets; however, rhotics tend to combine with obstruents more freely than laterals in this environment. Gaps in attested onset cluster combinations, for which corresponding obstruent-rhotic clusters exist, reveal this to be the case in English (*/tl-/, */dl-/, */θl-/, */ʃl-/), Spanish (*/tl-/, */dl-/), Dutch (*/tl-/, */dl-/), and French (*/tl-/, */dl-/). The same trend is observed in more complex onsets: in Camsá (Colombia, isolate), three-consonant onset clusters may end with a rhotic or a nasal, but not a lateral (Howard 1967). The same asymmetry can be observed in some languages with greater combinatorial freedom in consonant clusters: the only types of morpheme-internal coda clusters commonly found in native Lezgi (North Caucasian) words are /-rC/ and /-lC/, with the rhotic-obstruent coda being much more common than the lateral-obstruent (Haspelmath 1993).

Evidence from Romance suggests that when obstruent-lateral clusters are permit-

ted, they may be less stable than obstruent-rhotic clusters. The direction of neutralization of liquids in Campidanian clusters, for example, was lateral > rhotic (Table 2.21). Colatoni & Steele (2005) argue that obstruent-rhotic clusters are more diachronically robust: clusters containing rhotics in Latin were more likely to survive unchanged into modern Romance languages; clusters containing laterals, on the other hand, have devolved through a variety of processes, including assimilation, palatalization and vocalization (Table 2.22).

LATIN	SPANISH	FRENCH	ITALIAN	PORTUGUESE	GLOSS
pratu	prado	prarie	prato	prado	'meadow'
plorare	[ʎ]orar	pleurer	[pj]angere	[ʃ]orar	'to cry'
credere	creer	croire	credere	crer	'to believe'
clavis	[ʎ]ave	clef	[ki]ave	[ʃ]ave	'key'
barba	barba	barbe	barba	barba	'beard'
alba	alba	a[ub]e	a[ub]ora	a[wr]ora	'dawn'
firmus	firmo	firme	fermo	firme	'firm'
pulmone	pulmón	po[um]on	polmone	pulmão	'lung'

TABLE 2.22: **Diachronic Instability of Romance Obstruent-Lateral Clusters**.

In liquid-liquid coda clusters, rhotics are commonly found closer to the nucleus than the lateral. This is the case in Romansch /ʃtiərl/ *'calf'* but */-lr/# (Montreuil 1999), English: *pearl* but */-lr/#, and generally throughout the Germanic languages.

2.4.3 Asymmetries in Syllabification

Further evidence for differences in the stability of obstruent-liquid clusters may be found by examining patterns of syllabification in medial clusters. van de Torre (2003) observes that although all types of obstruent-liquid clusters are found in both word-initial and stressed word-medial positions in Dutch (Table 2.23a), medial obstruent-lateral clusters are prone to break across syllables, while obstruent-rhotic clusters tend to remain heterosyllabic at unstressed syllable boundaries (Table 2.23b).

A similar phenomenon can be observed in Icelandic, where the prosodic need for a stressed first syllable causes vowel-lengthening in open syllables, creating an inbuilt diagnostic for syllabification boundaries (van de Torre 2003). The long vowels in *etru* 'sober' and *ekra* 'field', for example, indicate that the medial obstruent-rhotic clusters are tautosyllabic (['ɛː.tru], ['ɛː.kra]), while the lateral clusters in *sigla* 'sail' and *ekla* 'lack' follow short initial vowels, and so must be heterosyllabic (['sɪk.la],

a.	*praat*	[pr̲at]	'talk'	*reprise*	[rə.'pr̲i.zə]	'reprise'
	draak	[dr̲ak]	'dragon'	*adres*	[a.'dr̲ɛs]	'address'
	krant	[kr̲ɑnt]	'newspaper'	*acryl*	[a.'kr̲il]	'acryl'
	plaats	[pl̲ats]	'place'	*repliek*	[rə.'pl̲ik]	'reply'
	klant	[kl̲ɑnt]	'customer'	*eclips*	[e.'kl̲ɪps]	'eclipse'
b.	*cobra*	['ko.br̲a]	'cobra'	*Popla*	['pɔp.l̲a]	'Popla'
	metro	['me.tr̲o]	'metro'	*Revlon*	['rɛp.l̲ɔn]	'Revlon'
	okra	['o.kr̲a]	'okra'	*Teflon*	['tɛf.l̲ɔn]	'Teflon'

TABLE 2.23: **Instability of Medial Obstruent-Lateral Clusters**: Dutch.

['ɛk.la]). The relative instability of the obstruent-lateral clusters allows Icelandic to override the maximum onset principle, while obstruent-rhotic combinations appear to be sufficiently robust consonantal clusters that they force Icelandic to use another strategy to satisfy its prosodic demands.

2.4.4 Interactions with Syllable Nuclei

Pursuing the idea that rhotics are more 'vocalic' than laterals, another interesting asymmetry may be observed in Eastern Kayah Li (Tibeto-Burman), in which many syllables take the form /CLV/. Although any set of consonants and liquids can combine to create an onset within this template, aspiration on the initial consonant is entirely predictable from the identity of the following liquid: voiceless stops will only aspirate before the rhotic, never the lateral: [p^{h}r-], *[p^{h}l-]; [pl-], *[p^{h}l-] (Solnit 1997). This suggests that the rhotic has a greater affinity for the syllable nucleus, patterning more like a glide by allowing the initial consonant to aspirate, while the lateral remains part of a complex cluster in the onset, blocking aspiration of the preceding consonant because it is no longer adjacent to a sufficiently vocalic segment.

This phenomenon suggests that there might be a greater asymmetry – in terms of their affinity for the nucleus – between the liquids in Eastern Kayah Li than there is in a language like English, where both liquids typically block aspiration in onset clusters (*[sp^{h}r-], *[sp^{h}l-]). More research is required to see how voiceless stops aspirate when followed by liquids in onset clusters in other languages, as this could provide interesting insights into language-specific characteristics and asymmetries of liquid consonants.

2.4.5 Asymmetries in Liquid Syllabicity

In Section 2.1.2, the shared capacity of rhotics and laterals to act as syllabic nuclei was considered as evidence for a class of liquids in some languages (Czech, Slovak). In other languages (Croatian, Serbian, Macedonian) the rhotic, but not the lateral, may be syllabic. Dihovo Macedonian, for example, uses nucleic rhotics in words such as [vr̩f] 'top' and [r̩ʃ] 'rye', but unlike Czech, has no words with syllabic /l̩/ (Crosswhite 2001).

The rhotic of Hakka Chinese patterns with the (non-dorsal) nasals in that it can fill a syllabic nucleus: /m̩ɻ/ *'not'*, /n̩ɻ/ *'fish'*, /sɻ̩ʰ/ *'teacher'* (Lee & Zee 2009). Unlike the nasals, the rhotic cannot occur in syllable-intial position: /maʰ/ *'mother'*, /naʰ/ *'to take'*, */ɹa/. The lateral, on the other hand, patterns with the obstruents in that its distribution is restricted to syllable-initial position: /laʰ/ *'to pull'*; */l̩/. These data are consistent with the cross-linguistic trend that laterals pattern more closely with other consonants than rhotics.

The asymmetry in syllabicity between liquids is clearly demonstrated in the allophonic behavior of the Gonja liquid (Section 2.3.1), which appears to be underlyingly lateral, but surfaces as a rhotic when the liquid becomes syllabic (Zec 1995). Diachronic evidence also points to the inferiority of the lateral as a syllabic consonant: the two syllabic liquids reconstructed for Proto-Indo-European merged into a single syllabic rhotic in Vedic Sanskrit: */l̩/, */r̩/ > */r̩/ (Watkins 1992).

2.4.6 Summary: Asymmetries between Liquids

In this section, some differences in the behavior of laterals and rhotics have been identified. Evidence from gaps in cluster inventories, the comparative diachronic stability of obstruent-liquid clusters, capacity to act as syllabic nuclei and other asymmetries in syllabification, all demonstrate that laterals can differ from rhotics in some important respects. Cross linguistically, when these asymmetries are observed between liquids, laterals tend to pattern more closely with obstruents, while rhotics behave more similarly to voicoids. It remains to be seen whether there might be a phonetic basis to these differences, and if so, how it might be modeled in an articulatory framework.

2.5 Summary: Phonological Characterization of the Class of Liquids

The data presented in this chapter constitutes a significant body of evidence suggesting that laterals and rhotics together constitute a phonological class within many languages. Some of the properties shared by liquids – such as distribution within the syllable – are commonly observed across a wide variety of languages. Yet, compared to other families of segments which pattern together phonologically (nasals, stops, vowels), the evidence for a universal class of liquids is less compelling. Some of the phenomena described here are restricted to a small number of languages, and none would appear to apply as universally as phonological processes such as devoicing or nasalization, which suggest the existence of more generic classes. Nor do the phonotactic constraints on liquids appear to be as universal as those which apply to broader classifications of segments, which in most languages, allow the classes of consonants and vowels to be defined with respect to their organization in the syllable.

Nevertheless, the data show that the consonants which function as liquids repeatedly exhibit similar behaviors across languages – behaviors which are broadly characterized by three important properties:

i. *liquids are cluster-enabling consonants*: complex onsets and codas typically involve, and often require, liquids to combine with obstruents to facilitate clustering
ii. *liquids exhibit an affinity for the nucleus*:[6] the ordering of consonants in onset and coda clusters is typically asymmetrical, locating liquids closer to the nucleus; liquids often function as syllabic consonants
iii. *liquids exhibit a high degree of interchangability within the class*, observed in rhotic-lateral allophony, as well as phonological processes including merger, neutralization, alternation, dissimilation, assimilation and harmonization

Some asymmetries in the phonology of liquids have been identified which suggest that laterals tend to be more consonantal in their behavior, and rhotics more vocalic. Having surveyed the ways in which rhotics and laterals pattern together (and differ) cross-linguistically, we will now examine the phonological and phonetic behavior of liquids in two languages in detail: Spanish and Russian. The goal of these case studies it to test the hypothesis that liquids in these languages are

[6] The phrase is attributed to Sproat & Fujimura (1993: 291), who proposed that English lateral approximants have a vocalic gesture which shows "a strong affinity for the nucleus of the syllable."

articulated as multi-gestural segments, and to examine some ways in which their phonological properties might follow from such a characterization.