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Possibility of Existence and Identification of Diphthongs and Triphthongs in Urdu Language

Abstract: This paper gives an account of possible diphthongs and triphthongs in Urdu. To identify these diphthongs and triphthongs., first a list of all possible diphthongs and triphthongs is prepared using an Urdu dictionary and then native speakers are asked to syllabify them. Diphthongs identified by them are then verified by analyzing their durations and comparing them with the duration of "pure" vowels. In this way the conclusions given at the end of paper are reached.

Keywords: *Diphthong, triphthong, phoneme, syllable, duration*

1. INTRODUCTION

In phonetics, a **diphthong** is a vowel combination usually involving a quick but smooth movement from one vowel to another, often interpreted by listeners as a single vowel sound, syllable or phoneme. While "pure" vowels are said to have one target tongue position, diphthongs have a moving tongue.

Pure vowels are represented in phonetic script by one symbol e.g. in English "seem" is represented as [si:m]. On the other hand, diphthongs are represented by two symbols, e.g. in English "house" as [haus], where the two vowel symbols are intended to represent approximately the beginning and ending tongue positions [7].

Duration as a property of sounds or units cannot be separated from the larger context of time and timing in speech production. Vowels are greatly affected in duration by a number of factor, such as the identity of the following consonant, the rate of speaking, the syllable stress, the number of syllables in the word, the position of the vowel in the phrase or sentence, the type of word, and the importance or emphasis assigned to the word by the speaker. Dipthongs follow rules similar to the vowels [6].

2. LITERATURE REVIEW

Not much work has been done on diphthongs or triphthongs in Urdu in the past. However, a paper identifying a few diphthongs and their acoustic properties was published by National Language Authority in Akhbare-Urdu June 2003 edition [1]. It identified only 13 diphthongs out of a possible list of 22 and declared that there may be more of them as their list was not exhaustive. The aim of this paper is to complete this list.

The majority of the languages of the world do not use diphthongs in their phonological inventory [2]. Generally speaking, if a language distinguishes more than about ten vowels then it may be exploiting diphthongal combinations [3]. As Urdu has 7 long vowels, 4 short vowels and 6 nasalized long vowels (Mannan et. al. 2002), it has chances of exploiting diphthongs.

According to Dr. Mehboob Alam [4] diphthongs in Urdu do not exist phonemically. However, their phonetic existence has not been independently verified, if explored at all.

3. METHODOLOGY

3.1 Data Collection

A list of words containing possible diphthongs and triphthongs was prepared by scanning the Feroz-ul-lughaat Urdu Dictionary [5]. All words that had 2 or 3 consecutive vowels were considered as possibilities for diphthongs and triphthongs respectively.

3.2 Subjects

The subjects of the survey were 20 native speakers of Lahori Urdu. They were given the concept of 'syllable' using examples of a few Urdu words and their syllables. Then they were asked to identify syllables from the list according to these examples using their innate knowledge.

3.3 Data Recording and Analysis

The words which contained diphthongs were recorded using 6 native speakers of Urdu, 3 male and 3 female. Also words containing "pure" vowels of Urdu were recorded by the same speakers. This recording and analysis was done in Praat 4.1, a speech processing tool designed for Windows users. Other equipment included high fidelity (Hi-Fi) microphone, a Teac integrated stereo amplifier and two high quality speakers.

3.4 Procedure

20 native speakers of Lahori Urdu were interviewed using the identified list of possible words containing diphthongs and triphthongs. They syllabified the words using their innate knowledge and the examples given to them before the interview. Using the results of these interviews we identified the diphthongs. If more than fifty percent of the speakers syllabified a word in such a way that the diphthong was preserved, it was accepted.

The words containing diphthongs or triphthongs, along with the list of words containing pure vowels of Urdu, were then recorded using 6 native speakers of Urdu, 3 males and 3 females. The duration of the diphthongs was used to verify their existence. If the duration of two consecutive vowels came out to be below 350 ms (the maximum duration of a long vowel) it is proved to be a diphthong.

4. **RESULTS**

The result of the survey for diphthongs is shown in Table 1 and that for triphthongs is shown in Table 2. The second column represents the diphthong/triphthong under consideration. The third column gives an example word to show the occurrence of the diphthong/triphthong in Urdu. The fourth column shows the total votes in favor of the diphthong/triphthong existence. Finally, if the votes in favor were 50% or more of the total votes, the diphthong/triphthong was accepted, as shown in column five.

Out of the list of 37 possible diphthongs, 18 were identified by the native speakers. On the other hand, no triphthongs were identified.

Table 1: Result of Survey of 20 Native Lahori Urdu Speakers for Diphthongs

Sr #	Diphthong	Word	Vote	Result
			count	
1	iu~	kiu~	19	A
2	ea	gea	16	Α
3	∂i	k ∂i	16	A
4	∂e	g∂e	16	Α
5	aI	<u>d</u> aImi	14	А
6	ao	ao	14	Α
7	eo	<u>d</u> eo	14	А
8	ui	hui	14	А
9	au~	au~	13	А
10	oe	k ^h oe	12	А
11	au	t∫ ^h auni	12	А
12	ua	mua∫ra	12	А
13	ue	hue	12	А
14	oi	k ^h oi	10	А
15	Io	nIo <u>t</u> a	10	А
16	υ∂	mu∂adʒdʒ∂l	10	А
17	io	d3io	10	А
18	ua	hua	10	А
19	oi~	roi~	8	R
20	∂I	mʊ <u>t</u> m∂In	8	R
21	ae~	ae~	8	R
22	ia	k ia	8	R
23	e∂	mumane∂ <u>t</u>	8	R
24	υi~	hʊi~	7	R
25	ai~	ai~	7	R
26	ai	k ^h ai	7	R
27	oe~	roe~	7	R
28	∂u	∫∂ur	6	R
29	i∂	zehni∂t	5	R

30	ia~	larkia~	5	R
31	æi	pæi	5	R
32	ae	k ^h ae	4	R
33	ie	kie	4	R
34	uo~	kuo~	4	R
35	ue~	<u>d</u> hue~	3	R
36	ua~	<u>d</u> hua~	1	R
37	υi	muib	1	R
			Key:	A = Accepted

R = Rejected

Table 2: Result of Survey of 20 Native Lahori UrduSpeakers for Triphthongs

Sr #	Triphthong	Word	Vote	Result
			count	
1	Iao	nlao	2	R
2	aIa~	razaia	0	R
3	oie	r oie	0	R
4	aie	aie	0	R
5	uie	t∫ ^h uie	0	R
6	uia~	suia~	0	R
7	ala	fIzaia	0	R
8	oia~	doia~	0	R
9	oia	poia	0	R
10	uaI	mʊaIna	0	R
11	oI∂	nວI∂ <u>t</u>	0	R
			Key:	A = Accepted

A = AcceptedR = Rejected

After identification of these diphthongs, the recordings were made for them. The duration of the diphthong was measured and its average for all speakers was taken (as shown in Appendix 2). These durations came out to be less than 350 ms (the duration of a long vowel) hence verifying these vowels to be diphthongs.

Furthermore, the duration of the pure vowels coming in each diphthong was measured for the same speakers and their average was recorded. The sum of these durations was then compared with the duration of the respective diphthong (see Appendix 3). It was thus verified from this data that the diphthongs identified by the native speakers were in effect lesser than the sum of the duration of separated pure vowels.

5. DISCUSSION

From the data collected through the survey, it was noticed that there was a great variation in the total number of diphthongs identified by the speakers (Table 4 in Appendix). For instance, one of the speakers identified as many as 32 diphthongs in a list of 37, whereas, another identified as low as 7 diphthongs. Hence, this leads to the conclusion that syllabification and perception is more or less speaker dependent.

It is interesting to note that two speakers identified one word as a triphthong whereas none others did (Table 5 in Appendix). Even more interesting is the fact that they identified the same word "nIao" as containing the triphthong "Iao". These speakers failed to identify triphthongs in any other words.

On scanning the dictionary it was discovered that Urdu has very less words containing two consecutive short vowels. Two such words were identified though, out of which only one made it to the final list of diphthongs. Majority of the diphthongs identified contained two long vowels or one long and one short vowel.

It is already a known fact that pure nasalized vowels are rather longer in duration. Out of the 18 diphthongs identified only 2 contained nasalized vowels, which as diphthongs, interestingly, come at the end of words only. Moreover, both of these nasalized vowels are u^{\sim} .

Table 3: Comparison between durations of identified diphthongs and the respective pure vowels

Sr #	Diph-	Average	Average	Added	
	thong	duration	of pure vo	owel (ms)	duration
		of			of pure
		diphtho	First	Second	vowels
		ng (ms)			(ms)
1	oi	314.81	234.38	232.72	467.1
2	oe	325.17	234.38	236.54	470.92
3	Io	176.53	96.1	234.38	330.48
4	∂i	283.1	106.62	232.72	339.34
5	∂e	298.4	106.62	236.54	343.16
6	υα	178.55	97.93	237.87	335.8
7	υ∂	150.45	97.93	106.62	204.55
8	aI	216.08	237.87	96.1	333.97
9	ao	348.62	237.87	234.38	472.25
10	au~	349.96	237.87	364.06	601.93
11	au	177.17	237.87	214.03	451.9
12	iu~	313.09	232.72	364.06	596.78
13	io	322.2	232.72	234.38	467.1
14	ea	298.95	236.54	237.87	474.41
15	eo	312.92	236.54	234.38	470.92
16	υα	299.87	214.03	237.87	451.9
17	vi	329.26	214.03	232.72	446.75
18	ue	350.11	214.03	236.54	450.57

From the analysis of the duration of the diphthongs it was noticed that the duration is dependent on speaker and on many other factors as already mentioned in section 1. While recording, all these factors were kept in mind.

The duration of diphthongs containing two consecutive long vowels was noticed to be near 350ms while that of diphthongs containing one short and one long vowel was observed to be below 300ms. The duration of diphthongs containing two consecutive short vowels was strikingly as low as 150ms.

If the duration of two separate long "pure" vowels is added, it exceeds the duration of a long vowel (Table 3). However, if the duration of one long and one short "pure" vowel is added, it is noticed that it sometimes remains within the range of a long vowel, i.e. 200 to 350ms.

On comparison of the average durations of the diphthongs with that of the sum of average durations of the separate "pure" vowels, it was verified that the diphthongs identified by the native speakers indeed had much lesser durations than the sum of the respective pure vowels (Table 3).

6. CONCLUSION

From the data collected from our interviews and through the recordings we conclude that Lahori Urdu has 18 diphthongs in total and no triphthongs whatsoever. This list is more or less exhaustive as the whole Urdu dictionary was scanned by the researchers who themselves are native speakers of Lahori Urdu.

It was also concluded that the process of syllabification and hence the identification of diphthongs/triphthongs is speaker dependent. The durations noticed through recordings were also heavily dependent on the speakers.

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APPENDIX

Sr	Dip	Vote	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
#	h	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	iu~	19	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	ea	16	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1
3	∂i	16	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1
4	∂e	16	1	1	1	0	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	1
5	al	14	1	0	1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	0	0	1
6	ao	14	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	0	1	0	1	1
7	eo	14	1	0	1	1	1	1	0	0	1	1	0	1	1	1	1	0	1	0	1	1
8	ui	14	1	0	1	1	1	1	0	1	0	0	1	1	1	1	1	0	1	1	0	1
9	au~	13	1	1	1	0	1	1	1	0	1	1	0	0	0	1	1	1	0	1	0	1
10	oe	12	1	0	1	0	1	1	1	1	1	0	0	0	1	1	1	0	0	1	0	1
11	au	12	1	0	1	0	1	0	1	0	1	1	0	0	1	1	1	0	1	1	0	1
12	ua	12	1	0	1	0	1	0	0	1	1	1	0	0	1	1	1	0	0	1	1	1
13	ue	12	1	0	1	1	1	1	0	0	0	0	1	0	1	1	1	0	1	1	0	1
14	oi	10	1	0	1	0	0	0	1	1	1	0	1	0	0	1	1	0	0	1	0	1
15	Io	10	1	0	1	1	1	1	0	1	0	1	0	0	0	1	0	0	0	1	0	1
16	υ∂	10	1	1	1	1	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0	1
17	io	10	0	0	1	0	1	0	0	0	0	1	1	0	0	1	1	0	1	1	1	1
18	ua	10	1	0	0	1	1	1	0	0	0	1	1	0	0	0	1	1	0	1	0	1
19	oi~	8	1	1	1	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0
20	∂I	8	1	1	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	1
21	ae~	8	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	1
22	ia	8	0	0	0	0	1	0	0	0	1	1	1	0	0	0	1	0	1	0	1	1
23	e∂	8	1	1	1	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1
24	υi~	7	0	0	0	1	0	1	0	1	0	0	1	0	0	0	1	1	0	1	0	0
25	ai~	7	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0
26	ai	7	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	1
27	oe~	7	1	1	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1
28	∂u	6	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	1
29	i∂	5	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1
30	ia~	5	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1
31	æi	5	0	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1
32	ae	4	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
33	ie	4	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1
34	uo~	4	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
35	ue~	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
36	ua~	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
37	υi	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tota			24	11	27	14	17	19	15	17	15	19	14	7	10	17	31	9	15	19	8	32

Table 4: Interview results of 20 native speakers for the identification of diphthongs.

S = Native Speakers of Lahori Urdu 0 = speaker did not identify it as a diphthong 1 = speaker identified it as a diphthong

Sr#	Diph	Votes	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
	-		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Iao	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
2	aIa~	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	oie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	aie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	uie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	uia~	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	ala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	oia~	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	oia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	ual	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	oI∂	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tota	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0

Table 5: Interview results of 20 native speakers for the identification of diphthongs.

S = Native Speakers of Lahori Urdu 0 = speaker did not identify it as a diphthong 1 = speaker identified it as a diphthong

Table 6: Duration	of Diphthongs	of 6 Native	Speakers (3 male and	3 female)
			~ [(

			Duratio	n of Native	Speakers (m	ns)	_	Average
Serial #	Diphthong	G 1	211					duration
		Salman	Nida	Ahmed	Mariam	Asad	Kıran	(ms)
1	oi	307.916	322.251	277.746	259.413	428.142	293.345	314.8022
2	oe	313.109	309.603	243.063	308.416	447.882	328.934	325.1678
3	Io	197.303	193.341	159.431	166.272	174.925	167.886	176.5263
4	∂i	284.416	271.049	238.389	239.718	377.076	287.896	283.0907
5	∂e	345.079	266.029	268.678	255.901	367.75	286.961	298.3997
6	υα	224.075	184.507	157.711	174.338	168.571	162.054	178.5427
7	υ∂	175.311	162.552	160.145	141.491	123.305	139.865	150.4448
8	aI	310.61	197.556	203.242	206.585	188.308	190.157	216.0763
9	ao	399.621	341.183	328.715	331.642	386.212	304.304	348.6128
10	au~	365.455	336.881	345.928	349.883	352.982	348.616	349.9575
11	au	196.943	168.693	155.996	173.33	161.063	206.957	177.1637
12	iu~	305.601	300.27	287.261	281.812	426.565	277.002	313.0852
13	io	352.703	325.426	239.529	309.363	391.861	314.306	322.198
14	ea	291.468	265.305	285.872	307.767	347.91	295.361	298.9472
15	eo	304.085	274.801	329.817	303.059	345.092	320.641	312.9158
16	ua	280.908	232.165	314.361	273.76	373.402	324.575	299.8618
17	ui	314.009	294.259	316.688	308.606	405.384	336.57	329.2527
18	ue	319.268	368.196	367.159	309.893	397.698	338.428	350.107

	Pure		Dura	ation of Nat	ive Speakers	s (ms)		Average
Serial #	vowel	Salman	Nida	Ahmed	Mariam	Asad	Kiran	duration (ms)
1	a	204.057	245.569	278.584	205.415	284.901	208.661	237.8645
2	0	201.703	220.56	260.975	204.75	272.008	246.266	234.377
3	Э	218.935	209.631	272.101	209.035	277.285	198.263	230.875
4	е	217.099	226.212	284.975	221.37	274.663	194.917	236.5393
5	i	241.535	227.739	219.774	174.614	304.492	228.14	232.7157
6	æ	231.647	256.91	257.275	221.591	245.476	211.29	237.3648
7	u	233.06	220.959	207.647	131.182	274.599	216.707	214.0257
8	∂	131.079	86.53	106.025	114.009	118.182	83.894	106.6198
9	I	83.449	91.783	90.7	74.455	99.854	136.358	96.09983
10	U	103.582	87.56	87.212	95.986	83.802	129.427	97.92817
11	i~	320.069	281.564	331.197	283.563	408.771	306.737	321.9835
12	æ	349.166	308.622	427.172	306.646	462.3	340.4478	365.7256
13	a~	331.934	339.731	411.806	337.373	548.883	326.177	382.6507
14	u~	321.952	339.731	400.011	317.688	494.184	310.76	364.0543
15	0 [~]	330.521	337.053	403.541	351.666	533.62	330.399	381.1333
16	e~	269.549	326.786	287.093	258.819	324.463	264.789	288.5832

Table 7: Duration of Pure Vowels of 6 Native Speakers (3 male and 3 female)