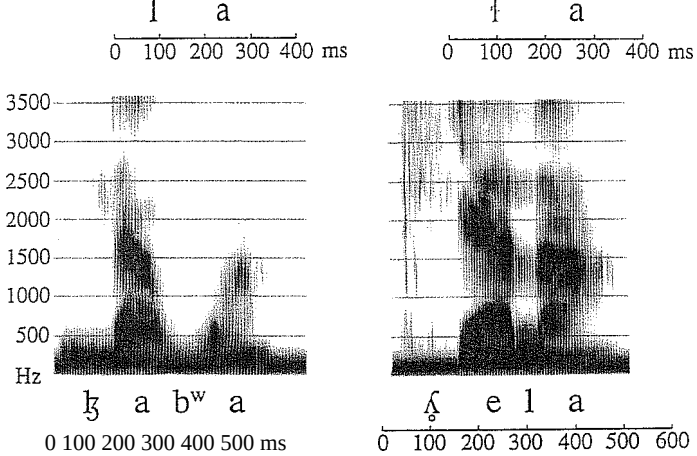

Figure 6.13 Spectrograms of four laterals in Bura. The words are la 'build', la 'cow', ljab“a 'beat' and Ada /Pela/ 'cucumber'.

We therefore know, so far, of dental, alveolar, post-alveolar (apical and laminal) and palatal places of articulation for lateral fricatives.

We can exemplify contrasts between lateral approximants, fricatives and affricates from Zulu. Words illustrating six contrasting types of laterals in this language are given in table 6.11. So that all the occurring lateral consonant types of Zulu are represented, lateral clicks are also included in this table, but further discussion of these is postponed until chapter 8.

There are seven different laterals illustrated in table 6.11, but the Zulu alveolar lateral affricate occurs only as an allophone of the voiceless lateral fricative 1 after a nasal. Spectrograms illustrating the five lateral sounds 1, tt, 1, kt' spoken by a male speaker of Zulu are given in figure 6.14. For some speakers the alveolar affricate may be produced as an elective, but the token we show is pulmonic. For this speaker the spectrum of 1 appears to have less energy in the

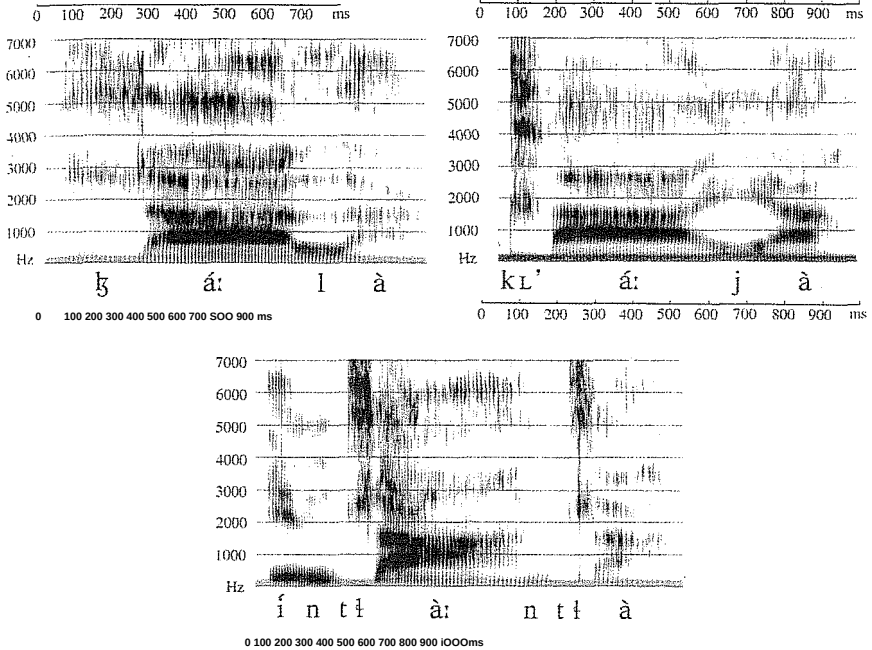

Figure 6.14 Spectrograms of Zulu lateral approximants, fricatives and affricates.

Table 6.11 Words illustrating lateral consonant types in Zulu

	VOICELESS	VOICED
ALVEOLAR APPROXIMANT		lala 'lie down'
ALVEOLAR FRICATIVE	lata 'cut off'	gala 'play'
ALVEOLAR AFFRICATE	intlantla 'good fortune''	
VELAR EJECTIVE AFFRICATE	kt’ aja 'push in between'	
ALVEOLAR CLICK	k||6k||a 'narrate'	g||ala 'stride'

region below 2000 Hz than occurs in the fricative portion of k^w. The voiced fricative b ■ has a noise spectrum similar to that of its voiceless counterpart; it has a considerably lower amplitude of voicing than the voiced approximant 1 and lacks any strong low frequency resonance that might be labeled the first formant. Thus, the large number of laterals in Zulu are clearly differentiated from each other.

The velar lateral ejective affricate illustrated in figure 6.14 is an unusual sound. In Ladefoged (1971) this segment was described as a palatal lateral ejective affricate (on the grounds that velar laterals were not believed to be possible speech sounds). However, there seems no reason to doubt that both components of this affricate are really velar in place of articulation, and we have described it this way in table 6.11 above. As Doke (1926) observed, when a homorganic nasal precedes this element that nasal is rj. We add that when a vowel precedes, the auditory impression is clearly of a velar closure. The fricative component of this affricate is auditorily reminiscent of the velar fricative x but is lateral. Hence our choice to transcribe this affricate as kt', using the raising diacritic to indicate that the voiceless velar lateral ʟ is fricative in these circumstances.

Zulu is not unique in having this type of exotic lateral. A set of several velar, or more precisely pre-velar, laterals of different types are reported to occur in Archi. These are all fricatives or affricates. Archi also has a Coronal lateral approximant of the more usual type, described as being apical. Examples from Kodzasov (1977) are given in table 6.12. (From the distribution of the pre-velar lateral fricatives it seems very likely that the voicing in these fricatives is allophonic, although Kodzasov reports voiced and voiceless pre-velar lateral fricatives as being separate phonemes.)

We have heard recordings of these sounds but have not observed their production. Kodzasov gives the following description:

> In the production of lateral fricated sounds the tip of the tongue is passively lowered to the lower teeth while the body of the tongue is raised to the palate, forming an extended obstruction covering both the velar and palatal regions.... In their articulation and auditory quality the Archi laterals are similar to palatalized velars (Archi speakers perceive Russian soft x as a lateral fricative) (pp. 225-6, our translation).

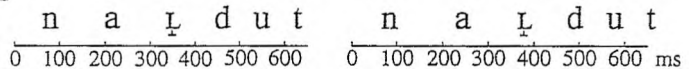

Figure 6.15 Spectrograms illustrating the voiced velar lateral fricative of Archi in the word nardut 'blue' as produced by two male speakers. The second speaker is an adolescent; frication of the lateral is even stronger in his speech than in that of the adult male.

Table 6.13 Words illustrating contrasts among laterals in Tlingit

VOICELESS FRICATIVE	**laa**	'melt'
EJECTIVE FRICATIVE	l'aa	'suck'
VOICELESS AFFRICATE	ttaa	'be big'
VOICED AFFRICATE	dljaa	'settle (of sediment)'
EJECTIVE AFFRICATE	tfaak'	Tie wet'

According to Kodzasov's description the closure for these sounds is more forward than that for the Zulu affricate. The auditory impression is of very strong frication. As may be seen in the spectrograms shown in figure 6.15, the resonance of the second formant is relatively high in frequency and quite close to that of the third formant. Both have strong amplitude. A non-ejective velar lateral affricate may also occur in Axluxlay (Stell 1972) but the description is somewhat unclear.

The most common lateral sound made with a glottalic airstream mechanism is an ejective affricate; ejective lateral fricatives are less frequent but do occur in a number of languages. Contrasts between voiceless pulmonic lateral fricatives and ejective lateral fricatives have been reported, but only in a few languages of North America, for example in Tlingit. This language is unusual in that it has laterals of five distinct types but none of them is a voiced lateral approximant of the common type. The examples of verb stems in table 6.13 from Story and Naish (1973) illustrate the contrasts between laterals in Tlingit. Place of articulation is not clearly indicated in the sources we have seen but is fairly certainly alveolar.

Navajo also has five contrasting alveolar laterals. It does not have the ejective fricative reported for Tlingit, but it has segments similar to the other

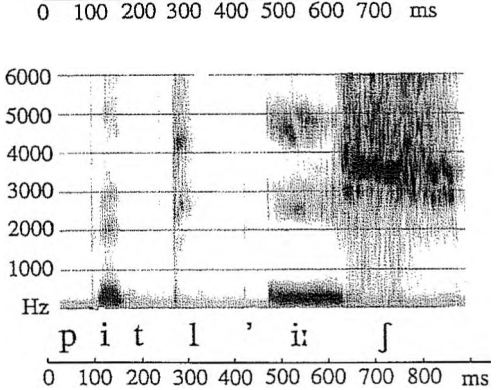

Figure 6.16 Navajo voiceless aspirated lateral affricate U^h in nitPiJ' *nitlish* 'it has arrived' and the ejective lateral affricate if in pitt'id *bitl'iish* 'his snake'.

four Tlingit laterals plus the more usual alveolar lateral approximant I (Sapir and Hoijer 1967). In Navajo the voiceless lateral affricate has a long period of frication which McDonough and Ladefoged (1993) considered to be equivalent to aspiration. Figure 6.16 shows the contrast between this pulmonic aspirated lateral affricate and the ejective lateral affricate. There is a long fricative portion in the aspirated lateral affricate tP, with only a very small interval for the aspiration. (Both the increase in length of the fricative and the small interval for the aspiration are similar to those in the other aspirated affricates in Navajo.) The ejective lateral affricate has a noticeable but short fricative period, as the source of frication is necessarily supraglottal. The duration of the frication is governed by the amount of air trapped above the glottis; it would be physiologically impossible to make it as long as in the pulmonic affricate in the upper part of the figure. In the Navajo lateral ejectives we have recorded, the glottal closure is often released and then re-made. This produces a spike on the spectrogram, as just to the left of the [’] symbol in figure 6.16. There is then a short interval in which there is a glottal stop, which is finally released as the

figure 6.17 Palatograms, linguograms and inferred sagittal view of the lateral ejective affricate in the word ²bone' mitX' a as spoken by two male Hadza speakers. The position of the tongue body is shown by a dashed line for speaker 1 as the mouth was not open sufficiently and the extent of contact cannot be seen (from Sands, Maddieson and Ladefoged 1993).

voicing in the vowel begins. For some speakers this interval was filled with two or three pulses of a creaky voice phonation.

The third lateral affricate in Navajo, transcribed dlj here, is often only weakly fricated. The stop closure is usually voiceless and only about 40 ms of the following lateral is voiceless. This is similar to the voice onset time measured after unaspirated velar stops (McDonough and Ladefoged 1993:154). The remainder of the lateral is voiced and approximant. The segment might well therefore be transcribed dl (or dl). The length of the approximant lateral segment in dl pronunciations of this unaspirated lateral 'affricate' in Navajo is similar to that of the lateral segment 1 occurring alone.

We have so far noted lateral affricates at alveolar and velar places. Lateral ejective affricates that are best described as palatal or palato-alveolar in place occur in Iraqw, Sandawe and Hadza. Palatograms and linguograms of two Hadza speakers are shown in figure 6.17. Speaker 1 shows a broad contact over the post-alveolar and palatal regions in the palatogram, with the tongue contact area extending from the back of the tongue blade to the tongue front. Speaker 2 has a narrower contact which is better described as laminal post-alveolar.

We thus see that the world's languages use a wide range of lateral segments in which there is a more constricted aperture than that found in the common lateral approximant sounds. In a number of languages lateral fricatives vary with lateral affricates, and the affricates sometimes vary between ejective and pulmonic pronunciations (as in Zulu), showing that these various types of constricted laterals have close interrelationships. Nonetheless, it is possible to find languages which clearly show their contrastivity.

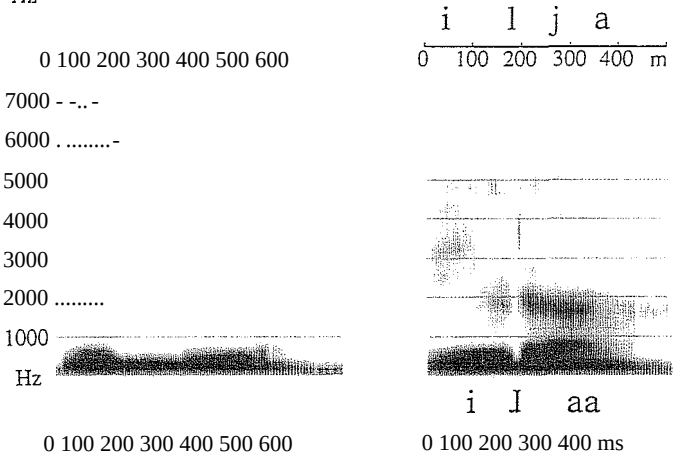

Figure 6.18 Spectrograms of the KiChaka words ilaa 'to lie down', ilja 'to eat', ilija 'to cry' and iJaa 'to dress oneself[7] illustrating major allophones of approximant 1 and the lateral flap J. The speaker is female.

Lateral flaps and taps

The final type of laterals that we must consider are those made with very rapid gestures, that is, lateral flaps and taps (the difference between these two types of articulation will be discussed in the next chapter, and we will not consider their distinction here). We have recorded lateral flaps in several languages. For example, one occurs in KiChaka in contrast with what seems to be only one other lateral phoneme, albeit one which has rather varied allophones. In addition to the apical alveolar lateral flap J, the KiVunjo dialect of KiChaka has a lateral approximant which is most typically laminal dental. In most vowel contexts this has a rather low F2 suggesting possibly some velarization, but before i it becomes a palato-alveolar or palatal lateral with a considerably higher F2. Before j a laminal alveolar lateral with some palatalization occurs. The

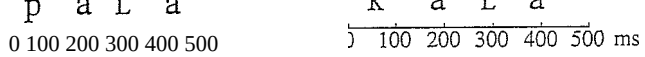

Figure 6.19 Velar lateral taps in the Melpa word pata 'fence' and the Kanite word kara 'dog'. Both speakers are male.

KiChaka apical alveolar lateral flap J also varies acoustically depending on segmental context, but less than I does. The three major allophones of 1 and the flap J are shown in the spectrograms in figure 6.18. Note the lowering of the second formant throughout the initial i in ilaa, compared to the more localized lowering before J.

Elugbe (1978) suggests that alveolar lateral taps occur in Ghotuo and Abua (as well as a number of other Nigerian languages for which he has only secondary data). In these languages there is a contrast between an alveolar lateral approximant of normal duration, and an alveolar lateral of brief duration that forms part of a series of lenis consonants in the phonological structure of these languages. Elugbe states that the formant frequencies of both the laterals are the same; however, in the one published pair of spectrograms in his article this does not seem to be the case. In particular, F2 seems lower in the brief lateral than it is in the longer one. We are therefore not sure if the two articulatory gestures are the same in the location of their target.

We also have seen and heard production of an apical post-alveolar lateral flap in 'O'odham, and Balasubramanian (1972) demonstrates that the non-geminate sublaminal lateral in Tamil is usually produced as a flap. Lateral flaps thus probably occur at all the places which have apical or sublaminal articulations. In addition, the intervocalic velar laterals that occur in Kanite and Melpa can be very brief and hence could be described as taps. We have used the same symbol for these as for velar approximant laterals. The spectrograms in figure 6.19 indicate that the articulatory closure lasted only 20-30 ms. Observation of the articulations as the speakers pronounced these words showed that the same narrowing of the tongue occurred in the velar region as in the case of the Mid-Waghi velar laterals discussed in section 6.1 above.

tives do contrast so we see no reason that such a contrast should not also appear among laterals. The only gap we believe is non-accidental is the contrast between voiceless lateral fricatives and voiceless lateral approximants, which we have marked with asterisks. All of the languages mentioned in this table have been discussed earlier in this chapter.

Table 6.15 combines information from tables 6.3 and 6.14 and adds further examples of languages with laterals at different places of articulation. The places at which lateral flaps can occur are limited. But apart from this restriction, we know of no other constraints on the relations between places and manners among laterals. The table is presented primarily as a summary of the data we have discussed in this chapter, and the gaps that occur do not indicate the impossibility of such segments. These tables show that many of the place and manner properties that distinguish other types of segments also apply to laterals. We especially note that since lateral segments occur at places of articulation that are Coronal or Dorsal in terms of the scheme proposed in chapter 2,

Table 6.14 Languages exemplifying contrasting types of lateral segments

	VOICELESS **AFFRICATE**	EJECTIVE **AFFRICATE**	VOICED **FRICATIVE**	VOICELESS **FRICATIVE**	EJECTIVE **FRICATIVE**	VOICED APPROX.	VOICELESS **APPROX.**	VOICED **FLAP**
VOICED **AFFRICATE**	Tlingit	Tlingit		Tlingit	Tlingit			
VOICELESS **AFFRICATE**		Tlingit	Archi	Navajo Archi	Archi	Archi		
EJECTIVE **AFFRICATE**			Archi Zulu	Navajo Archi	Tlingit	Navajo		
VOICED **FRICATIVE**				Archi Zulu		Zulu		
VOICELESS **FRICATIVE**					Tlingit	Navajo Zulu		
EJECTIVE **FRICATIVE**								
VOICED **APPROX.**							Burmese	KiChaka
VOICELESS **APPROX.**								

Table 6.15 Languages exemplifying contrasting places of articulation among lateral segments

	DENTAL		ALVEOLAR		POST-ALVEOLAR		PALA
	APICAL	LAMINAL	APICAL	LAMINAL	APICAL	LAMINAL	SUBAPICAL
	1	2	3	4	5	6	7
VOICED APPROXIMANT	Albanian	Kaititj	Albanian	Russian	Panjabi	Bulgarian	Malayalam
VOICELESS APPROXIMANT			Burmese		Iaai		Toda
VOICED FLAP		KiChaka			'O'odham		Tamil
VOICELESS FRICATIVE	Taishan	Kabardian	Zulu			Diegueño	
VOICED FRICATIVE		Kabardian	Zulu		Ao	Pashto	
VOICELESS AFFRICATE			Navajo				
VOICED AFFRICATE			Tlingit				
EJECTIVE AFFRICATE		Kabardian	Navajo				
EJECTIVE FRICATIVE			Tlingit				