

# English Diphthongs, [ai, oi, ou]

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A diphthong, by definition, implies a sequence of two different vocalic segments. Vocalic segments are characterized by the vocal tract configurations that are effected by the movements and positions of the tongue and lips. It is part of linguistic tradition to describe each vocalic segment in terms of the tongue raising or lowering, tongue advancement or retraction and lip positions.

The purpose of this presentation is not to discuss all the vowels, but rather to narrow the discussion to the three diphthongal sequences in American English: [ai, oi, au], as they occur in words like 'buy, boy, bough' respectively. Even within this narrow scope, the focus will be on the second element of these diphthongal sequences, i.e. [i,u].

There is no uniformity among phoneticians on how these sequences are perceived, and consequently these perceptions are reflected in the variety of phonetic transcriptions utilized, e.g. [ai, ai, ay; oi, oi, oy; au, a $\omega$ , ay] by Jakobson et al (1952), IPA (1949), and Chomsky and Halle (1968), respectively. In adaption from Smalley (1964), the diphthongal sequences are traced on the vocalic chart below in Figure 1.

Since the variations in the phonetic transcriptions are due to perceptions of different tongue positions, palatography provides data that determine the positions of the tongue in the production of diphthongs and vowels. The present experiments used artificial palates to record tongue contacts with the palate, as described in Sara (1979). It included seven female and five male native speakers of American English to measure tongue height as indicated by channel width (measurement a), and tongue advancement as indicated by (measurement b) in Figure 2.

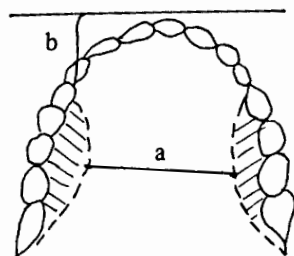
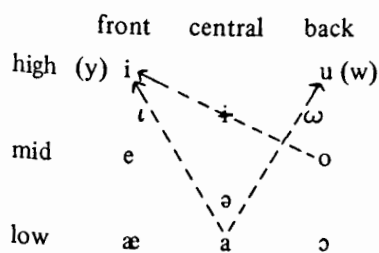


Figure 1. Diphthongal movement.

Figure 2. Channel width & Tongue advancement.

In the production of diphthongs and vowels, the higher the tongue the shorter measurement (a), and the more advanced the tongue, the shorter measurement (b) should be. The measurements from the thirteen subjects for the three diphthongs and the vowels [i, ɪ, e, ε, u, ω, o] as produced in the words: 'peep, pip, babe, pep, hoop, hoof, pope' respectively, are tabulated in Table I below. All measurements are to the nearest millimeter.

In correlating the measurements obtained for individual high and mid vowels with those for diphthongs as displayed in Table I. One can see how channel width (measurement a), and tongue advancement (measurement b) vary for each individual vowel in comparison with those for diphthongs. Table II tabulates the individual comparisons in terms of diphthongal measurements being 'wider' than, 'equal' to, or 'narrower' than those of individual vowels.

It is evident from the statistical comparisons in Table II that the tongue is lower and its advancement/retraction is less for diphthongs than for the high vowels. Based on the data of Table 2, it is accurate to say that the tongue motions in the production of the diphthongs [ai, oi, ou] reaches the mid vowel

Table I. a. Channel width; b. Tongue advancement

		i	ɪ	e	ε	ai	oi	u	ω	o	au
1	a	18	31	24	31	30	31	30	30	—	26
	b	19	25	14	23	24	26	24	21	—	22
2	a	15	33	27	29	15	22	33	32	35	37
	b	22	24	26	30	24	22	48	51	54	53
3	a	10	23	18	20	20	20	19	23	19	19
	b	9	20	15	22	16	23	43	48	49	41
4	a	19	26	19	25	22	19	—	—	—	—
	b	35	47	38	39	43	42	—	—	—	—
5	a	20	25	21	23	25	30	22	—	—	33
	b	14	19	15	25	17	27	40	46	—	23
6	a	10	25	18	24	24	31	17	25	24	34
	b	12	24	15	14	18	49	24	48	48	50
7	a	21	29	28	28	31	27	29	32	28	—
	b	20	19	26	33	25	28	39	39	41	—
8	a	13	26	25	27	29	28	25	—	—	—
	b	16	24	21	25	47	48	50	—	—	—
9	a	12	19	19	24	22	22	24	25	29	29
	b	10	16	19	16	25	25	30	33	46	43
10	a	18	24	23	30	20	24	44	44	—	43
	b	10	11	14	16	10	23	31	34	—	31
11	a	20	31	27	36	29	31	32	33	39	37
	b	17	19	19	31	22	32	41	38	41	37
12	a	20	27	25	33	32	30	31	32	32	35
	b	10	13	19	26	26	25	31	27	27	25
13	a	21	28	22	29	36	25	28	—	—	32
	b	14	21	22	23	27	28	27	—	—	25

Table II. Tabulated comparisons

Diph	Measure	Degree	Vowels				Total
			i	ɪ	e	ε	
[ai]	a	wider	12	05	10	04	31
		equal	01	01	00	02	04
		narrower	00	07	03	07	17
[ai]	b	wider	12	06	10	06	34
		equal	01	01	00	01	03
		narrower	00	06	03	06	15
[oi]	a	wider	12	05	10	03	30
		equal	01	03	01	02	07
		narrower	00	02	01	03	06
[oi]	b	wider	12	11	12	10	45
		equal	01	00	00	00	01
		narrower	00	02	01	03	06
[au]	a	wider	07	05	03		15
		equal	01	00	02		03
		narrower	00	02	01	03	06
[au]	b	wider	03	04	01		08
		equal	01	00	00		01
		narrower	06	05	05		16

position twice as often as it reaches the high vowel position. The diphthongal motions, then, are more appropriately represented by the solid line triangle than by the traditional phonetic transcriptions as represented by the broken lines of Figure 3.

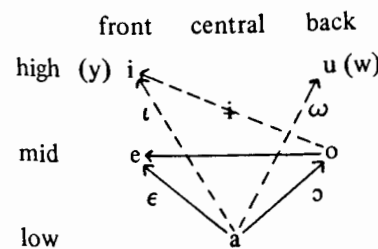


Figure 3. Diphthongal motions: --- predicted; ——— obtained.

## References

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