understood in terms of movement within phonological space. A crucial observation has been that there are always competing phonological pressures, both syntagmatic and paradigmatic; it is impossible to satisfy all of these at once, and a great deal of phonological change can be understood as endless attempts at satisfying these competing pressures, with each resulting change typically introducing new strains into the system. We have further seen evidence that the principle that sound change is regular is a very fruitful basis for examining the phonological history of a language, since clinging to this principle allows us to identify problematic data with great precision and often to find explanations for them, explanations that increase our understanding of the history of the language in question. Finally, while some changes apply only to particular segments, others apply instead to entire natural classes of segments, and these changes can often be considered most profitably within a rule-based framework like generative phonology, with each such change being interpreted as some kind of rule change.

Further reading

The study of phoneme systems and of phonological space was pioneered by the Prague School linguists almost 75 years ago, notably in Trubetzkoy (1939). Useful surveys of phoneme systems can be found in Hockett (1955), Sedlak (1969), O'Connor (1973: Chapter 7), Crothers (1978), Nartey (1979), Maddieson (1980a, 1980b, and especially 1984), Lass (1984: Chapter 7) and Lindblom (1986). The use of these ideas in exploring phonological change, and the notions of holes in the pattern and chain shifts, were chiefly developed by André Martinet, especially in Martinet (1955); more recently the American William Labov has been pursuing the investigation of chain shifts, especially in Labov (1994, 2001 and 2008). The classic work on the application of generative phonology to phonological change is King (1969). The leading figure in the field has long been Paul Kiparsky, who has developed his ideas in a series of publications, among the more important of which are Kiparsky (1968a, 1968b, 1971 and 1973). Kiparsky (1988) is an overview of phonological change including some topics discussed later in this book. Smith (2009) is an excellent non-generative treatment of English historical phonology.

Exercises

Wherever possible (it may not always be possible or helpful), you may like to write phonological rules for the changes you identify in each of the following problems and to put those rules into an appropriate historical order.

Exercise 4.1

Most varieties of Basque have the five oral vowels /i e a o u/. The Zuberoan (Souletin) dialect has six, the extra vowel being a front rounded vowel /ü/. Table 4.6 shows some Basque words, given both in their standard form, which represents the vocalism of most other dialects, and in Zuberoan. Try to explain what has happened in Zuberoan. Ignore any differences in the consonants; they are not relevant here. The data have been selected to avoid one or two complications.

Table 4.6 Vowel patterns in Zuberoan and other Basque dialects

			Standard	Zuberoan
1.	'cuckoo'		*kuku*	*kükü*
2.	'debtor'		*zordun*	*zordün*
3.	'foot'		*oin*	*huñ*
4.	'gold'		*urre*	*ürhe*
5.	'good'		*on*	*hun*
6.	'head'		*buru*	*bürü*
7.	'he has me'		*nau*	*nai*
8.	'help'		*lagundu*	*lagüntü*
9.	'hold'		*eduki*	*edüki*
10.	'hundred'		*ehun*	*ehün*
11.	'hut'		*ola*	*olha*
12.	'I have it'		*dut*	*düt*
13.	'island'		*uharte*	*üharte*
14.	'long'		*luze*	*lüze*
15.	'man'		*gizon*	*gizun*
16.	'night'		*gau*	*gai*
17.	'red'		*gorri*	*gorri*
18.	'short'		*motz*	*mutz*
19.	'sole'		*zola*	*zola*
20.	'take'		*hartu*	*hartü*
21.	'we'		*gu*	*gü*
22.	'when?'		*noiz*	*nuiz*
23.	'who?'		*nor*	*nur*
24.	'you have it'		*duzu*	*düzü*

Exercise 4.2

Hawaiian has undergone a number of unconditioned changes in the consonant system of its Proto-Polynesian ancestor. Table 4.7 lists some examples of these changes illustrating all the Proto-Polynesian consonants and their Hawaiian descendants. Identify the changes, and comment where possible on the order in which they occurred. Compare the resulting consonant system of Hawaiian with that of its ancestor, and comment on the degree of naturalness of the changes and on the degree of symmetry of the original phoneme system and of the resulting Hawaiian system (data from Crowley 1992).

Exercise 4.3

Spanish has the five vowels /i e a o u/. In some stems containing /e/ or /o/, these vowels alternate with the diphthongs /ie/ and /ue/ when stressed (the position of the stress is marked by an acute accent):

tenér 'have'	*tiéne* 'has'
cerrár 'close'	*ciérre* 'fastener'
certitúd 'certainty'	*ciérto* 'certain'
contár 'count up'	*cuénta* 'account, bill'
podér 'be able to'	*puédo* 'I can'
venezoláno 'Venezuelan'	*Venezuéla* 'Venezuela'

Table 4.7 The consonants of proto-Polynesian and Hawaiian (adapted from Crowley 1992)

		Proto-Polynesian	Hawaiian
1.	'back of canoe'	*takele	kaʔele
2.	'blow'	*pusi	puhi
3.	'branch'	*maŋa	mana
4.	'canoe'	*vaka	waʔa
5.	'constant'	*maʔu	mau
6.	'cry'	*taŋi	kani
7.	'dew'	*sau	hau
8.	'dodge'	*kalo	ʔalo
9.	'faeces'	*taʔe	kae
10.	'fermented'	*mara	mala
11.	'fire'	*afi	ahi
12.	'firemaking'	*sika	hiʔa
13.	'fish'	*ika	iʔa
14.	'forbidden'	*tapu	kapu
15.	'four'	*faa	haa
16.	'fruit-picking pole'	*lohu	lou
17.	'gall'	*ʔahu	au
18.	'hear'	*roŋo	lono
19.	'leg'	*vaʔe	wae
20.	'man'	*taŋata	kanaka
21.	'mouth'	*ŋutu	nuku
22.	'navel'	*pito	piko
23.	'nose'	*isu	ihu
24.	'octopus'	*feke	heʔe
25.	'quieten'	*naʔa	naa
26.	'root'	*aka	aʔa
27.	'scrotum'	*laso	laho
28.	'sea'	*tahi	kai
29.	'side'	*tafa	kaha
30.	'sit'	*nofo	noho
31.	'slap'	*paki	paʔi
32.	'tail'	*siku	hiʔu
33.	'thatch'	*kaso	ʔaho
34.	'two'	*rua	lua
35.	'up'	*hake	aʔe
36.	'wave'	*nalu	nalu
37.	'yam'	*ʔufi	uhi

In other words containing /e/ or /o/, however, there is no such alternation:

crecér 'grow'	*créce* 'grows'
meritório 'worthy'	*mérito* 'merit'
pelár 'cut the hair of'	*pélo* 'hair'
ponér 'put'	*póne* 'puts'
soledád 'solitude'	*sólo* 'alone'
costéño 'coastal'	*cósta* 'coast'

Propose a possible explanation for this difference in behaviour in terms of the phonological history of Spanish. You might like to compare your idea with the explanation given in a standard history of Spanish.

Exercise 4.4

Hungarian has the front vowels /i e ü ö/ and their long counterparts /í é ű ő/; it also has the back vowels /u o a/ and their long counterparts /ú ó á/. Hungarian has front-back **vowel harmony**: normally a word contains only front vowels or only back vowels, and the vowel of any suffix must harmonize in backness with the stem. Here are some examples:

kettő 'two'	*tanuló* 'pupil'
fehér 'white'	*sárga* 'yellow'
ügyes 'skilful'	*súlyos* 'heavy'
kert 'garden'	*kertben* 'in the garden'
ház 'house'	*házban* 'in the house'
hozunk 'we bring'	*ülünk* 'we sit'
varrunk 'we sew'	*verünk* 'we beat'

But the vowels /i í e é/ behave strangely. First, they can occur in words that otherwise contain only back vowels:

virág 'flower'	*kocsi* 'coach, car'
gyertya 'candle'	*vékony* 'thin'

Second, when they occur in back-vowel words, they are ignored in determining the backness of a suffix:

kocsiban 'in the car' (**not** **kocsiben*)

Third, some words containing *only* these four vowels take front-vowel suffixes, while others take back-vowel suffixes:

víz 'water'	*vízben* 'in the water'
kés 'knife'	*késben* 'in the knife'
kín 'torture'	*kínban* 'in the torture'
cél 'target'	*célban* 'in the target'

Propose a possible explanation for this curious behaviour in terms of the phonological history of Hungarian.

Exercise 4.5

Many urban accents of the northern USA exhibit a set of clearly related changes in the qualities of certain vowels; these changes have been collectively dubbed the *Northern Cities Shift*. Table 4.8 lists the six different changes involved, in the order in which they appear to have occurred, from earliest to most recent. For each of the six vowels, I provide a representative word containing it, a conservative pronunciation from an American accent in which the shift has not occurred, and an advanced pronunciation from an accent in which the shift is maximally prominent. Note that

Table 4.8 The 'Northern Cities Shift' (adapted from Labov 1994)

1.	/æ:/	hand	[æ:]	[iː(ə)]
2.	/a:/	got	[a:]	[æ:]
3.	/ɔ:/	talk	[ɔ:]	[a:]
4.	/e/	head	[ɛ]	[ʌ]
5.	/ɪ/	sing	[ɪ]	[ɛ]
6.	/ʌ/	bus	[ʌ]	[ɔ]

/æ:/ is a tense (long) vowel in most American accents (data from Labov 1994). These shifts are quite dramatic. Speakers who have not undergone the shifts, when listening to speakers who have undergone them, often mishear *Ann* as *Ian*, *socks* as *sax*, *chalk* as *chock*, *steady* as *study*, *sing* as *sang*, *bus* as *boss*, and so on.

Plot the movements of these six vowels on a diagram of the vowel space, and comment on what seems to have happened in these accents, in terms of the ideas introduced in the chapter.

Exercise 4.6

The Swiss German dialect of Schaffhausen has a back vowel /o/. Historically, this /o/ has been lowered to [ɔ] when followed by any non-lateral coronal, but not otherwise. Thus Schaffhausen has *holts* 'wood', *xopf* 'head', *bogə* 'bow' and so on, with a following labial, velar, or /l/, but *hɔrn* 'horn', *bɔdə* 'floor', *pɔʃt* 'post' and so on, with a following coronal other than /l/. Write a rule that accounts for this lowering.

In certain circumstances, most notably in the plural, the vowel /o/ is fronted to [ø], in the familiar Germanic process of *umlaut*. Thus, for example, the plural of *bogə* is *bøgə*, and the plural of *bɔdə* is *bødə*. Write a rule that accounts for this, citing the environment merely as [Plural].

In the neighbouring dialect of Kesswil, both the lowering of /ø/ and umlaut are also present, but the results are slightly different. Nouns which have [ɔ] in the singular have in the plural not [ø] but its lowered counterpart [œ], and hence *bɔdə* has the plural *bœdə*.

Now, both Schaffhausen and Kesswil possess a small number of forms containing front rounded [ø] in their stems followed by a coronal, such as *pløtsli* 'biscuit(s)' and *frøʃʃ* 'frog'. All such words, in both dialects, have only [ø] and never [œ].

Given these facts, propose an explanation of the phonological histories of Schaffhausen and Kesswil (data from Kiparsky 1968a).