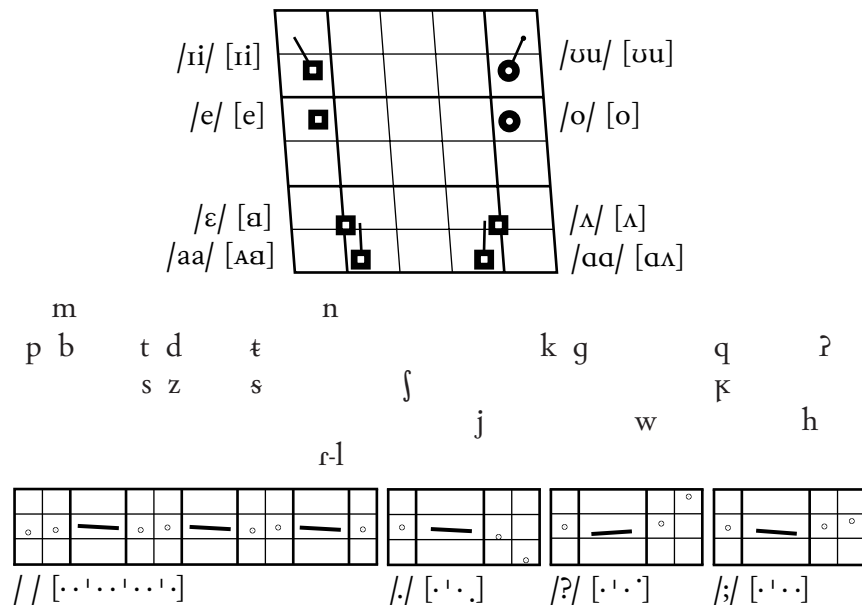22.46. *Akkadian* (Afro-Asiatic) had four *V*, both short and long (the latter being actually narrow diphthongs), which in a simpler, more abstract, (intra)phonemic transcription could be broadly indicated as /i, ii; a, aa; ɑ, ɑɑ; u, uu/. As for *C*, we further signal [n≡C], and *C* ≠ *CC*.
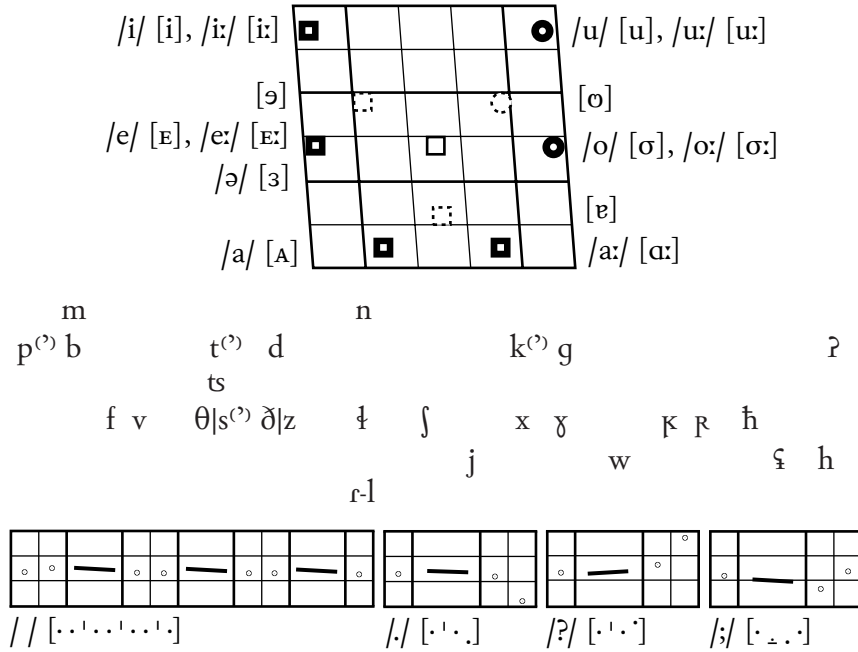

22.47. *Old Arabic* (Afro-Asiatic) had three *V*, both short and long, with taxophones resulting from the contact with uvular, uvularized, or pharyngeal *C* (and in the case of /a, aː/, even from a total lack of such *C*: [a, aː]). There were the diphthongs /ai, au/, also prone to the said influence. Further, it had [n≡C], and *C* ≠ *CC*. The major differences with Proto-Semitic relate to their stopstrictives and constrictives.
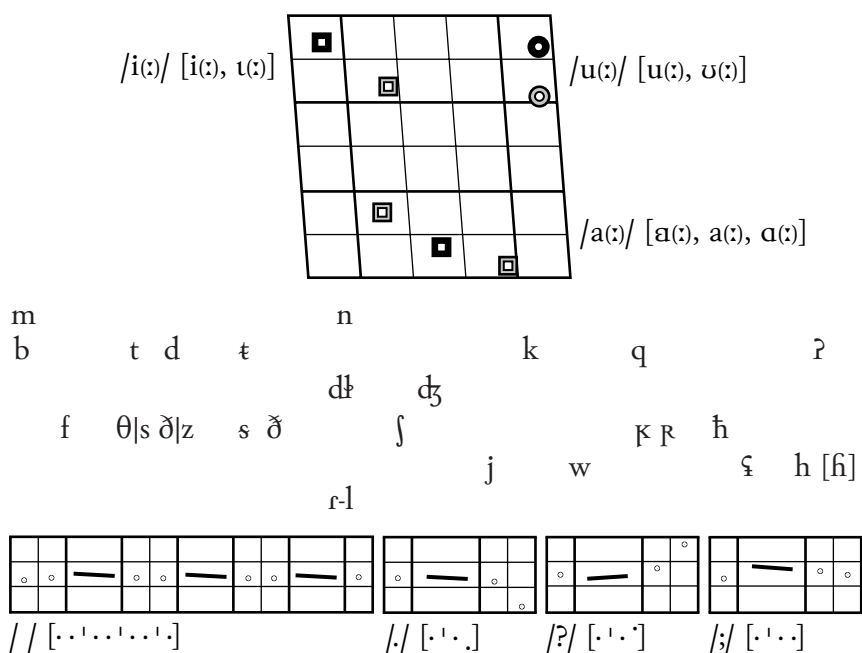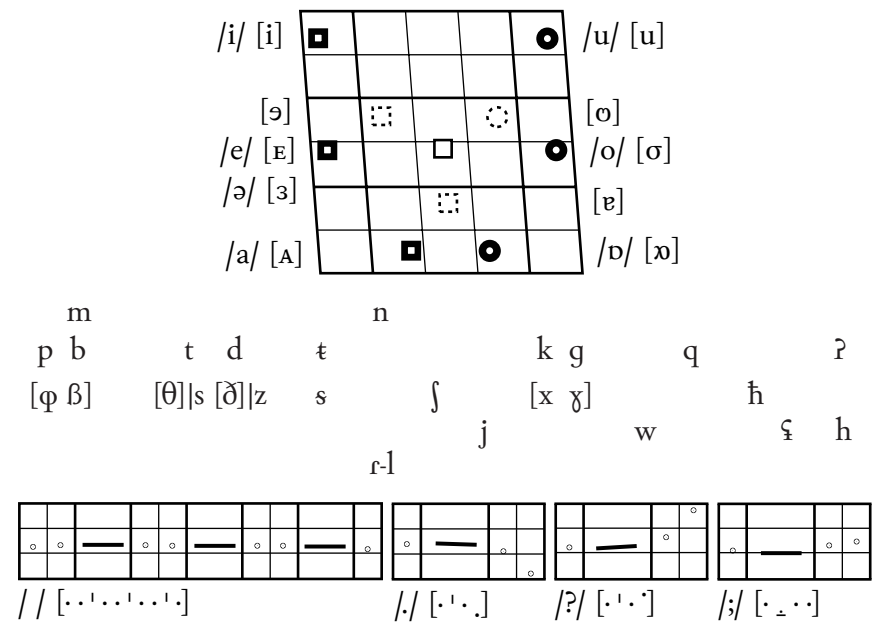

22.48. *Biblical Hebrew* (Afro-Asiatic) had five *V*, both short and long (with differences in timbre for the two low ones only), in addition to /ə/ [ɜ]. It also had
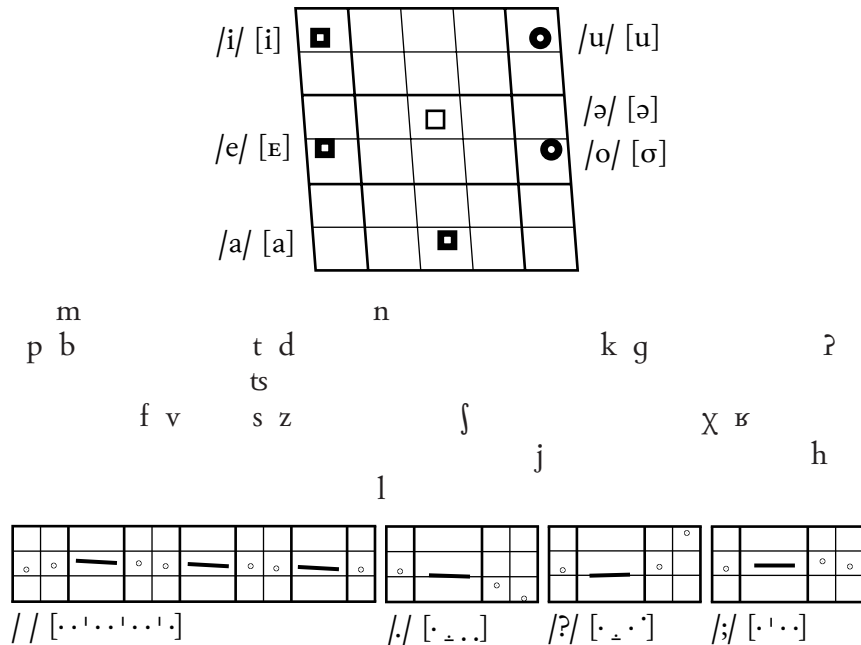
the diphthongs, /iu, ai, ɑi, oi, eu, au, ɑu, ui/, as well as three unstressed taxo-phones, [ə, ɐ, ʊ], known as ‹schwa augments› but actually representing the neu-tralization of /i(ː), e(ː)/, /a(ː), ɑ(ː)/, /o(ː), u(ː)/. It had opposition between C ≠ CC and between plain and ejective C; [n≡C], /ʕ/ [ʂ].

/i/ [i], /iː/ [iː]   /u/ [u], /uː/ [uː]
[ə]   [ʊ]
/e/ [ɛ], /eː/ [ɛː]   /o/ [o̞], /oː/ [o̞ː]
/ə/ [з]   [ɐ]
/a/ [ɑ]   /aː/ [ɑː]

m   n
p⁽ʼ⁾ b   t⁽ʼ⁾ d   k⁽ʼ⁾ g   ʔ
ts
f v   θ|s⁽ʼ⁾ ð|z   ɬ   ʃ   x ɣ   ĸ ʀ ħ
j   w   ʕ h
ɾ-l

/ / [··ˈ··ˈ··ˈ·]   /·/ [·ˈ·.]   /?/ [·ˈ·ˊ]   /;/ [·˯··]

22.49. *Tiberian Hebrew* (Afro-Asiatic) only had seven short V, including /ə/ [з] and the three taxophones stemming from the neutralizations (seen in § 22.44), [ə, ɐ, ʊ]. Notice, however, that in the Graeco-Roman tradition /a, ɒ/ [ɑ, ɒ] had merged into /a/ [a]. It showed opposition between C and CC (non-geminate /p, b; t, d; k, g/ exhibiting continuant taxophones, [ɸ, ß; θ, ð; x, ɣ]) and between plain and ejective C; [n≡C], /ʕ/ [ʂ].

/i/ [i]   /u/ [u]
[ə]   [ʊ]
/e/ [ɛ]   /o/ [o̞]
/ə/ [з]   [ɐ]
/a/ [ɑ]   /ɒ/ [ɒ]

m   n
p b   t d   ɬ   k g   q   ʔ
[ɸ ß]   [θ]|s [ð]|z   ş   ʃ   [x ɣ]   ħ
j   w   ʕ h
ɾ-l

/ / [··ˈ··ˈ··ˈ·]   /·/ [·ˈ·.]   /?/ [·ˈ·ˊ]   /;/ [·˯··]

22.50. *Sephardite Hebrew* (Afro-Asiatic) had six short *V* (including /ə/ [ə]), the C given, no *CC*, and [n≡C].

/i/ [i]   /u/ [u]

/ə/ [ə]

/e/ [ɛ]   /o/ [ɔ]

/a/ [a]

     m   n

p b   t d   k g   ʔ

       ts

   f v   s z   ʃ   χ ʁ   h

         j

     l

/ / [·· ˈ ·· ˈ ·· ˈ ·]   /./ [· ˍ ·.]   /?/ [· ˍ ·ˈ]   /;/ [·ˈ··]
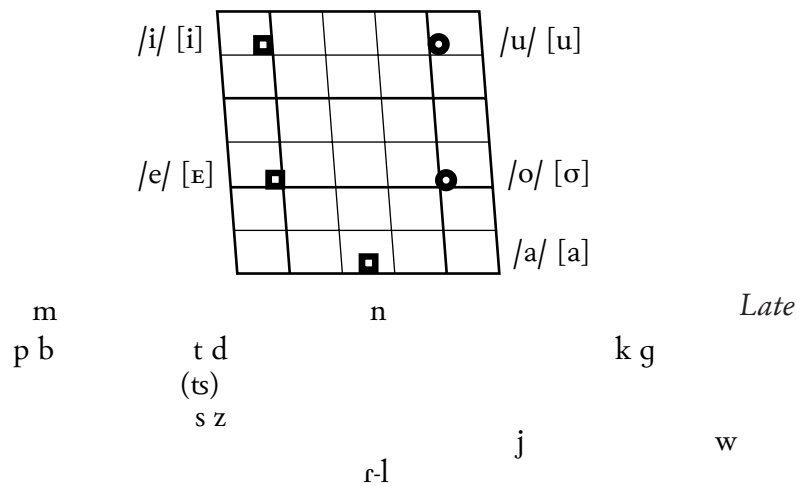
22.51. *Lydian* (IE) had six short *V*, two of them nasalized as well: /ã, ɔ̃/ [ã, ɔ̃]; [ə] broke its frequent *C* clusters, especially between consonants and sonants; no diphthong, nor phonemic length. The taxophones shown occurred in voiced contexts.

/i/ [i]   /u/ [u]

            /ə/ [ə], /ɔ̃/ [ɔ̃]

/e/ [ɛ]   /o/ [ɔ]

/a/ [a], /ã/ [ã]

     m   n   ŋ

p [b]   t [d]   k [g]   k̡ [ɡ̡]   [ʔ]

        ts dð|dz

    f v   s   ʃ

       ɾ-l|λ

/ / [·· ˈ ·· ˈ ·· ˈ ·]   /./ [·ˈ·.]   /?/ [·ˈ·ˈ]   /;/ [· ˍ ·.]
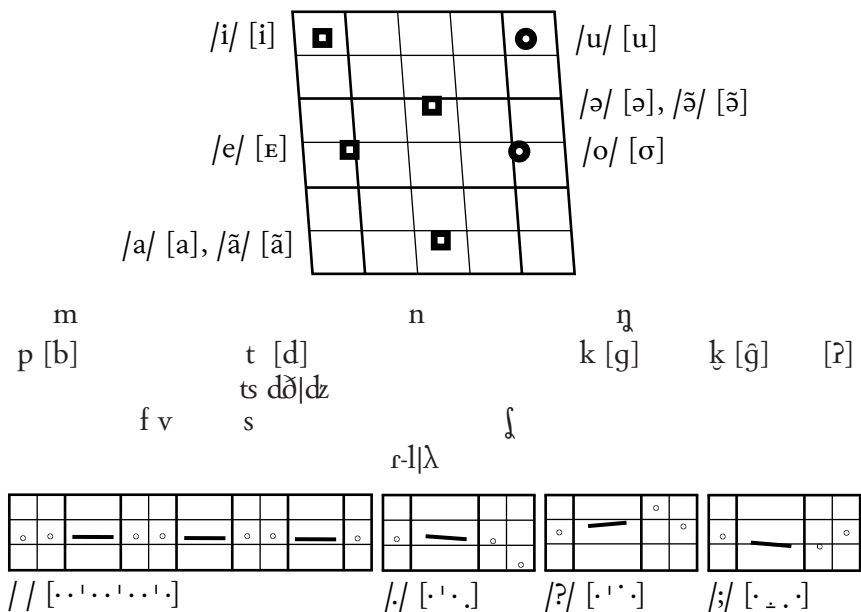
22.52. *Early Phrygian* (IE) had the five short and long (double) *V* indicated, with length neutralization in unstressed syllables, and four ‹short› diphthongs, /ei, ai, au, oi/, and two ‹long› diphthongs (*ie* the combinaztion of /aː, oː/ with /i/), which we do not show in the vocogram. It had the taxophone /s/ [z] before voiced *C*, and [n≡C].

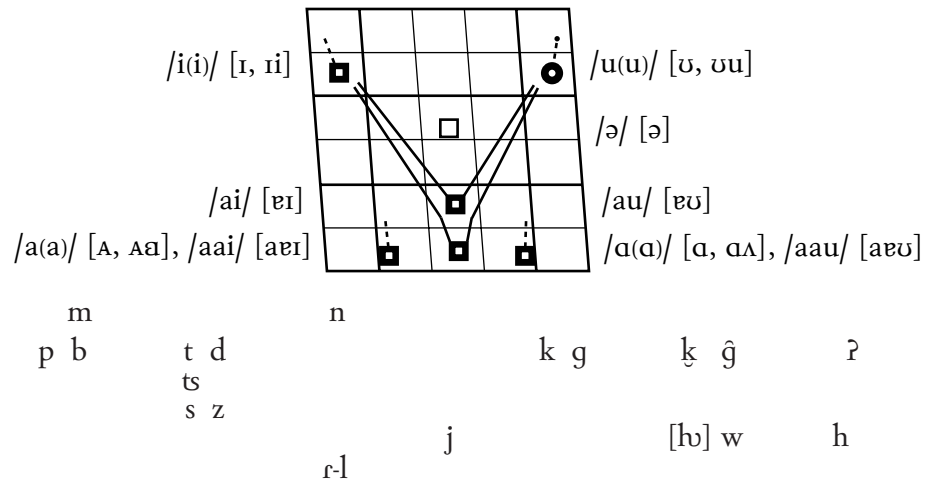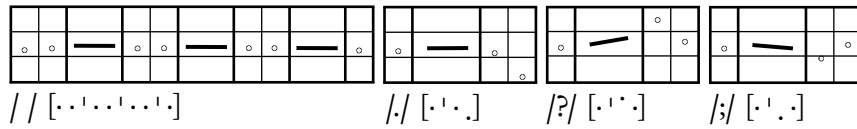*Late Phrygian* lost any diphthongs and vowel length; it changed /ʣ → z/ and reduced the occurrence of /ts/.

/i/ [i], /ii/ [ii, ₒi]   /u/ [u], /uu/ [uu, ₒu]

/e/ [ɛ], /ee/ [ɛɛ, ₒɛ]   /o/ [σ], /oo/ [σσ, ₒσ]

                                                          /a/ [a], /aa/ [aa, ₒa]

     m   n   *Early*
  p b   t d   k g
      ts ʣ
      s [z]
                                                    j   w
                              ɾ-l

/ / [·· ' ·· ' ·· ' ·]   /·/ [· ' ··]   /?/ [· ' ·· ·]   /;/ [· ' · ·]

/i/ [i]   /u/ [u]

/e/ [ɛ]   /o/ [σ]

                                                     /a/ [a]

     m   n   *Late*
  p b   t d   k g
      (ts)
      s z
                                                    j   w
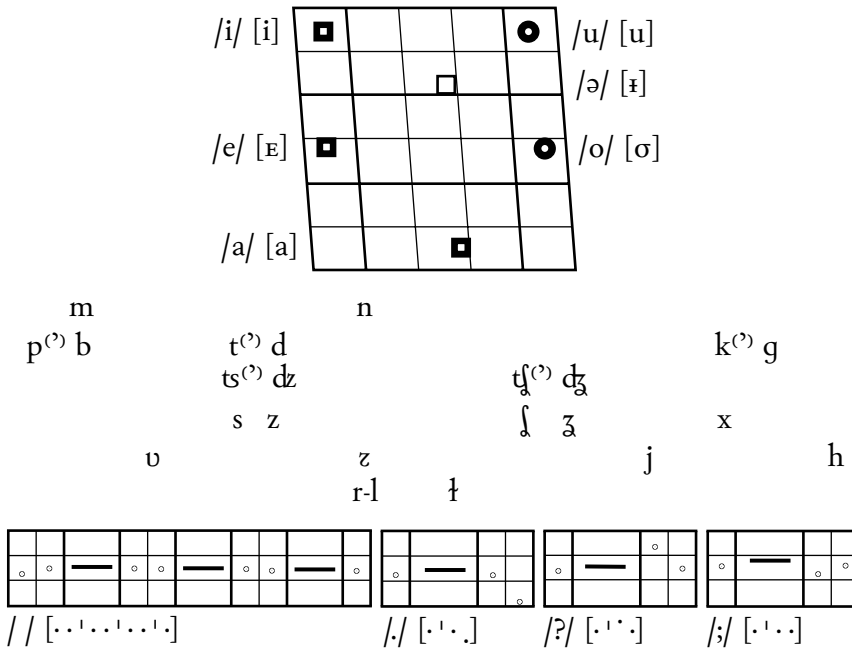   ɾ-l
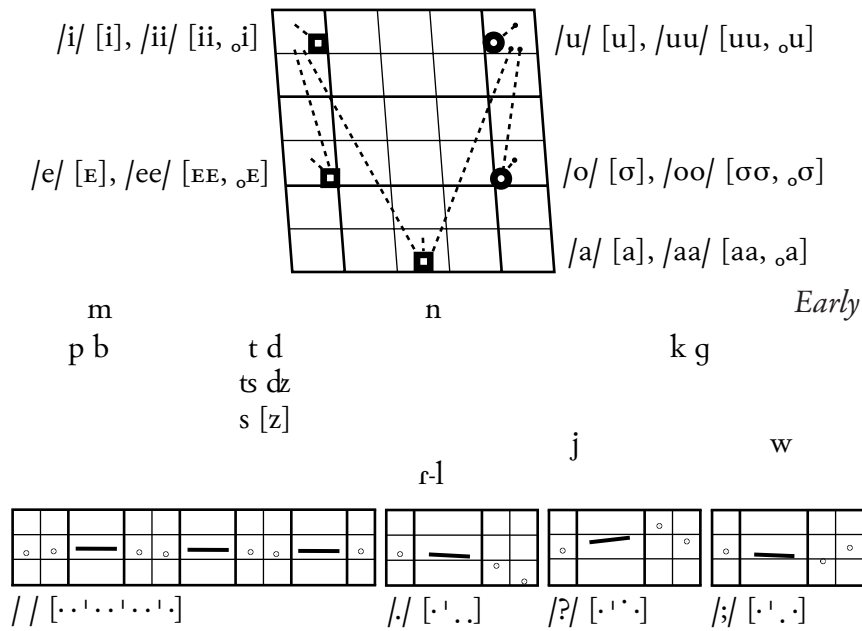
22.53. *Hittite* (ɪᴇ) had four *V*, both short and long (narrow diphthongs), and four phonemic diphthongs resulting from the combination of /ɐ(ɐ)/ with /i, u/:

/i(i)/ [ɪ, ɪi]   /u(u)/ [ʊ, ʊu]

                                                    /ə/ [ə]

/ai/ [ɐɪ]   /au/ [ɐʊ]
/a(a)/ [ʌ, ʌɐ], /aai/ [ɐɐɪ]   /ɑ(ɑ)/ [ɑ, ɑʌ], /aau/ [ɐɐʊ]

     m   n
  p b   t d   k g   ķ ĝ   ʔ
      ts
      s z
                                        j   [ɦʊ] w   h
                              ɾ-l

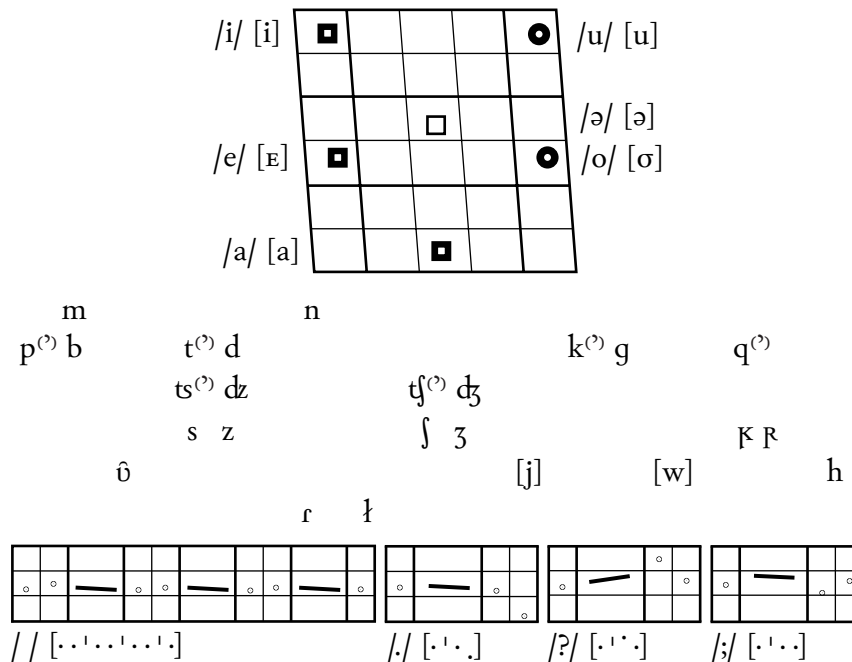/ / [·.·'..'..'.]   /./ [·'·.]   /?/ [·'·.]   /;/ [·'.·]

/ai, aai; au, aau/ [ɐɪ, aɐɪ; ɐʊ, aɐʊ]; besides, /ə/ [ə] to break heavy consonantal clusters; it had the *C* given, and [n≡C].

22.54. *Classic* or *Old Armenian* (ɪᴇ) had six short *V*, including /ə/ [ɨ] (inserted in consonant clusters), several diphthongs with /i, u/ as second elements, and the *C* given, with opposition between plain and ejective *C*; [n≡C].

/i/ [i]   /u/ [u]
          /ə/ [ɨ]
/e/ [ɛ]   /o/ [ɔ]
/a/ [a]

	m		n				
p⁽ʼ⁾ b		t⁽ʼ⁾ d				k⁽ʼ⁾ g	
	ts⁽ʼ⁾ dz		tʃ⁽ʼ⁾ dʒ				
	s z		ʃ ʒ			x	
ʋ		z			j		h
	r-l	ɬ				

/ / [·.·'..'..'.]   /./ [·'·.]   /?/ [·'·.]   /;/ [·'·.]

22.55. *Ancient Georgian* (Caucasian) in practice had the same short *V* of present-day Georgian, including /ə/ [ə] to break the typical complex clusters of

/i/ [i]   /u/ [u]
          /ə/ [ə]
/e/ [ɛ]   /o/ [ɔ]
/a/ [a]

	m		n				
p⁽ʼ⁾ b		t⁽ʼ⁾ d			k⁽ʼ⁾ g	q⁽ʼ⁾	
	ts⁽ʼ⁾ dz		tʃ⁽ʼ⁾ dʒ				
	s z		ʃ ʒ		ʁ ʁ̞	
ʋ̂			[j]	[w]		h
	ɾ	ɬ				

/ / [·.·'..'..'.]   /./ [·'·.]   /?/ [·'·.]   /;/ [·'·.]

C. Even its C have changed very little; it had the prevocalic taxophones of /i, u/ [j, w].

22.56. *Ubikh* (Caucasian), according to our analysis, based –among others– on recordings (as this language died out a few decades ago [cf § 22.0.3]), had 3 V and 31 C, instead of traditionalist 2 V and 80-odd C, even though there further were 4 V taxophones and 50 (or 58) C taxophones, including 7 functional ejective C, as well. We can obtain this inventory thanks to /Cj, Ci, Cɥ, Cu, Cw/ sequences.

The very inaccuracy of current descriptions, as the fluctuation in actual real-izations too, point out the non-essentiality of many [C] previously indicated as /C/. We further only signal the opposition between plain and ejective C.

/i/ [i, ɪ]   /u/ [μ, ʊ]

/a/ [ɑ, a, ə]

Consonant phonemes only

m   n
p⁽ʼ⁾ b   t⁽ʼ⁾ d   k⁽ʼ⁾ g   q⁽ʼ⁾
          ts⁽ʼ⁾ dz   tɬ⁽ʼ⁾   tʃ⁽ʼ⁾ dʒ   tʂ⁽ʼ⁾ dʐ   kɕ⁽ʼ⁾ gʝ
    f v   s z   ɬ ɮ   ʃ ʒ   ʂ ʐ   ɕ ʑ   x ɣ   ꭥ ʁ
                                           j   ɥ   w   h
          ɾ

Consonant taxophones as well

  m   [m̥]   [ɱ̊]   n   [ñ]   [ɳ]
p⁽ʼ⁾ b [p̬⁽ʼ⁾ b̥] [p̪⁽ʼ⁾ b̪]   t⁽ʼ⁾ d [t̬⁽ʼ⁾ d̥]   [ʈ⁽ʼ⁾ ɖ]   [c⁽ʼ⁾ ɟ][ɕ⁽ʼ⁾] k⁽ʼ⁾ g [k̬⁽ʼ⁾ ĝ] q⁽ʼ⁾ [q̂⁽ʼ⁾]
          ts⁽ʼ⁾ dz [t̬s⁽ʼ⁾ d̥z]   [tʂ⁽ʼ⁾ dʐ][tʃ⁽ʼ⁾ dʒ] tʃ⁽ʼ⁾ dʒ [t̬ʃ⁽ʼ⁾ d̥ʒ]
          tɬ⁽ʼ⁾ [t̬ɬ⁽ʼ⁾]   [t̬ɬ⁽ʼ⁾]
    f v [f̬ ɣ̥][f̪ v̪] s z [ş ẑ]   [ʂ ʐ]   [ʃ ʒ]   ʃ ʒ   [ʃ̬ ʒ̥] [ɕ ʑ] [ɕ̬ ʑ̥] x ɣ [x̂ ɣ̂] ꭥ ʁ [ꭥ̂ ʁ̂]
          ɬ ɮ [ɬ̬ ɮ̥]   [ɬ̬ ɮ̥]
                                                  [ħ] j   ɥ [ʜʋ] w   h
          ɾ   [ɾ̪]   [ɽ]

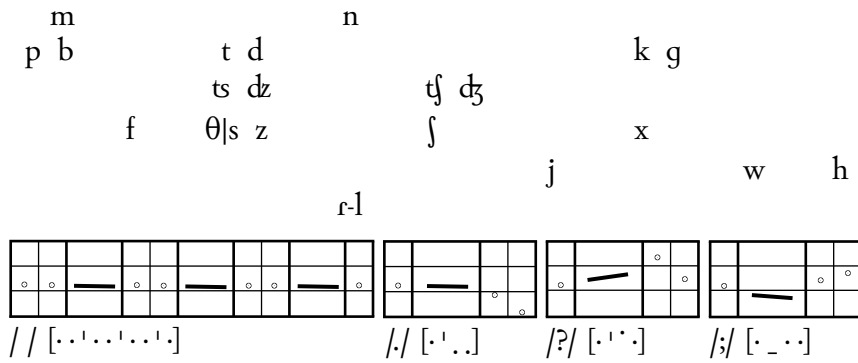/ / [··ˈ··ˈ··ˈ·]   /./ [·ˈ..]   /?/ [·ˈˈ·]   /;/ [·ˈ··]

22.57. *Proto-Iranian* (IE) had three V, both short and long (the two series hav-ing very different timbres), and four diphthongs (the first element corresponding

/iː/ [iː]   /uː/ [uː]

/i/ [e]   /u/ [o]
/ai/ [ʌɪ]   /aːi/ [ɒːɪ]
/au/ [ʌʊ]   /aːu/ [ɒːʊ]
/a/ [ʌ]   /aː/ [ɒ]

$$\text{m} \qquad\qquad\qquad \text{n}$$

p b   t d   k g

ts ʣ   ʧ ʤ

f   θ|s z   ʃ   x

j   w   h

ɾ-l

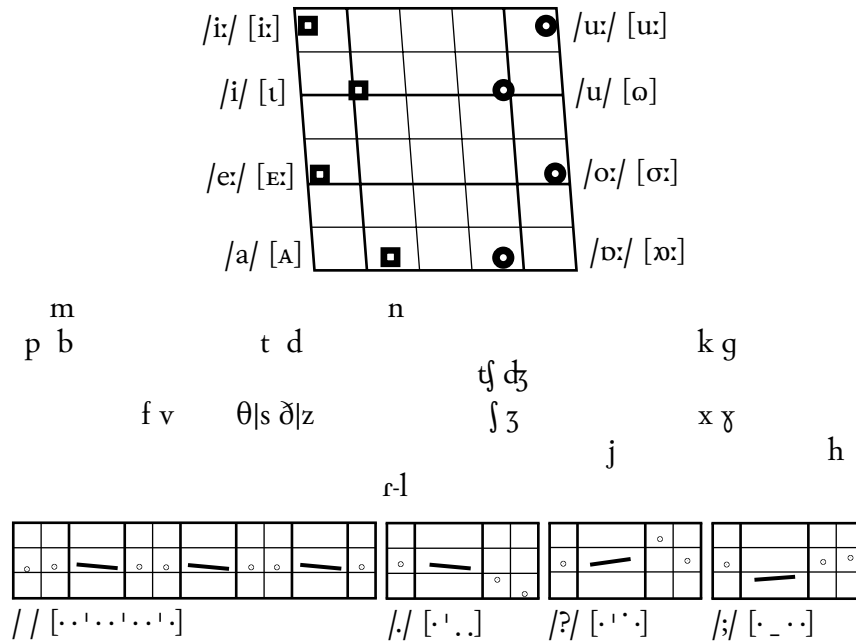/ / [·· ' ·· ' ·· ' ·]   /·/ [· ' ..]   /?/ [· ' ' ·]   /;/ [· _ ··]

to /a/ [ᴀ] or /aː/ [ɒː]), as well as other less common combinations. As for C, we signal [ɾ] and [n≡C].
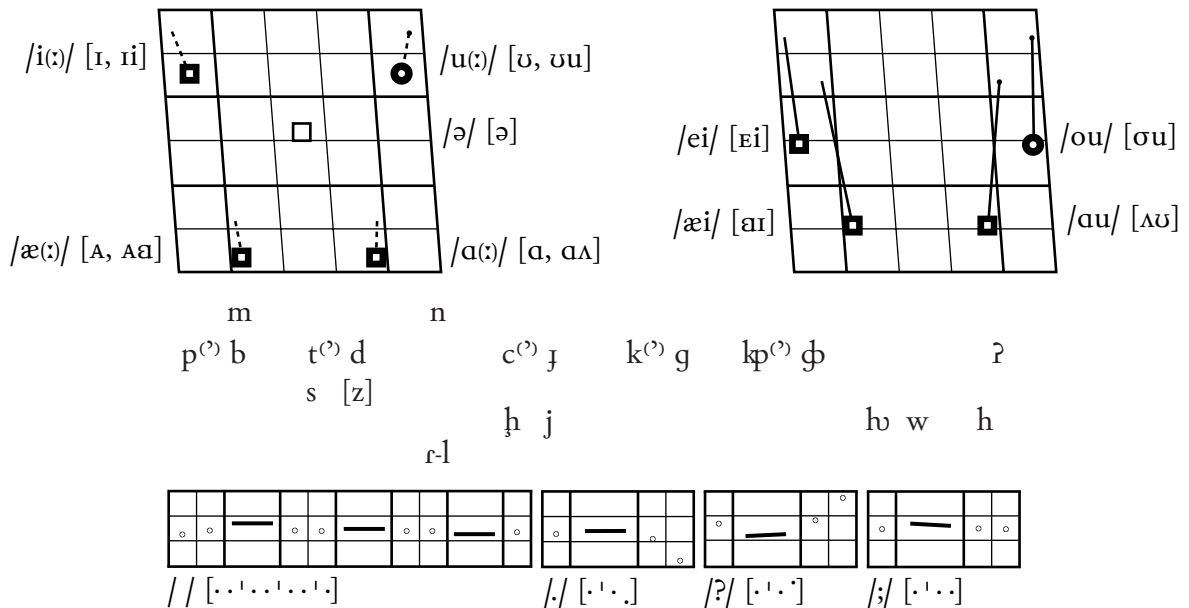
22.58. *Avestan*, or *Avestic* (ɪᴇ), had six short *V* (three of them nasalized as well) /ɪ, ɛ, ɐ, ɔ, ʊ, ə/, and seven long *V* (narrow diphthongs, one nasalized as well) /ɪi, ɛe, æɛ, ɒɔ, ɔo, ʊu, əɨ/, as can be seen on the first vocogram; besides, three phonemic diphthongs /ɐe, ɐo, ɔi/ and two ‹long› diphthongs /æɛi, ɒɔu/, resulting from the combination of the two low long *V* with the two high short ones. In addition, it had the C given, including the sequences /ŋj, ŋw, hj, hw/ [ɲ, ŋ̊, ç, ʍ], and, at least, /hm, hɾ/ [m̥, ɾ̥]; besides [n≡C], and /l/ in loanwords.

/ɪi/ [ɪi], /ɪ/ [ĩ], /ɪ/ [ɪ̃]   /ʊu/ [ʊu], /ʊ/ [ʊ], /ʊ̃/ [ʊ̃]

/əɨ/ [əɨ], /ə/ [ə], /ə̃ɨ̃/ [ə̃ɨ̃]

/ɛe/ [ɛe], /ɛ/ [ɛ]   /ɔo/ [ɔo], /ɔ/ [ɔ]

/ɐ̃/ [ɐ̃]

/æɛ/ [æɛ]   /ɒɔ/ [ɒɔ]

/ɔi/ [ɔi]

/ɐe/ [ɐe]   /ɐo/ [ɐo]

/æɛi/ [æɛi]   /ɒɔu/ [ɒɔu]

m   n   [ɲ]   ŋ   [ŋ̊]

p b   t d   k g

ʧ ʤ

θ|s ð|z   ꞩ   ʃ ʒ   x ɣ

ɸ β   [ç] j   [ʍ] w   h

ɾ-(l)

/ / [·· _ ·· ·· _ ·· _ ·]   /·/ [· _ ..]   /?/ [· _ · ·]   /;/ [· _ ··]
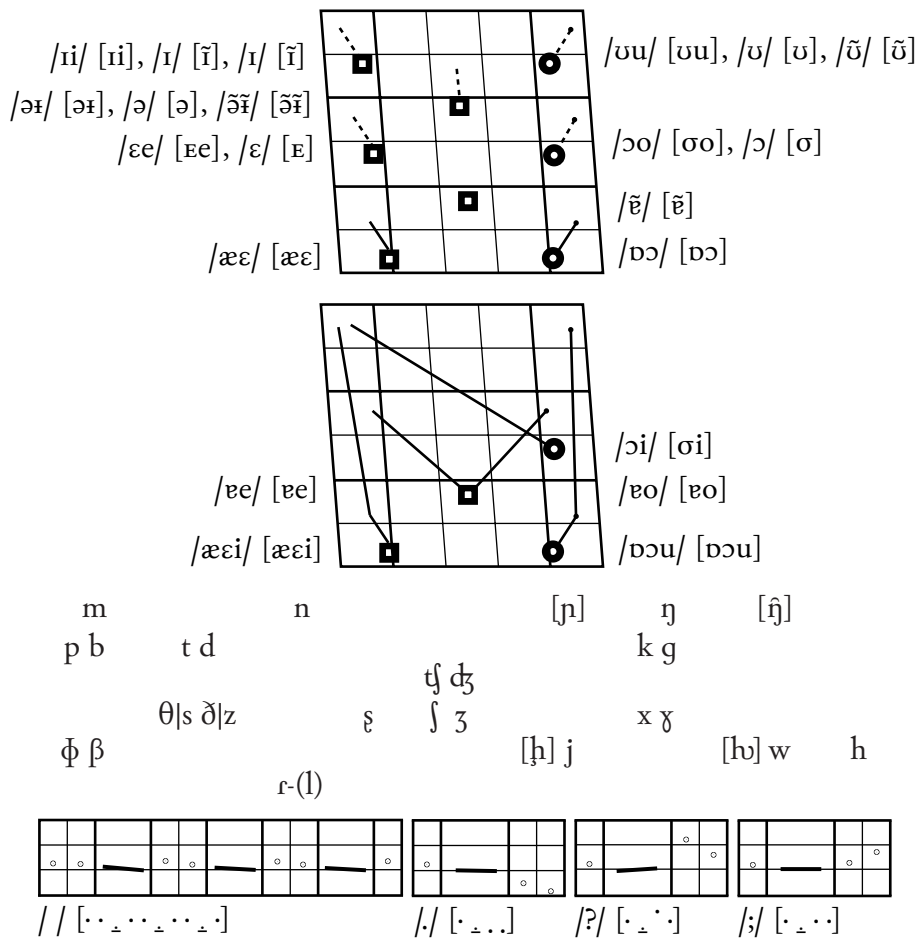
22.59. *Middle Persian*, *Pehlevi* /ˈpɛɪləvi/, *Pahlavi* /ˈpɑːləvi/, (ɪᴇ), had three short and five long *V* (with very different timbres) and the C given, with [n≡C].

/iː/ [iː] /uː/ [uː]

/i/ [ɪ] /u/ [ʊ]

/eː/ [ɛː] /oː/ [ơː]

/a/ [ʌ] /ɒː/ [ɒː]

```
      m                 n
   p b              t d              k g
                    tʃ dʒ
    f v    θ|s ð|z   ʃ ʒ           x ɣ
                      j               h
             ɾ-l
```

/ / [·.'..'..'·]   /./ [·'..]   /?/ [·'·]   /;/ [·_··]

22.60. *Early Proto-Indo-European* (= ɪᴇ) and its later stage (given in the follow-
ing section), are the two principal sources for the various ɪᴇ languages, which
developed at different times (and in different areas). Only by positing two sepa-
rate phases, the previous very different proposals of reconstruction can find oth-
erwise impossible answers. The early stage only had five short V (including /ə/
[ə]) and four long V (actually narrow diphthongs, with the same starting points
as the short V), and four partially different phonemic diphthongs. As for C, we
signal the opposition between ‹aspirated› and ejective C, the occurrence of
velar–bilabial C, /kp, kp’, ɡb/ [kph, kp’, ɡb], of three ‹laryngeal› approximants (two
of them with supralaryngeal colorings, /ħ, h, ɦʊ/ [ħ, h, ɦʊ]), the occurrence of
/əm, ən, əɾ, əl/ [m̩, n̩, ɾ̩, l̩], and of the assimilatory taxophone /s/ [z].

/i(ː)/ [ɪ, ɪi] /u(ː)/ [ʊ, ʊu]

/ə/ [ə]

/æ(ː)/ [ʌ, ʌɐ] /ɑ(ː)/ [ɑ, ɑʌ]

/ei/ [ɛi] /ou/ [ơu]

/æi/ [ɑɪ] /ɑu/ [ʌʊ]

```
        m             n
    p⁽’⁾ b      t⁽’⁾ d        c⁽’⁾ ɟ     k⁽’⁾ g    kp⁽’⁾ ɡb            ʔ
                s [z]
                            ħ j                   ɦʊ w    h
              ɾ-l
```

/ / [··'..'..'·]   /./ [·'..]   /?/ [·'·]   /;/ [·'··]

22.61. *Late Proto-Indo-European* (= ɪᴇ) had six short V (including /ə/ [ə]) and
five long V (the two series having different timbres), as well as six phonemic diph-

thongs. As for *C*, especially noteworthy is the opposition between /C̦, C̦h, Ç, Çh/ [C̦, C̦h, Ç, Çɦ]. There were /Cj, Cw/ sequences for /kj, khj, gj, ghj, hj/ [c, ch, ɟ, ɟɦ, ḥ] and /kw, khw, gw, ghw, hw/ [k̬, k̬h, ĝ, ĝɦ, ʋ]; and the occurrence of /əm, ən, ər, əl/ [m̩, n̩, ɾ̩, l̩], of the assimilatory taxophone /s/ [z], and of [ɦ] for /Çh/ [Çɦ]. It had a normal stress accent (which could be distinctive as a consequence of its being free), which was of a rather high-pitched nature but did not contrast with a low-pitched one. However, this tonetic feature acted as an embryo for the word-tonemes (or pich accents) which would subsequently develop in a number of ɪᴇ languages.
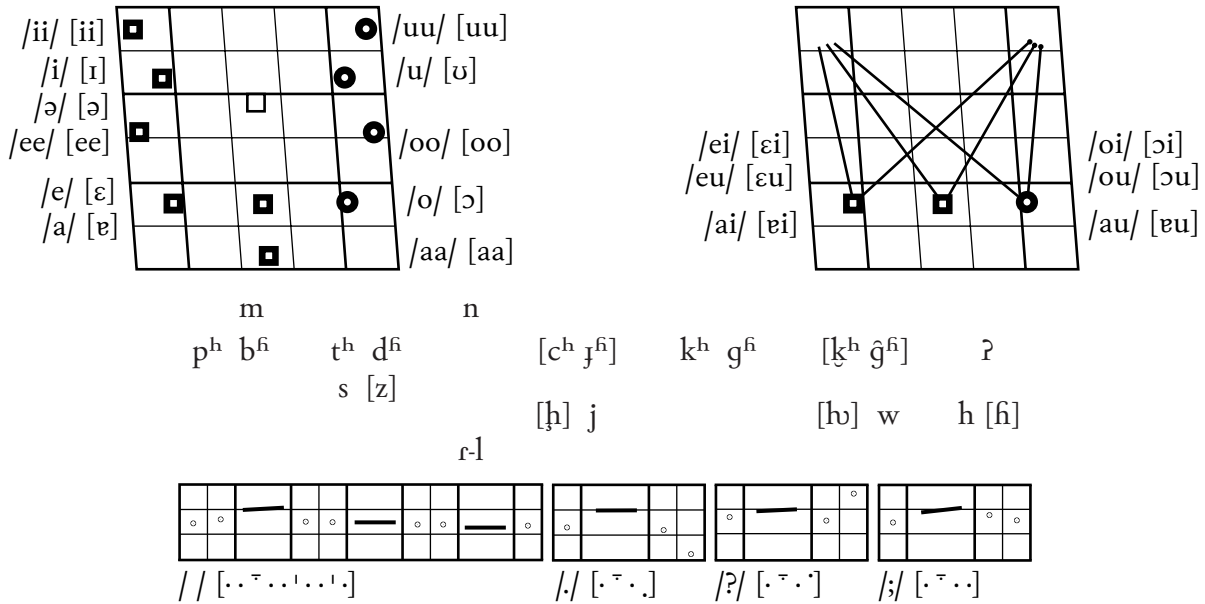
22.62. *Sanskrit* (Indic, ɪᴇ), reconstructed on the basis of the reflexes in the Indian languages (and of the ancient borrowings in different languages, such as Greek and Chinese), had three short and five long *V*, as well as the two diphthongs given. It had opposition between /C̦, C̦h, Ç, Çh/ [C̦, C̦h, Ç, Çɦ].
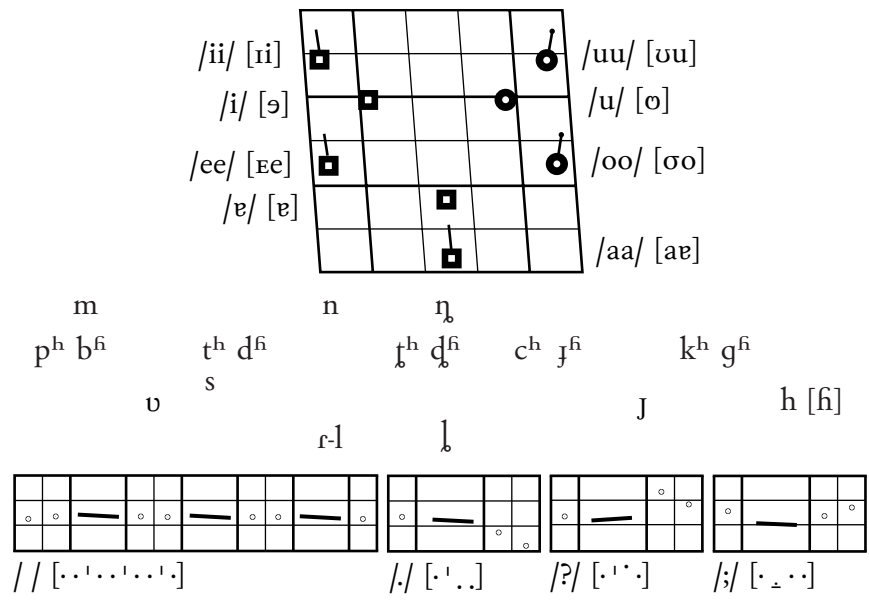
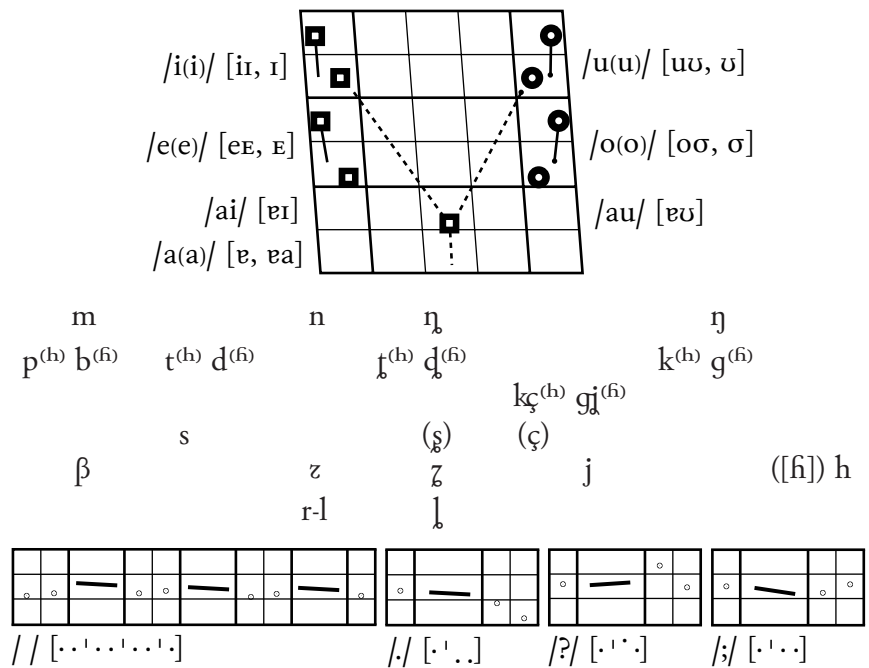Particularly noteworthy were the various approximant taxophones of /hC/: [ḥ]
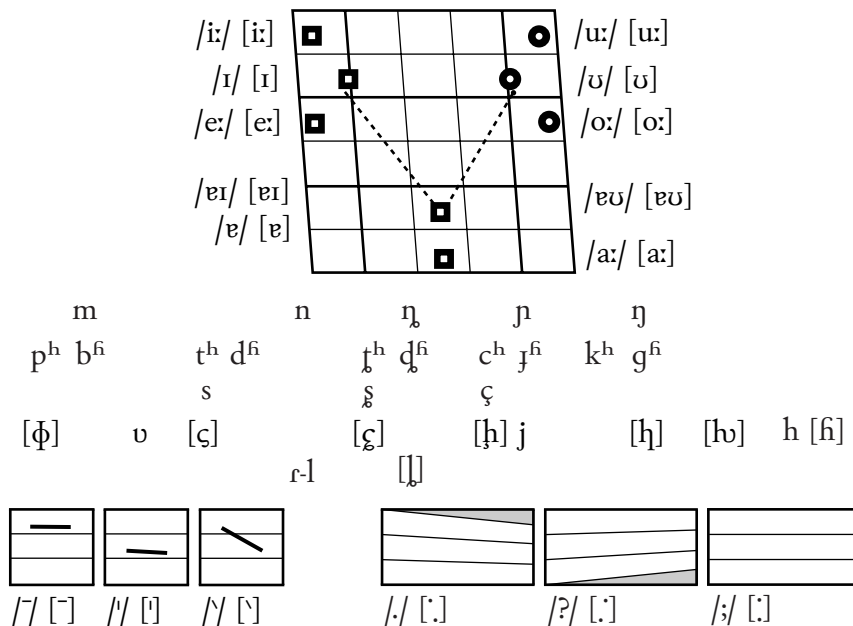
after front *V*, [ʰʊ] after back *V*, [ɦ] after low *V*; further: [ɸ] before labial *C*, [ç] before dental *C*, [ʝ] before apico-palatal *C*, [ɧ] before palatal *C*, [ɧ] before velar *C*.

It had opposition between *C* and *CC*, in addition to /r̩, r̩ː, l̩/, the sequences /hm, hn, hɳ, hʋ, hr, hl/ with [ɦC] as well as others like /ɟɲ, kʂ/ [ɟɲ, kʂ̌]; /hV/ [ɦV]; besides, [n̥≡C] but [Ṽŋ] + /s, ʂ, ç, ʋ, j, h, r, l/; lastly, it had the three tonemes given.

22.63. *Pali* (Indic, ɪᴇ) had three short *V* (which could be distinctively nasalized, as well) and five long *V* (actually narrow diphthongs), differing in timbre. There were no /ai, au/, which had become /ee, oo/, nor intense *C*. It had opposition between /C̬, C̬h, C̬, C̬h/ [C̬, C̬h, C̬, C̬ɦ]; only /s/, but /l̩/ [l̩], and, *C* ≠ *CC*, [n̥≡C].

/ii/ [ɪi]   /uu/ [ʊu]
/i/ [ə]   /u/ [o]
/ee/ [ᴇe]   /oo/ [ɔo]
/ɐ/ [ɐ]
    /aa/ [aɐ]

m   n   ɳ
pʰ bɦ   tʰ dɦ   ʈʰ ɖɦ   cʰ ɟɦ   kʰ gɦ
   ʋ   s   J   h [ɦ]
     r-l   l̩

/ / [··ˈ··ˈ··ˈ·]   /·/ [·ˈ··]   /?/ [·ˈ·ˈ]   /¡/ [·˯··]

22.64. *Old Telugu* (Dravidian) had five *V*, both short and long (the latter being actually narrow opening diphthongs) and the two phonemic diphthongs given.

/i(i)/ [iɪ, ɪ]   /u(u)/ [uʊ, ʊ]
/e(e)/ [eᴇ, ᴇ]   /o(o)/ [oɔ, ɔ]
/ai/ [ɐɪ]   /au/ [ɐʊ]
/a(a)/ [ɐ, ɐa]

m   n   ɳ   ŋ
p⁽ʰ⁾ b⁽ɦ⁾   t⁽ʰ⁾ d⁽ɦ⁾   ʈ⁽ʰ⁾ ɖ⁽ɦ⁾   k⁽ʰ⁾ g⁽ɦ⁾
       kç⁽ʰ⁾ gʝ⁽ɦ⁾
   s   (ʂ)   (ç)
β   z   ʐ   j   ([ɦ]) h
    r-l   l̩

/ / [··ˈ··ˈ··ˈ·]   /·/ [·ˈ··]   /?/ [·ˈ·ˈ]   /¡/ [·ˈ··]

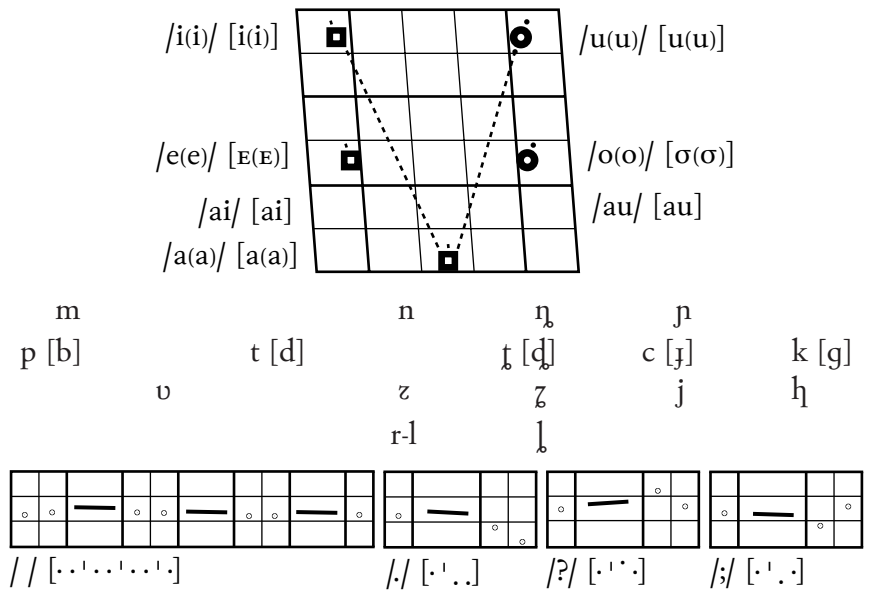The phonemes in brackets, including ‹aspirations›, were used in borrowings from Sanskrit.

22.65. *Old Tamil* (Dravidian) had five V, both short and long (the latter being actually narrow diphthongs) and the two phonemic diphthongs given. The voiced C taxophones occurred in intervocalic position; further, [n≡C].
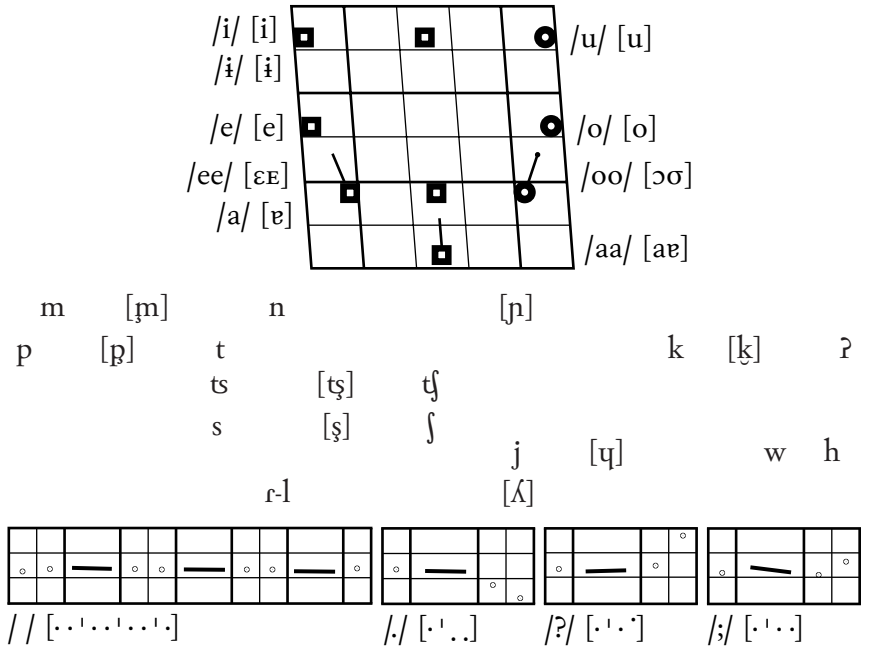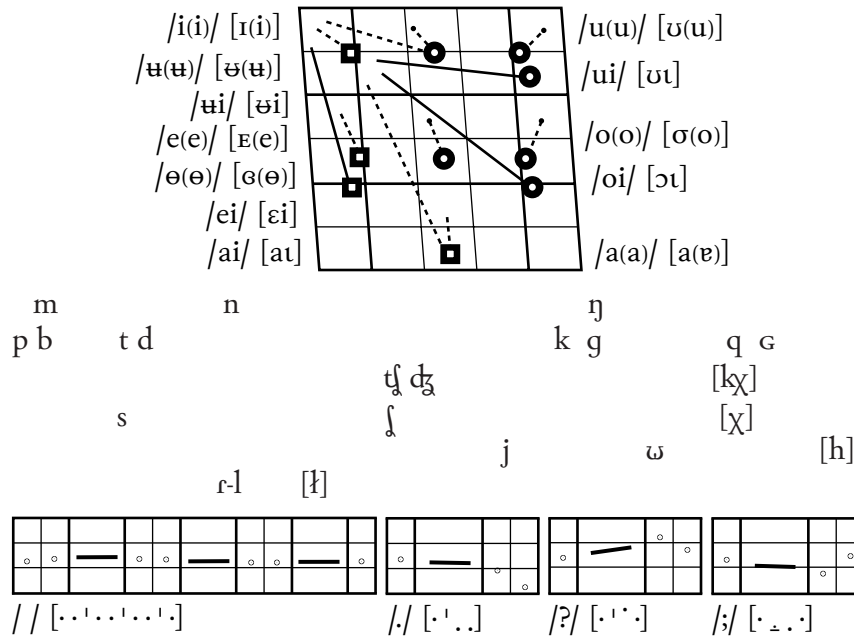


```
/i(i)/ [i(i)]                    /u(u)/ [u(u)]



/e(e)/ [ɛ(ɛ)]                    /o(o)/ [ʊ(ʊ)]
/ai/ [ai]                        /au/ [au]
/a(a)/ [a(a)]
```

```
       m                    n        ŋ̊        ɲ
   p [b]            t [d]         ʈ [ɖ]   c [ɟ]      k [g]
          ʋ                 z      ẓ        j         ɦ
                        r-l       ḷ
```



```
/ / [··'··'··'·]        /./ [·'..]    /?/ [·'·]    /;/ [·'·.]
```

22.66. *Common Tocharian* (IE) had six short and three long V (the latter being actually narrow diphthongs) with differing timbres. It had palatalized C taxophones interpreted as /Cj/ sequences, as was /wj/ [ɥ], as well, along with /kw/ [k̟]; further, [n≡C].


```
/i/ [i]                            /u/ [u]
/ɨ/ [ɨ]

/e/ [e]                            /o/ [o]
/ee/ [ɛɛ]                          /oo/ [ɔʊ]
/a/ [ɐ]

                                   /aa/ [aɐ]
```

```
    m      [m̥]        n            [ɲ̊]
  p      [p̟]       t                          k      [k̟]     ʔ
                    ts     [tʂ]    tʃ
                    s      [ʂ]     ʃ
                               j   [ɥ]           w    h
          r-l                  [ʎ]
```



```
/ / [··'··'··'·]        /./ [·'..]    /?/ [·'·]    /;/ [·'·]
```

22.67. *Classical Mongolian* (Altaic) had seven V, both short and long (the latter being actually narrow diphthongs) and five phonemic diphthongs. Voiceless momentary C were ‹aspirated›; /q/ was mainly [χ, kχ].

/i(i)/ [ɪ(i)]
/ʉ(ʉ)/ [ʊ(ʉ)]
/ʉi/ [ʊi]
/e(e)/ [ᴇ(e)]
/ɵ(ɵ)/ [ɞ(ɵ)]
/ei/ [ɛi]
/ai/ [aɪ]

/u(u)/ [ʊ(u)]
/ui/ [ʊɪ]
/o(o)/ [ɤ(o)]
/oi/ [ɔɪ]
/a(a)/ [a(ɐ)]

m   n   ŋ
p b   t d   k g   q ɢ
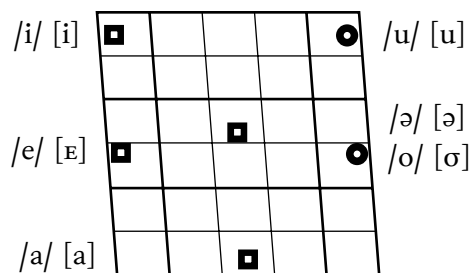   tʃ dʒ   [kχ]
        s   ʃ   [χ]
                      j   ɯ   [h]
        ɾ-l   [ɫ]

/ / [··ˈ··ˈ··ˈ·]   /./ [·ˈ··]   /?/ [·ˈˈ·]   /;/ [·⌣··]

22.68. *Old Chinese* (Sino-Tibetan) had only four short V and combinations of them. It showed both opposition between /C̬, C̬h, C̬/ and the sequences /kw, khw, gw, ʔw, hw/ [ḵ, ḵh, ĝ, ʔ, ḥ]. It had no tonemes.

/i/ [ɪ]
/u/ [ʊ]
/ə/ [ə]
/a/ [a]

m   n   ŋ   [ŋ̊]
pʰ b   tʰ d   kʰ g   [ḵʰ ĝ]   ʔ   [ʔ̬]
        tsʰ dz
        s
        z   j   w   h   [ḥ]
        l

/ / [··ˈ··ˈ··ˈ·]   /./ [·ˈ··]   /?/ [·ˈ··]   /;/ [·ˈ··]
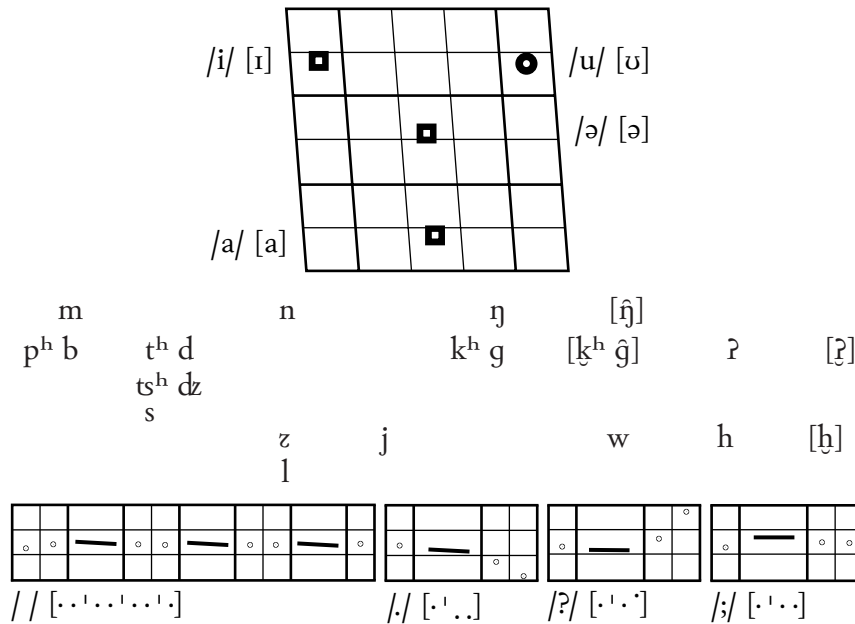
22.69. *Middle Chinese* (Sino-Tibetan) had six short V and their combinations with /i, u/ as second elements of diphthongs. It showed opposition between /C̬,

/i/ [i]
/u/ [u]
/ə/ [ə]
/e/ [ᴇ]
/o/ [ɤ]
/a/ [a]

$$\begin{array}{cccccc}
\text{m} & & \text{n} & & [\text{ɲ}] & \text{ŋ} \\
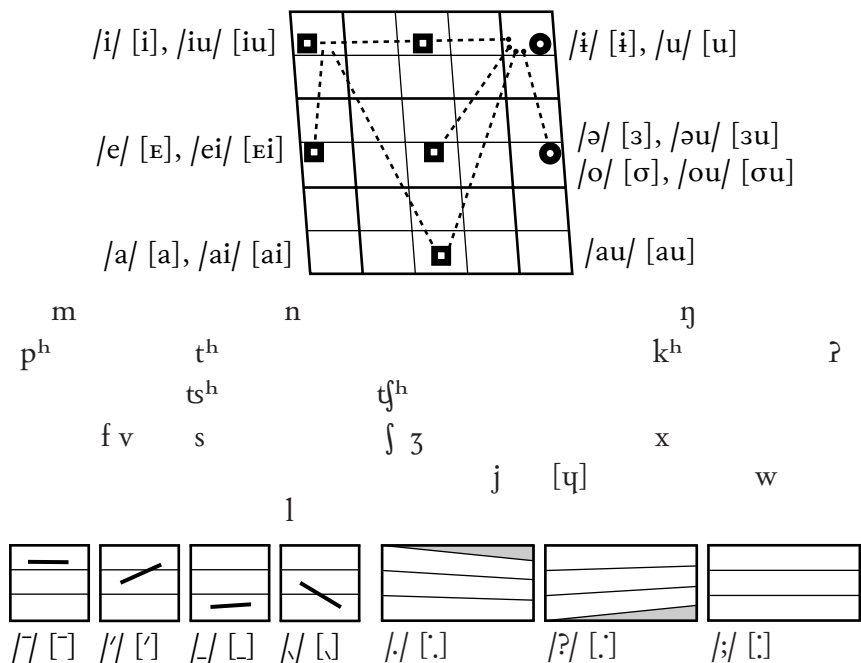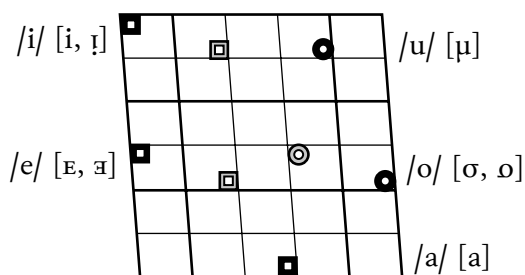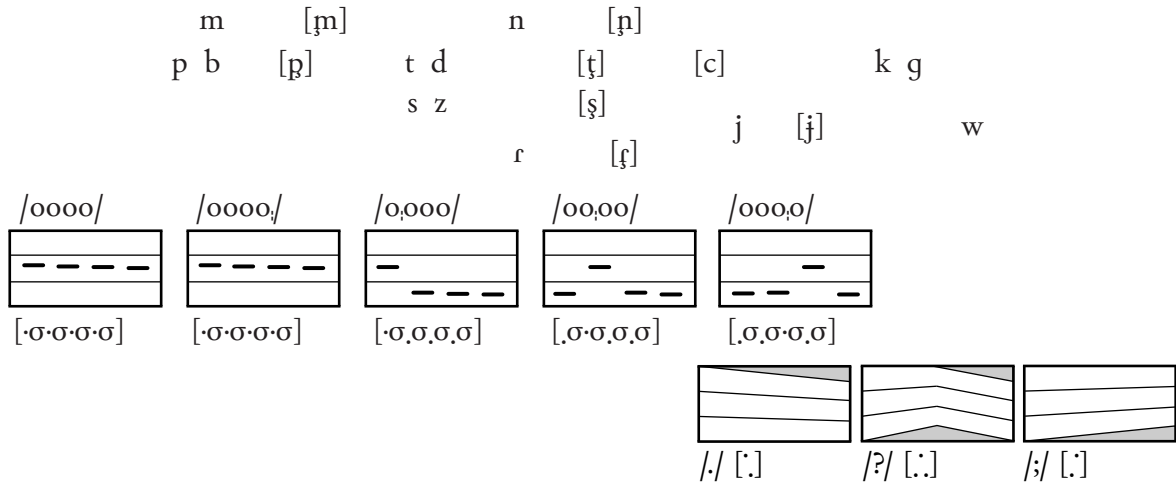\text{p}^\text{h}\ \text{b} & \text{t}^\text{h}\ \text{d} & & \text{t}^\text{h}\ \text{ɖ} & & \text{k}^\text{h}\ \text{g} & (\text{ʔ}) \\
& \text{ts}^\text{h}\ \text{dz} & & \text{tʂ}^\text{h}\ \text{dʐ} & [\text{tʃ}^\text{h}\ \text{dʒ}] & \\
& \text{s}\ \text{z} & & \text{ʂ}\ \text{ʐ} & [\text{ʃ}\ \text{ʒ}] & \text{x}\ \text{ɣ} \\
& & & & \text{j} & & \text{w} \\
& & \text{l} & & &
\end{array}$$

/'/ ['] /ˌ/ [ˌ] /ˌ/ [ˌ] /'/ ['VKᐟ] /./ [ˑ] /ʔ/ [ˑ] /;/ [ː]
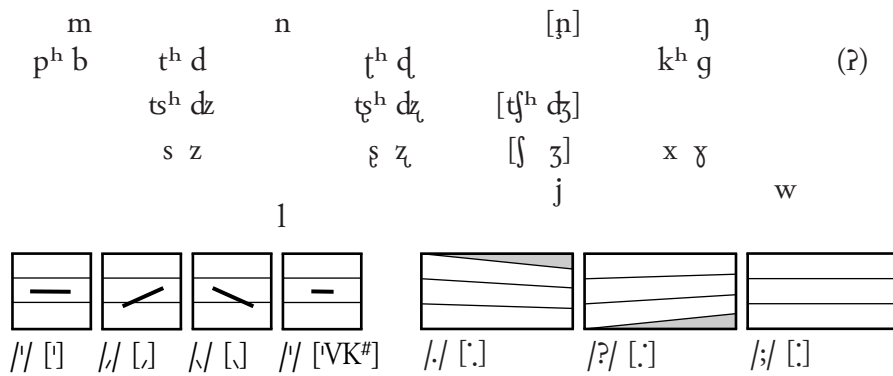
Çh, Ç/. Further, there were the taxophones [ɲ, tʃ, tʃh, dʒ, ʃ, ʒ], which realized /n, ts, tsh, dz, s, z/ before /j, i/, and [n≡C]. It had four tonemes.

22.70. *Old Mandarin Chinese* (Sino-Tibetan) had seven short *V* and six diphthongs. It showed opposition between /Ç, Çh/; besides, /jw/ [ɥ], [n≡C]. It had four tonemes.
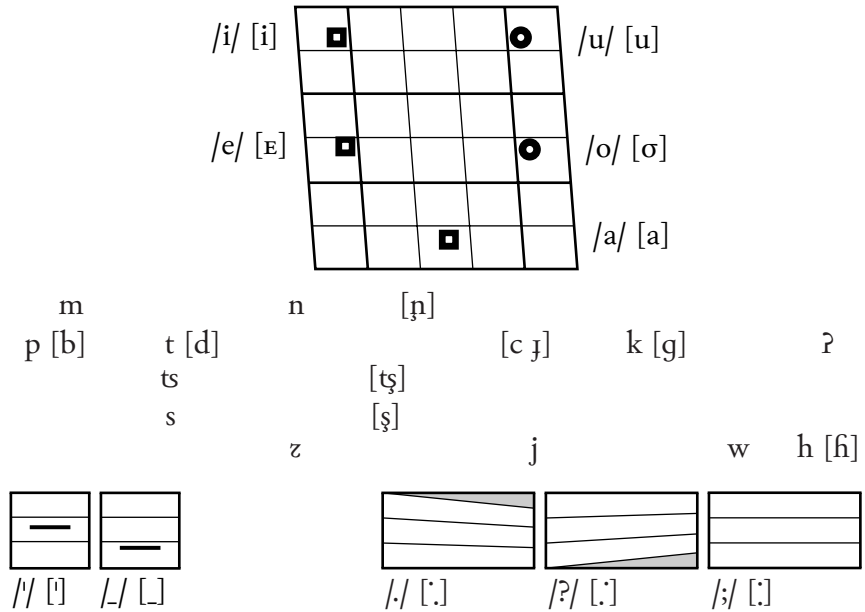
/i/ [i], /iu/ [iu]   /ɨ/ [ɨ], /u/ [u]
/e/ [ɛ], /ei/ [ɛi]   /ə/ [ɜ], /əu/ [ɜu]
                      /o/ [ɔ], /ou/ [ɔu]
/a/ [a], /ai/ [ai]   /au/ [au]

$$\begin{array}{cccccc}
\text{m} & & \text{n} & & & \text{ŋ} \\
\text{p}^\text{h} & \text{t}^\text{h} & & & & \text{k}^\text{h} & \text{ʔ} \\
& \text{ts}^\text{h} & & \text{tʃ}^\text{h} & & \\
& \text{f}\ \text{v}\quad\text{s} & & \text{ʃ}\ \text{ʒ} & & \text{x} \\
& & & \text{j}\quad[\text{ɥ}] & & \text{w} \\
& & \text{l} & & &
\end{array}$$

/ˉ/ [ˉ] /'/ ['] /ˍ/ [ˍ] /ˋ/ [ˋ] /./ [ˑ] /ʔ/ [ˑ] /;/ [ː]

22.71. *Old Japanese* (Altaic) had five short *V*, /i, e, a, o, u/ [i, ɛ, a, ɔ, ɯ], with three additional taxophones for /i, e, o/, [ɪ, ɜ, ʊ]: [ɪ, ɜ, ʊ] occurred after /m, n, p, t, k, s, ɾ/, whereas, before /i, j/, there were [m̡, ɳ, p̡, ʈ, c, ʂ, ɾ̡], with [i, ɛ, ʊ]. It had the sequence /jwo/ realized as [ɟʊ], in opposition to both /jo/ [jɔ] and /wo/ [wɔ]. It further had word or rhythm-group tonemic patterns similar, though not identical, to the ones found in present-day Japanese.
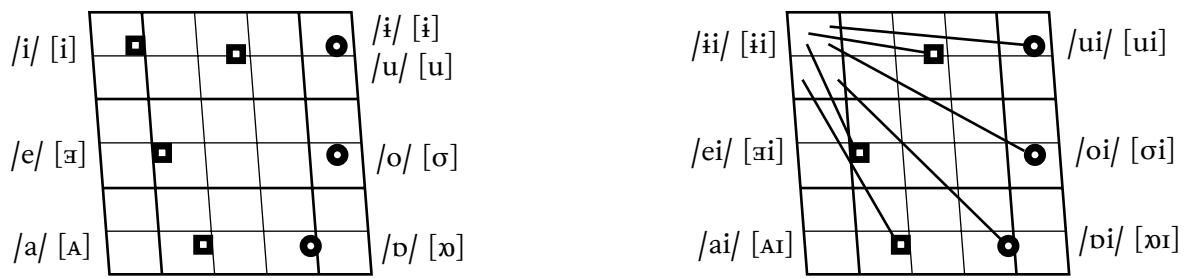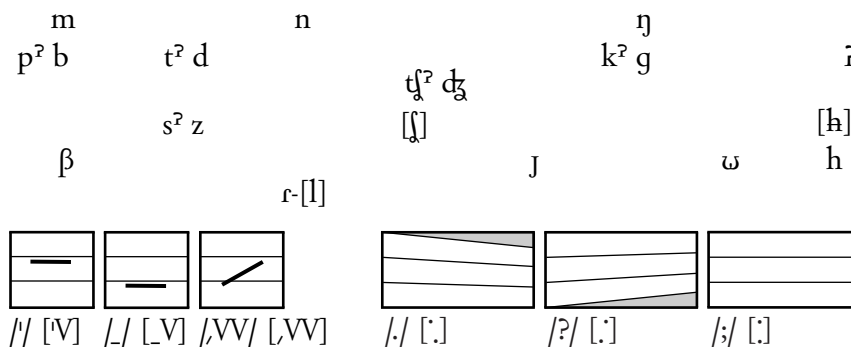
/i/ [i, ɪ]   /u/ [ɯ]
/e/ [ɛ, ɜ]   /o/ [ɔ, ʊ]
              /a/ [a]

m   [m̥]   n   [n̥]
p b   [ɓ]   t d   [ʈ]   [c]   k ɡ
s z   [ʂ]
ɾ   [ɽ]   j [ɟ]   w

/oooo/	/oooo̗/	/o̗ooo/	/oo̗oo/	/ooo̗o/
— — — —	— — — —	— ———	— ——	— —

[·σ·σ·σ·σ]   [·σ·σ·σ·σ]   [·σ̗σ̗σ̗σ]   [ˌσ·σ̗σ̗σ]   [ˌσ̗σ·σ̗σ]

/./ [ˑ]   /?/ [ːˑ]   /;/ [ˑ]

22.72. *Ainu* (isolated), which has no monolingual speakers any longer nowa-
days, had five short *V*, /i, e, a, o, u/ [i, ɛ, a, ɔ, u], and some diphthongs with /i,
u/ as second elements. Word-beginning *V* were preceded by /ʔ/; between
low-pitched *V*, /ʔ/ was weakened, [ʔ̆], up to [Ø]. It had the *C* taxophones given,
with /p, t, k/ being [b; d; ɡ, ɟ] between *V*, and /n, k, ts, s/ [ɲ, c, tʂ, ʂ] before /j, i/.
Word-final stops were inaudibly released; besides, it had /VhV/ [VɦV], [n≡C], and
the seqence [hn̥]. Lastly, it had two tonemes, with the characteristic that its
akusento (differently from modern Japanese) marked the change from low to mid
pitch, /̗/, and all preceding syllables were low.

/i/ [i]   /u/ [u]

/e/ [ɛ]   /o/ [ɔ]

                          /a/ [a]

m   n   [n̥]
p [b]   t [d]   [c ɟ]   k [ɡ]   ʔ
ts   [tʂ]
s   [ʂ]
z   j   w   h [ɦ]

/'/ [ˈ]	/_/ [ˌ]		/./ [ˑ]	/?/ [ːˑ]	/;/ [ˑ]

22.73. *Middle Korean* (Altaic) had seven short *V* and six diphthongs. There

/i/ [i]   /ɨ/ [ɨ]   /ɨi/ [ɨi]   /ui/ [ui]
              /u/ [u]

/e/ [ɛ]   /o/ [ɔ]   /ei/ [ɛi]   /oi/ [ɔi]

/a/ [ʌ]   /ɒ/ [ɒ]   /ai/ [ʌi]   /ɒi/ [ɒi]

m   n   ŋ

pˀ b   tˀ d   kˀ g   ʔ

ʧ�ˀ ʤ

sˀ z   [ʃ]   [ħ]

β   ɟ   ω   h

ɾ-[l]

/ˉ/ [ˈV] /_/ [_V] /ˏVV/ [ˏVV]   /·/ [˙.]   /ʔ/ [˙.]   /;/ [˙.]

was opposition between /Ç, Ç̣, Ç̬/, with /Ç̣/ = [p̣ː, ṭː, ḳː, ʧ̣ː, sː, ħː]. It had [ʃː] + /i/, [n≡C], and three tonemes.

22.74. *Proto-Austronesian* (Austronesian) had four short *V* and the four diphthongs given, as well as other juxtaposed sequences. We give here both its core system and the extended one, which added six phonemes (given in round brackets) as possible space-time variants. Further, we signal the sequences /hn, hɾ, hl/ [n̥, ɾ̥, l̥].

/i/ [i], /iu/ [iu]   /u/ [u], /ui/ [ui]

/ə/ [ə]

/a/ [a], /ai/ [ai]   /au/ [au]

m   [n̥] n   ɲ   ŋ

p b   t d   (c ɟ)   k g   ʔ

ts (dz)   (tʂ dʐ)   ʧ ʤ

s   (ʂ)   ʃ   (ç)   (x)

j   w   h

[ɾ̥-l̥] ɾ-l   ʀ

/ / [·· ˈ ·· ˈ ·· ˈ ·]   /·/ [· ˈ ·.]   /ʔ/ [· ˈ ˈ ·]   /;/ [· ˈ ··]
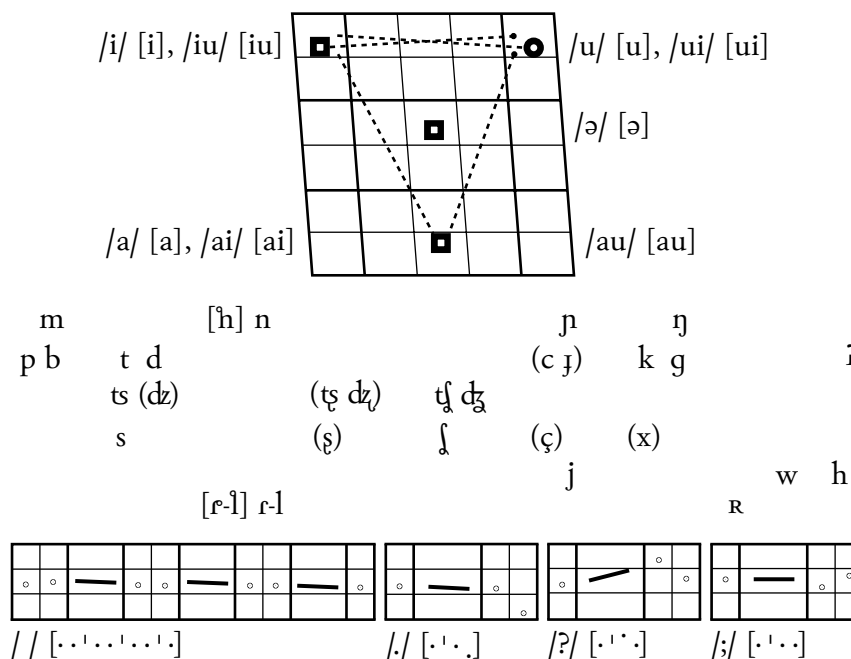
22.75. *Proto-Tai* (Thai) had nine short *V*. Much like in present-day Thai, there were also several diphthongs of various kinds, such as both /iu, ɯi, uɯ/ and /ɤi, ɒi, ɤu, au/, or /iæ, ɯɒ, ua/ and /ie, uɤ, uo/. They could be followed by /i, u/, too, resulting in the triphthongs /uɤi, uai, iɤu, iau/, or they could occur in sequences
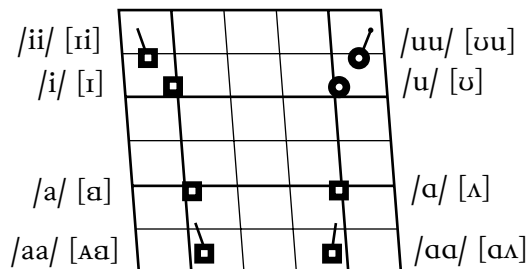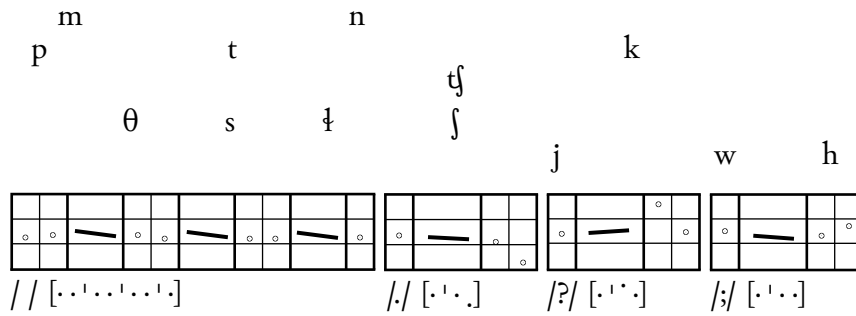
/i/ [i]   /ɯ/ [ɯ], /u/ [u]

/e/ [ɛ]   /ɤ/ [ɤ], /o/ [ɤ]

/æ/ [æ]   /a/ [a], /ɒ/ [ɒ]

[m̥] m   [n̥] n   [ɲ̥] ɲ   [ŋ̥] ŋ

pʰ ⁽ˀ⁾b   tʰ ⁽ˀ⁾d   [ʔ] kʰ g   [ʔ]   ʔ

                            tʃ̬ʰ dʒ̬

     f v   s z   x ɣ

                [ç] ʐ   j   ɰ   w   h
                [l̥] l

/˥/ [˥] /˧/ [˧] /˩/ [˩]   /./ [ˑ]   /?/ [ˑ]   /;/ [ː]
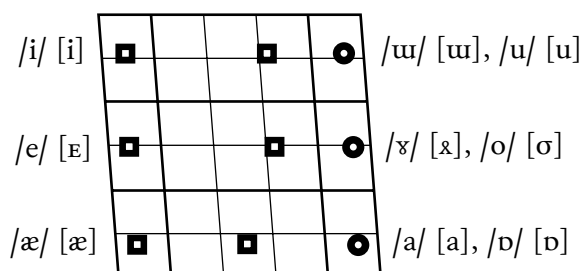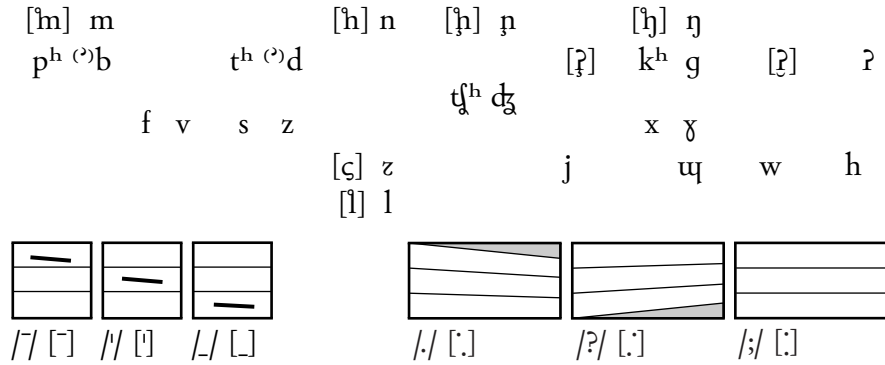
beginning with /j, ɥ, w/ (such as /jæ, jɤu, ɥu, ɥai, wɯ, wɤi/, which of course
are not ‹triphthongs› but /CVV/). Further, it had /hm, hn, hɲ, hŋ, hʐ, hl/, /ʔj, ʔw/,
/p, ph, b, ’b; t, th, d, ’d/ with the taxophones indicated (*r* = /ʐ/); and three
tonemes.

22.76. *Old Javanese, Kawi* (Indonesia: Austronesian), had six short and three
long *V* (the latter being narrow diphthongs). Further, as far as stops were con-
cerned, it showed opposition between /C̬, C̬h/ for /t, th; ʈ, ʈh/.

/ii/ [ii]   /uu/ [uu]
/i/ [ɪ]   /u/ [ʊ]
                                 /ə/ [ə]
/e/ [ɛ]   /o/ [ɔ]
/a/ [ɐ], /aa/ [aa]

  m   n   ɲ   ŋ
p b   tʰ d   tʰ ɖ   k g

                      tʃ̬ dʒ̬

    s   ʂ   ʃ
                        j   w   h
      r-l

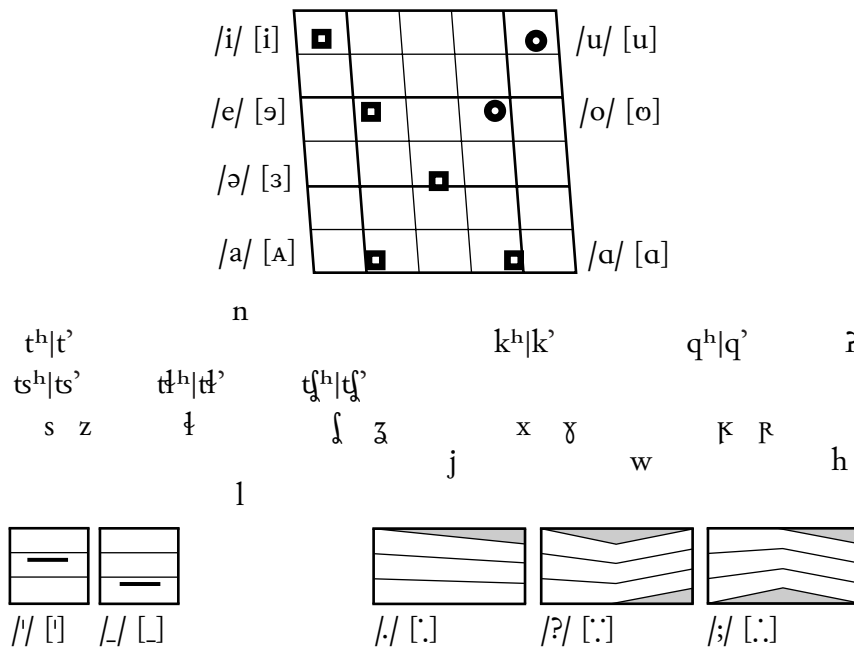/ / [··ˈ··ˈ··ˈ·]   /./ [·ˈ·.]   /?/ [·ˈˑ·]   /;/ [·ˈ.·]
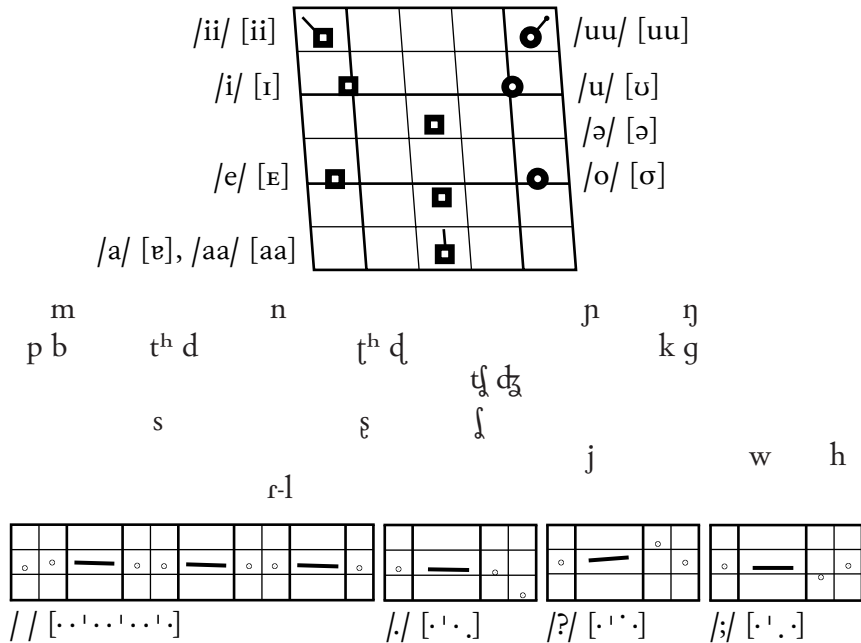
22.77. *Proto-Algonquian* /æɬˈɡɒŋk(w)iən/ (Amerindian) had four *V*, both short
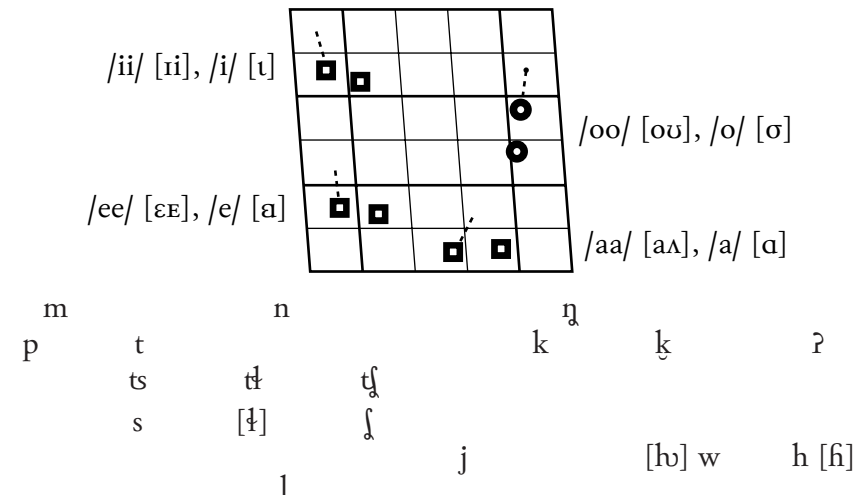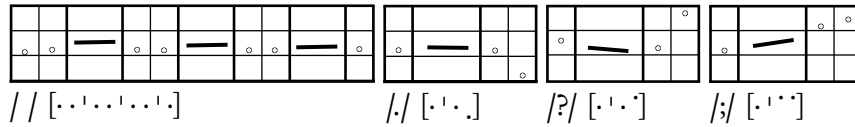and long (the latter being actually narrow diphthongs) and the *C* given. Its only
lateral was /ɬ/.

/ii/ [ɪi]   /uu/ [ʊu]
/i/ [ɪ]   /u/ [ʊ]

/a/ [ɐ]   /a/ [ʌ]
/aa/ [ɐɑ]   /aa/ [ɑʌ]

m   n

p   t   k

              tʃ

θ   s   ɬ   ʃ

                   j   w   h

/ / [·· ' ·· ' ·· ' ·]   /./ [· ' ·.]   /?/ [· ' ·.]   /;/ [· ' ··]

22.78. *Proto-Athabaskan* (Amerindian) had seven short *V*, opposition between /C̩, C̩h, C̩'/, the peculiar lack of any labial *C*, only one *N*, /n/, several sequences of the /Cw/ kind for postalveo-palatal, velar, and uvular *C*, and two tonemes.

/i/ [i]   /u/ [u]

/e/ [ə]   /o/ [ʊ]

/ə/ [ɜ]

/a/ [ʌ]   /ɑ/ [ɑ]

       n

tʰ|t'   kʰ|k'   qʰ|q'   ʔ

tsʰ|ts'   tɬʰ|tɬ'   tʃʰ|tʃ'

s   z   ɬ   ʃ   ʒ   x   ɣ   ӄ   ʁ

                  j   w   h

       l

/'/ [ˈ]   /_/ [˳]   /./ [ˈ]   /?/ [ˈ]   /;/ [ˈ]

22.79. *Aztec, Old* or *Classical Náhuatl* (Amerindian), had four *V*, both short and long (the latter being actually narrow diphthongs) and the *C* given, including /tɬ/ [tɬ, ɬ#], /h/ [h], and the sequences /hm, hn, hw, kw, Vh#/ [ɦm, ɦn, hʊ, ӄ,

/ii/ [ɪi], /i/ [ɪ]   /oo/ [oʊ], /o/ [ɤ]

/ee/ [ɛɛ], /e/ [ɐ]   /aa/ [aʌ], /a/ [ɑ]

m   n   ŋ̩

p   t   k   ӄ   ʔ

     ts   tɬ   tʃ

     s   [ɬ]   ʃ̩

            j   [hʊ] w   h [ɦ]

     l

/ / [··ˈ··ˈ··ˈ·]   /·/ [·ˈ·.]   /?/ [·ˈ·ˈ]   /;/ [·ˈˑˑ]

Vɦ#]; further, /?/, even at the end of words, and /Vŋ/ [Ṽŋ̩].

22.80. *Olmec* (Amerindian), had six V, which were short (more rarely, long: very narrow diphthongs); besides, the C given, with the taxophone /n/ [ŋ#, ŋC], not [Ṽŋ̩].

/ii/ [ii], /i/ [i]   /uu/ [uu], /u/ [u]
/ɨɨ/ [ʜ], /ɨ/ [ɪ]
/oo/ [ɵɵ], /o/ [ɵ]
/ee/ [ɛɛ], /e/ [ɑ]
/aa/ [aa], /a/ [a]

m   n   [ŋ]
p   t   k   ?
       ts
        s
                    j   w   h
        l

/ / [··ˈ··ˈ··ˈ·]   /·/ [·ˈ·.]   /?/ [·ˈ·ˈ]   /;/ [·ˉˈ·]
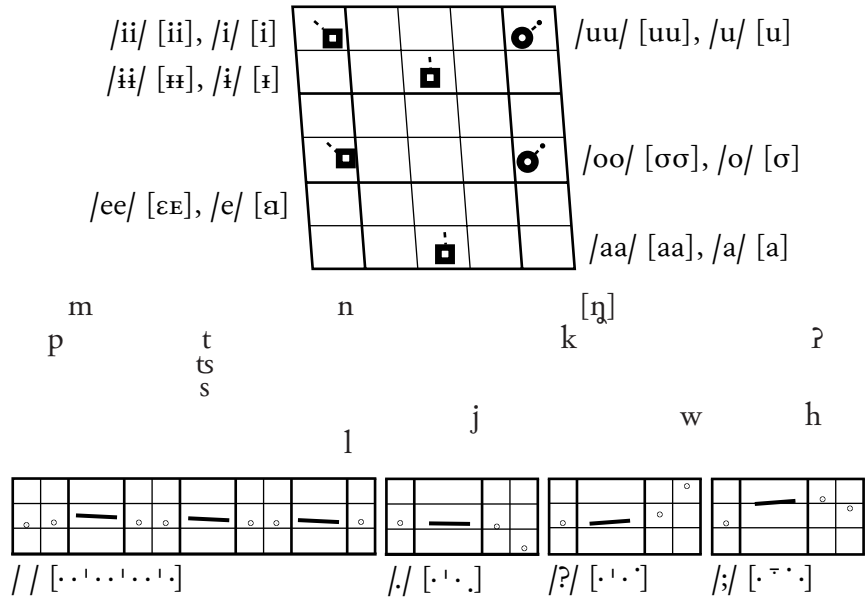
22.81. *Maya* (Amerindian) had five V, both short and long (the latter being actually narrow diphthongs), with some phonemic diphthongs, *eg* /ai/, and the C given, with opposition between /Ç, Ç'/, and with /b/ = [ˀb]. Further, it had [n≡C] and two tonemes.

/i(i)/ [i(i)]   /u(u)/ [u(u)]

/e(e)/ [ɛ(e)]   /o(o)/ [ɵ(o)]

/a(a)/ [a(ɐ)]

m   n
p⁽ʼ⁾ b   t⁽ʼ⁾   k⁽ʼ⁾   ?
        ts⁽ʼ⁾   tʃ⁽ʼ⁾
        s   ɬ   x
                        j   w   h
        ɾ-l

/ˈ/ [ˈ]   /ˌ/ [ˌ]   /·/ [˙]   /?/ [˙]   /;/ [˙]