

SOME DATA ON THE DURATION OF CHINESE STOPS AND AFFRICATES

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The purpose of this note is to report on some measurements of the duration and voice onset time (i.e. the duration of the aspiration phase) for Standard Chinese stops and affricates. Such data seem not to be readily available except in Chinese sources: Feng 1985 gives data on the total duration and the duration of the closure phase for Chinese stops and affricates, and Qi and Zhang 1982 measured the total duration of Chinese consonant sounds (excluding the closure phase for stops and affricates).

As is well known, there are two series of stops and affricates in Standard Chinese, voiceless unaspirated and aspirated (here given with IPA symbols and the standard *pinyin* transcription within <...>):

Unaspirated: p t <d> k <g> ts <z> tʃ <zh> tʂ <j>
Aspirated: p' <p> t' <t> k' <k> ts' <c> tʃ' <ch> tʂ' <q>

Stops and affricates occur only syllable initially in Chinese, and for this investigation monosyllabic words were used. They were read in a carrier sentence Wǒ pǎ _____ tsì çǐěxǎo <Wǒ bǎ _____ zì xiěhǎo> 'I finish writing the character _____'. The word containing the investigated consonant was thus in a focussed position.

In the test syllables, the stops and affricates were followed by the vowel /a/, except for the palatals, which occur only before /i/ and /y/. The following syllables were used:

pā	<bā>	p'āi	<pāi>
tāo	<dāo>	t'ā	<tā>
kāo	<gāo>	k'āi	<kāi>
tsāo	<zāo>	ts'āo	<cāo>
tʃāo	<zhāo>	tʃ'āo	<chāo>
tʂāi	<jiā>	tʂ'iāo	<qīāo>

These words embedded in the carrier sentence were read twice by four speakers of Standard Chinese, three of whom had grown up in Peking; the fourth, originally from Liaoning province, had been living in Peking since his mid teens.

For each stop and affricate, the duration of the closure phase, the aspiration phase, and for the affricates, the fricative phase, were measured from oscillograms made with the ILS program package. The results are given in Table 1.

The results show that the aspiration phase of Chinese stops is relatively long (90-110 ms), as might be expected in a language where aspiration is the only phonetic property which differentiates two series of stops and affricates. This can be compared with languages such as Swedish or Arabic, which have one series of voiceless, somewhat aspirated stops, and one series of voiced stops, and where aspiration is usually analyzed as a non-distinctive property of the voiceless stops. The duration of the aspiration phase in these languages is about 30-50 ms (Löfqvist 1976; Gårding et al. 1986), much shorter than in Chinese stops.

As is usually the case, aspiration increases with the backness of the place of articulation, both for stops and affricates. In particular, 'unaspirated' [k] has a VOT of about 30 ms.

Aspiration is shorter in the affricates than in the stops, around 70 ms. Since there is a gradual transition from the fricative to the aspiration phase, it was difficult in some cases to find a clear boundary point between them. For the unaspirated affricates, no aspiration phase could be detected. It can be noted that the alveopalatal affricate [tʃ] has a relatively short fricative phase, which may be related to the fact that there is no stop with this place of articulation.

As is often noted in descriptions of Chinese (e.g. Kratochvíl 1968:26), the unaspirated stops and affricates may become voiced in some speech styles. (Because of the syllable structure of Chinese, syllable initial consonants are always preceded and followed by voiced sounds, unless they are utterance initial.) The exact circumstances under which this takes place are not known, but it seems that only stops and affricates in unstressed syllables may become voiced. Voicing was not observed in my test words, which were in a focussed position in the sentence frame, but especially for speaker 2, /p/ in the object marker /pǎ/, and /ts/ in the word /tsì/ 'character' were often voiced. The oscillogram of *wǒ pǎ tsì çìěxǎo* shown in Figure 1 illustrates this. In the sentence frame, *tsì* forms a noun phrase (e.g. *pǎ tsì* 'the character *pǎ*') together with the preceding word. The object marker *pǎ* is syntactically in construction with this noun phrase, but is phonetically cliticised to the subject *wǒ* 'I'.

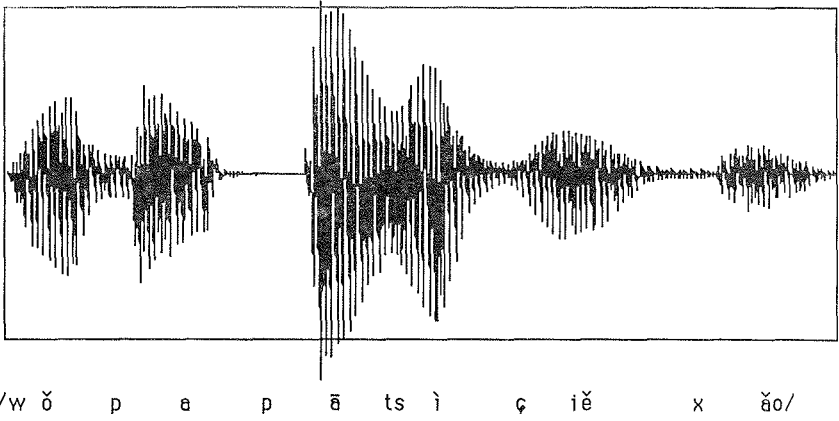


Figure 1. Oscillogram of wǒ pǎ pǎ tsì çǐěxǎo (Speaker 2).

References

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Table 1. Duration of Standard Chinese stops and affricates (ms).

Speaker:		1		2		3		4		mean
[p]	Cl.	115	127	120	141	96	111	140	125	122
	Asp.	8	6	7	4	13	10	7	8	8
	Tot.	123	133	127	145	109	121	147	133	130
[t]	Cl.	123	127	146	110	126	129	166	127	132
	Asp.	8	7	13	16	10	10	11	12	11
	Tot.	131	134	159	126	136	139	177	139	143
[k]	Cl.	92	126	126	104	86	114	106	94	106
	Asp.	26	21	30	36	29	30	43	36	31
	Tot.	118	147	156	140	115	144	149	130	137
[pʰ]	Cl.	74	94	179	90	104	101	120	95	107
	Asp.	112	112	80	80	61	105	102	101	94
	Tot.	186	206	259	170	165	206	222	196	201
[tʰ]	Cl.	88	105	101	84	89	94	119	101	98
	Asp.	124	123	96	82	93	108	97	93	102
	Tot.	212	228	197	166	182	202	216	194	200
[kʰ]	Cl.	74	74	107	68	80	104	96	96	87
	Asp.	129	102	86	77	91	119	129	127	108
	Tot.	203	176	193	145	171	223	225	223	195
[ts]	Cl.	106	87	137	110	86	76	104	110	102
	Fric.	36	59	37	40	47	52	77	58	51
	Asp.	-	-	-	-	-	-	-	-	-
	Tot.	142	146	174	150	133	128	181	168	153
[tʂ]	Cl.	90	101	123	85	123	88	89	81	98
	Fric.	36	43	20	30	25	29	41	46	34
	Asp.	-	-	-	-	-	-	-	-	-
	Tot.	126	144	143	115	148	117	130	127	131
[tʂʰ]	Cl.	71	72	103	72	53	56	90	86	75
	Fric.	62	64	58	62	67	75	78	78	68
	Asp.	-	-	-	-	-	-	-	-	-
	Tot.	133	136	161	134	120	131	168	164	143
[tsʰ]	Cl.	71	76	135	83	85	89	77	89	88
	Fric.	58	65	48	37	36	44	56	39	48
	Asp.	71	49	52	54	75	58	97	69	66
	Tot.	200	190	235	174	196	191	230	197	202
[tʂʰ]	Cl.	77	66	104	103	96	88	69	69	84
	Fric.	49	50	49	44	29	41	51	61	47
	Asp.	86	79	56	59	68	82	88	71	74
	Tot.	212	195	209	206	193	211	208	201	204
[tʂʰʰ]	Cl.	56	59	96	68	67	72	69	79	71
	Fric.	52	56	55	59	54	46	51	56	54
	Asp.	82	98	58	53	53	57	99	94	74
	Tot.	190	213	209	180	174	175	219	229	199