

A NOTE ON WORK IN PROGRESS: SECONDARY ARTICULATION
IN THAI STOPS

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AND

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The present paper outlines the system of obstruents in Modern Central Thai and points out various controversial issues having to do with laryngeal control and supralaryngeal secondary articulation. Some very preliminary findings concerning Thai /p t/ are mentioned, and it is shown with fiberoptic illustrations how the epiglottis is crucially involved in an articulatory gesture found with these consonants in certain environments.

I. INTRODUCTION

There are certain phonetic properties associated with the stop consonants of (Central) Thai which are frequently mentioned in general phonetic literature because they have a bearing on central issues. Thus, over the years, evidence from Thai has been adduced repeatedly in connection with the concept of Voice Onset Time (VOT) in Consonant-Vowel sequences (cf. Lisker and Abramson 1964). Another subject of very general interest is constituted by the pitch perturbations associated with CV-sequences in tone languages, Thai giving clear evidence (Erickson 1975 and others) that the fundamental frequency starts lower after voiced than after voiceless stops, even in such a language in which tone in itself has a lexically distinctive function (and even though the tonal accents of Thai are to some extent reflexes of earlier manner differences among initial

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consonants (cf. Brown 1962, Egerod 1971, Henderson 1982), so that the scenario repeats itself over time, as it were).

In the more specialized literature on Thai linguistics and phonetics the emphasis of interest is somewhat different, more controversial issues being the presence or absence of certain secondary articulatory features in unaspirated stops in this language. Before mentioning some of these controversies it may be expedient to tabulate the stop consonants of Thai (or rather the whole obstruent system, for reasons that will be apparent).

II. THE OBSTRUENT SYSTEM

Syllable initially the stops exhibit a contrast of three manners of articulation, viz. voiceless unaspirated, voiceless aspirated, and voiced (unaspirated), and a contrast of four oral points of articulation, which we may roughly label as follows: labial, alveolar, palatal (more precisely: alveolo-palatal, often with some affrication), and velar. In addition, there is a glottal stop (which of course goes with the voiceless unaspirated series if glottal closure is defined as a point of articulation on a par with the others). The system is "asymmetric" in a non-surprising way in that the voiced series is limited to the most advanced points of articulation. For these points of articulation there is also a series of voiceless fricatives, and if we include /h/ as an obstruent (classificatorily), the total system looks as follows:

Initial obstruents

ph	th	ch	kh		
p	t	c	k	and	ʔ
b	d				
f	s			and	h

Syllable finally there are no manner distinctions whatsoever within the obstruent system, the four series above being matched by only one series, which is variably rendered in the literature as voiceless unaspirated or voiced stops, although the former notation (with support from instrumental phonetic observation, cf. Abramson 1972) is now dominant. Moreover, there is (in Modern Thai) no palatal point of articulation (palatals having changed to alveolars). We thus get the following set:

Final obstruents

p	t	k	and	ʔ
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Such a tabulation is, however, more controversial than it may look. Thai syllables behave differently in terms of termination depending on the quantity of the vowel. If the vowel is long (in a current phonemic notation: geminate) the syllable may or may not end in a consonant, but the only possible stop consonants then are /p t k/. The glottal stop, if it occurs, is not

contrastive with its absence. Syllables with a short vowel, on the other hand, must end in a consonant, and in this case all four possibilities above are utilized. What is not always fully recognized in authoritative phonemicizations is that syllables ending in /ʔ/ may drop this element in sandhi (and certain items regularly do this). It is more important, however, to note that there is even a marginally occurring though extremely frequent termination in [h], cf. the polite particle given as /khâ/ in Haas' dictionary (1964), which occurs utterance finally (or as a whole utterance in itself) and is often said with a very audible puff of air: [k^hah]. One must, then, consider whether this means that Thai has open syllables with a short vowel, or whether /h/ should be added to the inventory of final obstruents (the latter would seem somewhat far-fetched, perhaps).

As for the final inventory it may be noted, incidentally, that there is another collapsing of manners of articulation within the resonants. Initially there is a series of (three) nasals and moreover two types of liquids, but finally these are matched by nasals only. Historically this altogether impressive mismatch between initial and final consonant inventories is to some extent traceable to mergers (and both old and recent borrowings give evidence of substitutions such as /n/ for both /l/ and /r/).

Leaving aside the special problem of "khâ" and other final particles we may thus conclude that consonantal syllable terminations in the remaining Thai vocabulary involve oral or nasal stops or /ʔ/, that is, a syllable final consonant must involve oral and/or glottal closure (with or without concomitant nasalization). One of the standing issues in Thai phonetics is whether the oral stops in final position are (always or sometimes) glottalized or laryngealized. Harris (1972, p. 11ff) maintains that there is simultaneous oral and glottal closure in these consonants (both initially and) finally (for initials, see below). This question of manner of articulation in final stops is of course interesting in itself (also to satisfy the curiosity of language teachers who may wonder why foreigners often have such difficulty in hearing the place of articulation in final stops), but it is perhaps of particular interest in a historical and comparative perspective, viz. in connection with the general discussion of phonation type and tonogenesis in Southeast Asian languages.

Syllable initially, the series /b d/ are very strongly voiced, and according to Harris (1972, p. 14) "utterance initial voiced stops and approximants are usually preceded by weak glottal closure", though they are not assumed to exhibit implosive articulation. Historically, authoritative reconstructions derive /b d/ of Modern Thai from */ʔb ʔd/, so from this point of view the exact articulation of the modern stops is, of course, of considerable interest (although other Thai languages and dialects, as well as loanwords exchanged between Ancient Thai and Mon-Khmer languages, give strong evidence for the reconstruction */ʔb ʔd/, whatever the exact phonetic interpretation of these symbols).

Most controversial, however, is the series /p t c k ʔ/. If one series of stops is aspirated and another possibly laryngealized (in addition to being voiced), /p t c k ʔ/ would seem to be the truly "plain" series of stops. However, some authors claim that these consonants have simultaneous oral and glottal closure. This is said quite explicitly by, a.o., Marvin Brown (1965, p. 39), who refers to the "tenseness of pronunciation" of /p t c k/ in Bangkok in favour of the assumption that there is simultaneous oral and glottal release. Harris (1972, p. 11-13) states that "Siamese voiceless glottalized stops and affricates are pronounced with simultaneous oral and glottal closures. The release of the oral and glottal closure is usually simultaneous so that the glottal release is not heard. (..) In the pronunciation of Siamese glottalized stops and affricates the articulation is usually quite tense with a firm closure between active and passive articulators. In the release phase of these consonants there is usually a clear sharp onset of the following vowel." (p. 11). Interestingly enough, this contention is not particularly favourable in the context of Brown's diachronic account of the tonal developments in Thai, since he has some difficulty with register assignment under the assumption that /p t c k/ were always accompanied with glottal closure, but he finds the evidence for a change of articulation over time too weak and therefore assumes this feature even for Ancient Thai. Again, a precise analysis of the phonetic nature of Modern Thai stop consonants would seem very relevant to the historical and comparative debate.

A new dimension entered the discussion with the study of Gandour and Maddieson (1976). They found by measurement that the larynx is sharply raised in the production of /t/ and conclude that the glottis cannot be closed in this consonant, since this would produce an ejective quality, which is not found in Thai. (They refer to E.A. Henderson for the contention that /t/ is said with a closed glottis; also cf. the references above.)

The most intriguing feature of secondary articulation in Thai stops is the alleged velarization in the series /p t c k/: It is generally recognized that at least some of these stops have a special quality before certain vowels. This special quality has been interpreted by several authors as a matter of velarization. Miller (1956, p. 254) notices velarization in the speech of a Thai speaker born in Bangkok (but speaking another dialect for the purpose of his study); among later sources are Noss (1964, p. 9), Egerod (1961, p. 65), who speaks of velar pressure in the consonants in question and velarized quality in the following vowel, Noss (1964, p. 9), and Harris (1972, p. 13), who characterizes /t/ before close front vowels as both glottalized and velarized.

There is some disagreement among these authors as to the distribution of this feature of velarization. As for limitations on the stop consonants exhibiting this feature, Harris only mentions velarization in some allophones of /t/; Miller and Egerod note it for both /p/ and /t/; Noss even includes /k/,

which of course is velar in itself. Nobody posits velarization of the palatal stop or fricative. In addition to the stops, Harris (p. 17) also points to the existence of velarized variants of the voiceless fricatives /f/ and /s/; Noss (p. 9) speaks of both stops /p t k/, nasals /m n ŋ/, and spirants /f s h/ as being slightly velarized (before certain vowels). As for the vowels with which this alleged velarization is heard, Harris speaks only of "close front vowels" (i. e., in the phonemicization used in this paper, /i/ or /ii/); in the case of /s/ he refers to emphatic speech as a condition under which the velarized variant is common (before close front vowels). Egerod speaks of /ii/ as being velarized, and notes that a gliding quality of /uu/ is audible after the same consonants (viz. /p t/). Miller (p. 254) speaks more generally of vowels as being "heard slightly velarized as a consequence of the release of the velaric pressure", and he even includes the lateral consonant following /p t/ in clusters. He notes that velarization is most audible in the case of "the high front vowel phonemes, where the delay in raising the root of the tongue, due to the nature of the stop, produces a very clear velarization of the vowel, almost diphthongal in effect" (it should be remembered that his study does not deal with the Bangkok dialect, or Central Thai in general, but still its description seems highly relevant to the present paper). Noss, finally, speaks of slight velarization before all of the high vowels /i y u/. - It is not clear to what extent some of the above statements were supported by instrumental observation.

Gandour and Maddieson (1976) found raising of the larynx in /t/, as said above. This was measured externally, but they suggest the presence of pharyngeal constriction, rather than glottis closure, on this basis. This, in their view, can explain the much debated modification found with vowels after unaspirated voiceless stops, a modification which they refer to as "the commonly observed 'dark' quality of vowels, especially the high front vowel, following this stop series". (Incidentally, Nina Thorsen in a transcription worked out in 1969, as part of the requirements for the B.A. degree in phonetics, noted pharyngealization in some vowels, when transcribing Thai as an unknown language.)

III. PRELIMINARY OBSERVATIONS ON /P T/

In the winter 1982-83 the authors of this paper had the opportunity of entering a discussion of the nature of Thai stops in a weekly seminar held by Professor Søren Egerod, and partly as a corollary of this (and partly for educational purposes) we did some very preliminary experiments with fiberoptic observation of Thai syllables involving stops as articulated by Amon Thavisak. We found that the view was seriously hampered in the case of /p t/ before /i/, and according to the opinion of Harris (1972) and others referred to above one might speculate that this were due to the fiberscope being pushed out of position by a velarization gesture. However, with proper positioning of the fiberscope it became clear that the field

of vision was reasonably stable, but that the upper edge of the epiglottis moved backwards so that a greater or lesser part of the picture of the glottis was covered by the front side of the epiglottis.

Similar backward movement of the epiglottis has been reported for certain Semitic languages, partly with reference to emphatic consonants and partly with reference to pharyngeal fricatives (cf. Laufer and Conday 1979, El-Halees 1982), but it does not seem to be claimed anywhere that this feature typically accompanies velarization as such (unless "velarization" is taken as a broad term covering the features associated with emphatic articulation in Arabic). Indeed, there would seem to be no obvious physiological reason why these features of articulation should go together, whereas there is an obvious connection between tongue retraction and (passive) epiglottal movement, and also a clear connection between larynx raising and epiglottal movement (cf. Lindqvist 1972).

There are, then, two kinds of questions to be asked in articulatory terms: (a) is the backward movement of the epiglottis associated with a backward movement of the tongue root?, with some kind of laryngeal articulation?, with both?, with neither? (the last possibility is hardly applicable according to the generally accepted views on the physiological constraints on speech articulation), and (b) are /p t/ before /i/ characterized by both velarization and something going on at the level of the epiglottis, or is the alleged velarization not truly velarization but rather pharyngealization, as suggested on independent grounds by Gandour and Maddieson (1976)?

In linguistic terms one may ask why something special should happen to /p t/ before /i/ but not before all vowels, and why it should not comprise the consonants /c k/ as well. If there is in fact a laryngeal gesture involved one might speculate whether this has something to do with the skewness of the system, /p t/ being the only "plain" stops which are in contrast with voiced stops, and moreover represent the points of articulation most favourable to spontaneous voicing, so that some special feature helping to keep them distinct from /b d/ might be called for. However, the same "velarized" quality can be heard with the Thai fricatives /f s/ in similar environments (as pointed out in Harris 1972, p. 17), which certainly does not lend much support to such a functional explanation. Moreover, it has been argued (Søren Egerod, personal communication) that the restrictions on the occurrence of this strange feature of pronunciation seems reasonable enough if it is velarization that is involved: it is heard most clearly with the front vowel /i/, and it does not occur with consonants whose articulation already involves the dorsum of the tongue (viz. /c k/).

We have undertaken a series of videotape recordings using the fiberscope technique in order to study laryngeal and supralaryngeal aspects of Thai stop consonants and of /p t/ in particular. These must of course be supplemented by studies

aiming at confirming or disconfirming the contention that these consonants are velarized in certain environments. So far we have fiberscope recordings of four (female) informants plus an X-ray recording of a series of words spoken by one informant (ATh).

It would be entirely premature to report on the results in any detail. This must await further work including supplementary techniques (photo-glottograms) and additional X-ray recordings, and comparisons with acoustic displays (sound spectrograms, Fo tracings) of the syllables in question.

However, it can be safely claimed already that the backward movement of the epiglottis is a seemingly very constant feature of syllables involving initial /p t/ at least before the vowel /i/ (to what extent this feature appears before the remaining vowels of Thai, of which /e/ and /u/ are - along two different dimensions - the first candidates for comparison, will be investigated in the future). This feature does not occur in our recordings with /c k/, nor with any of the other stops (e.g. aspirated voiceless /ph th/; voiced /b d/), so it is genuinely a feature characterizing /p t/, whatever the reason for this restriction on its occurrence within the stop consonants. We have observed a similar movement of the epiglottis with voiceless fricatives (and even with /r/, where the reason may be that the trill involves a complex articulation which may have nothing directly to do with the epiglottal feature in obstruents). The backward movement of the epiglottis is not equally strong in all cases; but its occurrence with /p t/, and its absence with other stop consonants, is a surprisingly stable phenomenon.

As for the question of the cases of this epiglottis movement, the limited X-ray evidence available so far suggests that it may be a consequence of tongue-root retraction. However, a passive effect by which the epiglottis is pushed backwards by the tongue-root may not be all there is to it, since the recording of a series of syllables spoken with very emphatic articulation showed stronger displacement of the epiglottis than usual, the latter moving way out from the tongue-root in a not very fast gesture. One might, then, speculate whether some laryngeal gesture is involved. On this point the evidence from our recordings is extremely clear as regards lateral constriction in the larynx. Firstly, the view of that part of the glottis which is left visible by the epiglottis is totally unhampered by constriction of the false vocal folds, so the consonants are at least not strongly laryngealized. Secondly, the glottis is typically not firmly closed in /p t/, as it should be if these consonants were glottalized, but it is rather slightly open, exactly as one expects with a plain voiceless unaspirated stop. The Appendix illustrates what the difference in epiglottis position looks like for certain types of syllables with various informants.

IV. CONCLUDING REMARKS

According to our preliminary findings it can be concluded that syllable initial Thai /p t/ are not glottalized, whereas certain sequences of these consonants with vowels exhibit a mechanism of pharyngeal constriction involving backward movement of the epiglottis (i.e. pharyngealization?, cf. the description of Arabic "emphatics" in terms of pharyngealization proper in Giannini and Pettorino 1982). Whether there is concomitant velarization remains to be studied.

Tongue-root retraction having been posited as a feature of certain "register type" Languages of South-East Asia (but found to have no phonetic basis for at least Nyah Kur, see Thongkum 1982), the existence of a possibly similar feature in Central Thai is of some interest in an Area Linguistic perspective, no matter how this feature will eventually turn out to be conditioned (in terms of context and in terms of possibly concomitant features).

As will be obvious, the above remarks constitute an explanation of the *raison d'être* of, rather than a proper report on, a phonetic investigation in its beginnings. Our preliminary observations on /p t/ were presented in guest lectures by one of the authors (JR) at Chulalongkorn university and Mahidol university in August 1983, and the reactions seemed to warrant that these limited observations are non-trivial enough to be presented in more accessible form, although the bulk of phonetic research certainly remains to be done (and to be presented with full documentation), both as regards Central Thai proper, and as regards the possible later extension of such study to other, typologically (if not genetically) related languages and dialects of South-East Asia.

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APPENDIX

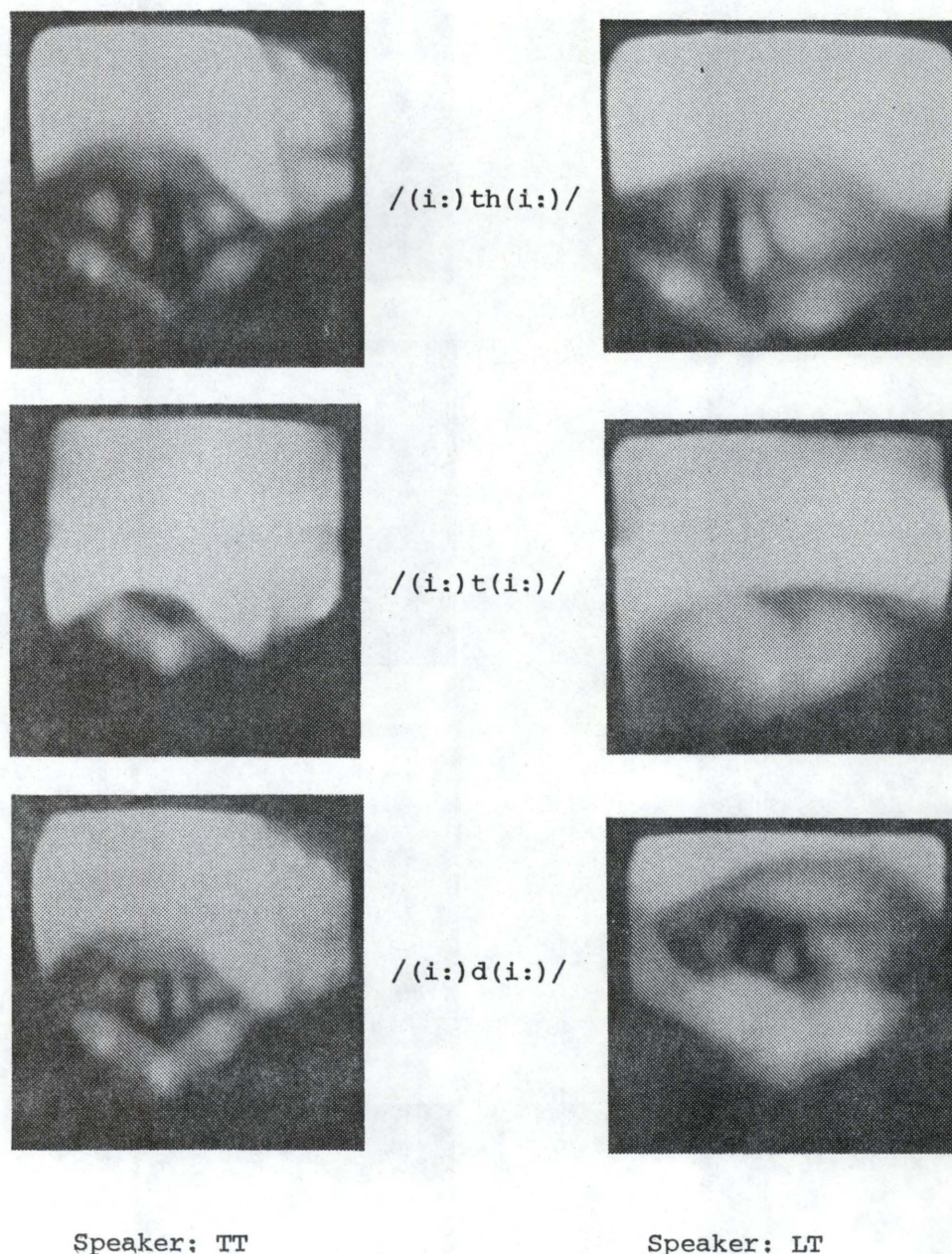


Figure 1

Fiberscope pictures of the glottis (photographed from the screen of a TV monitor, hence the rather poor quality) for three different consonants: aspirated, unaspirated voiceless, and voiced alveolar stop. The sequences /i:ci:/ occurred in meaningful phrases of analogous structure, all pictures of each column (i.e., for each speaker) being from the same reading of a list to ensure minimum displacement of the fiberscope relatively to the glottis. With these recordings we had no synchronization pulses enabling us to select a specific moment during the articulatory events; the pictures were chosen so as to illustrate the (maximum) degree to which the epiglottis tilts back during the consonantal phase for each of the three consonants.

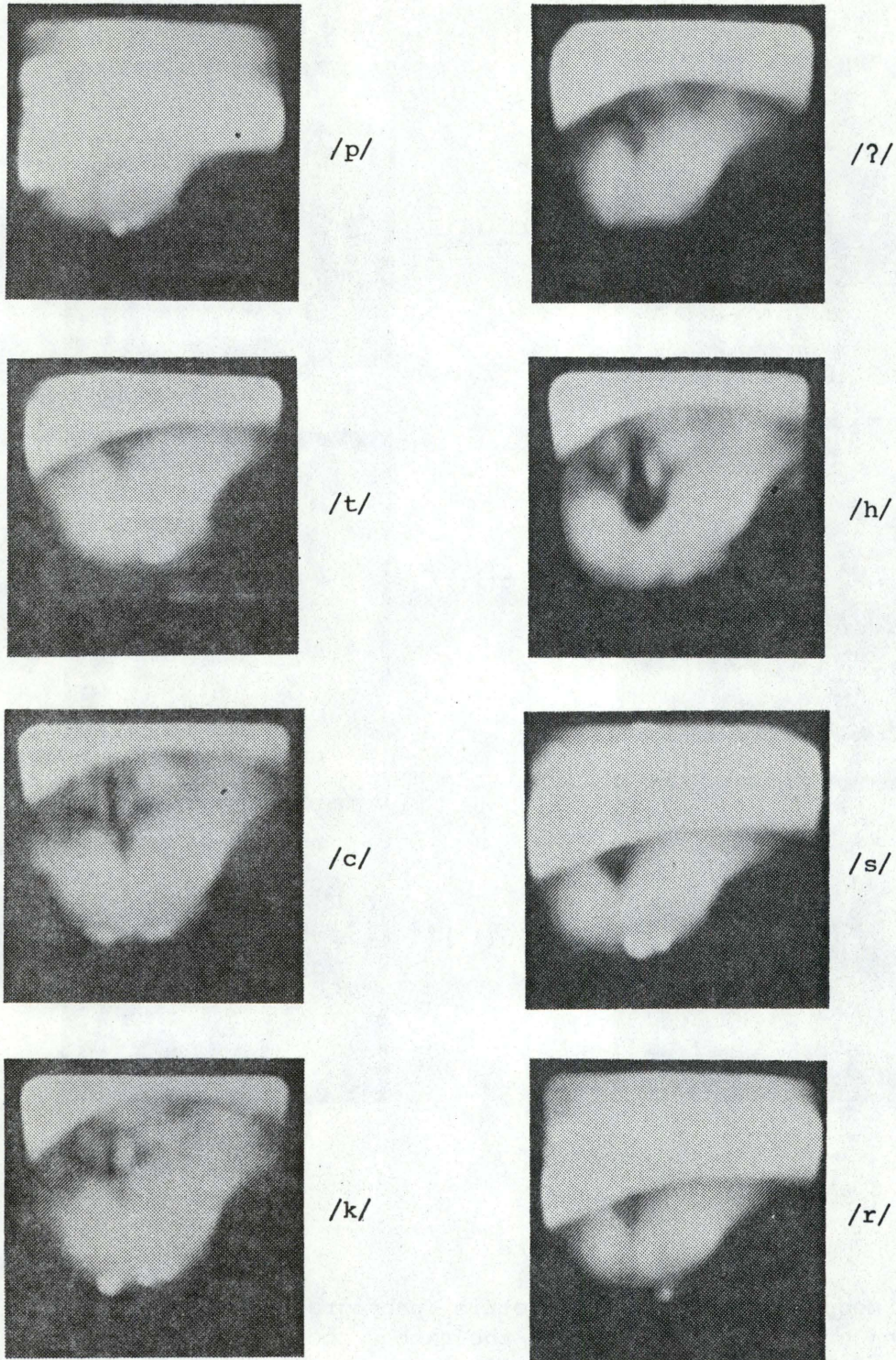


Figure 2

The four unaspirated voiceless stops (left) compared with the two glottal consonants and with /s/ and /r/ (right). Note the similarities among the epiglottis gestures for /p t s r/. - Speaker AT. (These pictures were taken from a reading of nonsense sequences of the structure /i:ci:/.)