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PANJABI PHONETICS.

EXPERIMENTAL STUDY OF AMRITSAR DIALECT.

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The materials of the present work, the palatograms of Panjabi sounds, were gathered during the months of June and July a.c. in the laboratory of Experimental Phonetics at Collège de France in PARIS, with the purpose to continue my previous studies on the nature of so-called retroflex sounds (1) in Indian dialects.(2)

(1)-The term RETROFLEX has been adopted to design the group of sounds called often CACUNIMALS, SUPRADENTAL or INVERTED sounds. The ancient Indian phoneticians called them MURDHANYA (sound of the head e.i. of the summit of the palate) which denomination was probably translated by European grammarians as CEREBRAL consonants. If the term "retroflex" has been adopted in this study, it was done only as a fact of scientific discipline to be in accord with the propositions of the International conference at Copenhagen (in

As I met a good subject of experience whose patient amability doubled by scientific interest and love for his mother tongue permitted me to extend the sphere of my experiments to all Panjabi sounds. I was able to study them by all methods, direct and experimental. In this preliminary sketch I shall treat only the lingual consonants as to the contact of the tongue and palate to have a sure basis for the classification of Panjabi sounds as to the point of articulation and the mode of their formation.

The palatographic method gives really the best test about the point of articulation and a simple print of the tongue contact conveys generally more than a long description to anyone able to read it and to make conclusion on the correspondent position and physiological movements of the tongue. The palatographic method keeps always, at least in the beginning, its individual character and avoids large generalisations about the articulations of all the idiom; but its objectivity, if carefully executed, prevents many mistakes, gives the best basis for phonetic exploration of a dialect and indicates useful hints for scientific investigations with other methods.

The palatograms presented here have been executed with two artificial palates, one made of thin metal (0,4 mm) and the other of thin celluloid (0,2mm) prepared in Paris. Though both permitted a good work,

April 1925), but the aim of this work can be put, on the contrary, to search if at all and how far this denomination is applicable for Panjabi Phonetics. "Retroflex" is here employed as generic term for a class of phonemes, ancient ^{meanwhile} mardhanya sounds, without physiological meaning as to the formation of these sounds.

(2)- S. "Les consonnes rétroflex^{cb} du Bengali et leurs correspondantes non rétroflexes." (Revue de Phonétique, Fasc. 2 et 3, PARIS 1928.)

I have preferred the second one to be sure that the subject is not hindered by the thickness of the palate. This precaution was especially necessary for some retroflex sounds whose tongue contact is very slight and was originally the real aim of this palatographic study. After a few^{er} experiments, the subject felt quite easy and the presence of the artificial palate in the mouth did not disturb his pronunciation. The exercise and practice of more than two months of our common work, made my subject quite accustomed to the artificial palate, which proved, moreover, also the constancy of the traces, for all articulations of typical words chosen as examples, have been repeated several times and at different periods.

The proceeding was as usual: the contacts of the tongue on the artificial palate were designed on its horizontal projection, obtained by its photography (in natural size); some little holes, symmetrically disposed on it, permitted easier control, and served as guiding points for the design of the lines of contact. The contour of this projection was prepared in the form of indiarubber stamp, to work easier and more surely.

For the ordinary consonants, it is sufficient to content one's self with the contact on the palate, because in their normal articulations, the opposite part of the tongue takes part in their articulation. But for the retroflex sounds, it seemed necessary to put at the same time the trace of the contact on the tongue too. For this purpose the colored method of ancient physiologists was chosen. The (natural or artificial) palate was painted with black colour and the contact on the tip and on the blade of the tongue was measured with compasses and drawn like the palatograms. That is why the original designs of the projection of the palate and of the tongue were made in natural size so as to permit

easier ~~xxxxxx~~ measures and direct comparison.

The subject of the following experiments was SIR UMRAOSING SHER-GIL of NAJITHA; from Amritsar district, 60 years old, who speaks Panjabi as his mother-tongue, and both his parents spoke the same dialect of Amritsar. He spent all his youth in Amritsar District, spoke at home and in his neighbourhood this Panjabi dialect. In the primary school, he learnt hindoustani too and in secondary school English and Persian. But the English ~~xxx~~ ~~xxxxxx~~, though fluently spoken, seems ^{not} to have apparently influenced his Panjabi articulations, on the contrary his English consonants to the ear, present Indian character i.e. without aspirations. His voyages and dwelling abroad in Europe took place in advances age, so that he did not notice any particular influence on the pronunciation of his mothertongue, because he was not personally interested in imitation of the foreign sounds.

So, his Panjabi pronunciation can be regarded as very near to the normal common Panjabi.

THE LIST OF WORDS.

The list of words, the palatograms of which are studied in this work, presents:

- (in the 1st column, phonetic transcription;
- in the 2nd column, transliteration of Panjabi orthography;
- in the 3d " , their significance.

For the phonetic transcription on principle, the phonetic alphabet of the International Phonetic Association has been adopted. (§)

The transliteration has been made on the basis of gurmukhi alphabet as it is usual in the sect of Sikhs and which is current to our

(§) By underlined letters in the phonetic transcription I mark in this

subject from his youth in his ordinary writing. All words spoken with the artificial palate or with the Kymograph, were written down by the subject himself, to avoid the psychological influence of any other, even phonetical transcription. I have transliterated these typical words with regard to the usual transcription of sanscrit alphabet. That is why I left the guttural \tilde{n} , and palatal \tilde{m} nasals, the retroflex $t d n$, affricate c ($\check{c}, t\check{s}$), ch ($\check{ch}, t\check{sh}$), j ($d\check{z}, dz$), jh ($d\check{zh}, dzh$), but to indicate that in gurmukhi alphabet there is only a single sign the aspiration ^(or subsequent fricative element) is marked as little index () \check{h} . For m, n , (anusvara et anunasika) in gurmukhi a point over the precedent sign is written, I write it too over the precedent vowel. The point over indicates the s^v [\check{s}] that is in gurmukhi marked by a dot in the sign of s, especially in Persian words, or simply by s . For a double consonant also is let the original sign \check{h} over its simple (latin) letter. The long vowels a, e, u , are transliterated as usual in sanscritic transcriptions, the horizontal dash indicating very well the vertical (for \check{a}, i) or horizontal (for u) dash added to the original gurmukhi letters.

x (list of words 51-4 followed by 9 Plates 55-513)

P A R T- I- PALATOGRAMS.

work some sounds the aspiration of which was lost or weakened, as t, t^s, d etc., and the character of which will be studied later. ^{The sign} ∂ at the end of the words, does not indicate only the ^{of e} quality, but ~~is~~ an indistinct vowel sound in general.

P A R T-I- PALATOGRAMS.

In this preliminary study of Panjabi sounds, we shall present the palatograms of dental, palatal, guttural and of so called retroflex consonants that permit to take the traces of contact on the ordinary artificial palate. Generally, we shall take some words presenting the respective articulation in three typical positions : initial, final and intervocalic.. The influence of the vocalic neighbourhood has been observed but is known as a fact of general phonetics and in this first sketch has not been farther developed; it would be easily completed by adding some more examples of all consonants with neighbouring vowels both of the front and back series. We have used it only for the velar consonants to approach their point of articulation more forward.

In the second part, we intend to study the breath current with the usual dispositives on the kymograph. From both these studies, we shall try to make some conclusions on the pronunciation of our subject and to give the classification of his Panjabi sounds.

DENTAL.

t

The voiceless dental t is formed by the contact of the upper part of the ridge of the tongue blade pressed off the limit of the gums and on the upper teeth. It is useful to prepare such a palate that shows all the upper teeth and permits to control how far reaches the contact on them. In the pronunciation of our subject t always marks the contact upon the upper incisive teeth in all positions. That seems to distinguish

7

the Panjabi t from the French one that is formed generally at the limit of the incisives and of the gums and from the English t that is less advanced than the French one. The Panjabi t is real dental and not only alveolar as it occurs in many indoeuropean languages. The point of greatest pression (marked in the design by small crosses) is on the ridge of the upper teeth. The initial t presents greater pression (Plate I, n^o.1) not only forward, but also by sides; this is proved by a larg contact on the palate for [tapə, Pl.I, n.2] The intervocalic t in [mata. Pl I.3] *has less contact*

There is very little difference between the final ~~position~~ and intervocalic position. This is rather comprehensible because in Panjabi there are very rare final consonants in single words. The off glides of the final consonants are always accompanied by a voiced (or at least voiceless) sound. In the pronunciation of our subject, I heard always the tendency to pronounce at the end of all words especially of those ending in a plosive consonant a little vowelsound (In the phonetical transcription it is sometimes indicated by a little vowel-like index) That is why the final trace of t and other plosives often present the form of intervocalic articulation; the intervocalic position of t after a short vowel ex. patt (Pl I n.5) seems to favour the region of canine teeth and relaxation on the sides as is shown by the shape of the trace. The greater pression of the intervocalic consonant after a short vowel is due to a sort of doubled consonant(this phenomenon is otherwise known as common already in Prakritic phonetics)

In any case the muscular tension of the point of the tongue is much nearer to the initial position than before a single consonant, after a long vowel; ex mata. (Pl I.n.3).

-d- th

The aspirated voiceless dental plosive has the same contact as the t in all positions and the same articulation, but the general pression is lesser and the muscular tension of the tongue is weaker than for t. The intervocalic th is less pressed than the initial one when it follows the main accent. After a short accentuated vowel ex [mattha'] (Pl I, n.9) the consonant is doubled and present the same energy in articulation as in the initial position, the width of the contact in thammə (Pl I, n.7) is the same as in mattha' (Pl I, n.9)

d

The voiced dental plosive is articulated in the same way as t, but the pression of the tongue contact seems to be replaced. As we said, the place of the greatest pression in t was the edge of the tongue against the teeth and the limit of the upper gums; in the voiced dental d the larynx is a little lowered and retired backwards and the pression is reported on the inner side of the contact (S. the crossed portion of the trace (n.10, Pl I).

For initial t, the muscular tension of the tongue is greater than for d and the shape of the blade is more pointed, the contact narrower: for d the blade of the tongue is more pressed on the inner side and the contact is enlarged backwards. The comparison is evident if both articulations t and d are pronounced one after the other; the trace of d on the inner side covers that of t (Pl I, n.1 and n.10).

In the intervocalic position (pəda, Pl I, n.12) the contact is relatively narrower and the pression is less, and in the final position (padə Pl II, n.13) yet less.

9

dh [t,d]

The contact and all characters of the initial aspirated voiced dental plosive dh, e.i. orthographed as such a one, are much nearer in the real pronunciation to a t than to a d. Auditively, it is a voiceless consonant, and its aspiration is scarcely heard, but it does not entirely disappear, it seems to modify the ^{quality} ~~tone~~ of the following vowel. These particularities will be examined in the second part of this study as they regard the breath, the outglide of the [t] and the onglide of the following vowel and its melody. If we compare the real dh as pronounced, for instance, in sanscrit alphabet [dha] (Pl II, 12) by our subject and his Pandjabi dha [ta] (Pl II, n. 15) in his usual pronunciation of modern words, we see that the contact in [ta] is larger and the pression greater than in [dha].

The intervocalic aspirated voiced dental plosive (orthographed dh) does not exist either, but is replaced by the corresponding unaspirated d (voiced dental plosive). In the example, ma'do (Pl II, n. 16) orthographed matho, the tongue touches a smaller part of the gums than for an unaspirated d in pa'da (L, 12). In this case, the relaxed pression of the whole articulation of d < dh seems to show that muscular tension is relaxed in d < dh in the same degree as we have seen in th in comparison with t. If it is so, then d < dh has lost only its aspiration in the intervocalic position but has maintained the original relaxed muscular tension, and does not seem to be confused with ordinary dental d in the pronunciation of our subject. The analysis of the breathline and larynxline, and examination of other examples will give some more indications. The final position of dh does not occur.

n

The voiced dental nasal has the same articulation as d, but the pression is not so great. The tongue touches the upper incisive teeth as for d. The comparison of both articulations n and d (as shown in

Ex. na (Pl II, n. 19)
na, m (Pl. II n. 20) and
Pl I. n. 10, 11 for d)

indicate the relaxed tension and larger contact along the molar teeth for d than for n. the blade of the tongue is much more hollow with strengthened edges for d; for n the blade is flatter and the contact softer. The final position is the weakest as in (ma; nɔ. Pl II, n. 21.)

l Liquid.

In the voiced lateral dental the tip of the tongue touches the incisives. Sometimes, the contact reaches only the edge of the teeth. The contact is quite small and goes along the upper teeth, from incisives to the first molars; the back part of the tongue is lowered so that the air escapes by sides over an through the last molars. (Ex. Pl II, 22, 23) .

l

The voiced alveolar vibrant is formed by the tongue concave raised to the alveols^e and touching on the sides the molars and the palate. The tip of the relaxed tongue beats some flaps against the alveols^e (Ex. re (h) Pl. II, 24). The trace on the tongue^e ^(Fig. 1, B) does not appert anything new, but completes the precedent indication. The upper edge of the lightly concave tongue beats against the alveols^e; the contact is larger on the sides than

fig 1

than in the middle at the tip of the tongue. The trace has no continuous contact, but shows little traces of some flaps that are executed with the upper marginal part of the tongue. Ex. ra (h) fig. 1, a trace on the palate β corresponding trace on the tongue.

RETROFLEX.

t
~
~

The retroflex voiceless dental plosive [t̡] is articulated on the alveols much more backwards than the ordinary not retroflex dental t. The concave blade of the tongue is raised and touches the palate opposite the canine or first molar teeth. The contact is executed by the ridge of the tongue that is laid slightly by a movement from back to the front, so that the edge of the tongue sweeps a rather wide portion of the palate, glides a little, as is shown by arrows in Pl III, 25, steps for executing the closure and then jumps down with explosion towards the lower teeth. (In reality, in Penjabi- in the pronunciation of our subject- there is no "retroflex" t, e.i. during the production of the articulation the tip of the tongue is not curled up, but only slightly hollow in the form of a spoon and applied against the palate with the edge sweeping the alveoles and jumping down and keeping always this curved position during the articulation of [t̡]. This position of the tongue causes that the articulation is accompanied by a slight projection of the lower jaw. To have a more persuasive proof of the real articulation, I took both traces on the palate and on the tongue at the same time. For this purpose, I employed the colouring method. To obtain an hygienic and inoffensive mixture I prepared a paste of condensed milk with the powder of carbonised wood (pastils) by adding some drops of boiled water to obtain the required density. With a little brush, the

fig 2

the colour is put on the palate and after the articulation the tongue is shown and the figure of the contact on the dry tongue can be measured and designed on a projection of the tongue prepared in advance (as in Fig 2,β). The curve T T' represents the projection of the edge of the tongue. The design over this curve is the trace on the lower inverted side of the tongue, within is the upper part of the blade.

So was obtained the figure 2,β and γ, which proves that the contact is executed just by the edge, the apex of the tongue and not with its inverted lower side. Ex tappə, Fig. 2,β and γ.

The real retroflex, e.i. inverted position of the tongue slip occurs only when the point of the tongue is ^{hooked} strengthened, in an exaggerated pronunciation, and curled up while the articulation is executed far back and high in the middle part on the roof of the palate as can be seen in the Ex.ta in Fig 3,β.

fig 3

But this is not the ordinary and normal pronunciation of the so called retroflex t. For our subject the "mardhanya sounds" will say simply articulated on the alveols.

th

The aspirated voiceless retroflex plosive th is marked in our examples thappə (Pl III n.33; atthə (Pl. III, n.34)

by a smaller contact than the unaspirated t, but both have the same retroflex character.

If we compare the contact of the initial and final positions (ex. thappə Pl. III, 33) and atthə Pl. III, 34, pa·thə Pl. III, 35, we see that the final th in Pl III N. 34 and 35 presents as large a contact as the initial one in III, 33, in any case, not less.

This phenomenon has been stated in a very constant way and strikes the attention because it presents a character that is quite opposite to the treatment of dental t. In dental series the initial t is more pressed than the intervocalic and the final t is the weakest; this phenomenon is a general work of all dental ~~phonemes~~ phonemes pronounced in words. If we see here just the contrary; it must have a special reason and ~~analysis~~ tell us that there is a change in the articulation. The palatograms of atth and path show that the final articulation is more advanced, approaches the incisives without touching them and its trace becomes more alike to the dental; this can indicate the partial or total loss of the aspiration in the final position. The analysis of the breathline of the same words will prove if the aspiration of th disappears or not. Than the initial th has a small contact because the tongue is more stretched and thinner, the ridges are thinner when the tongue rests concave. A thinner contact is not here a sign of weaker pression.

fig 4
The trace of the tongue (Ex thapp - Fig 4) shows that the contact is mostly performed by the upper part of the blade and by the ridge of the tongue. It is easy to see that the tip of the tongue is not inverted. The upper part of the tongue is more active in the formation of th than the lower one.

-d-

The articulation of the voiced retroflex plosive [d̠] is the executed in a similar manner as [t̠]. The pression of the voiceless is a little greater and its articulation is more advanced especially in the initial position. As several palatograms were taken in different positions, it can be stated, that the point of articulation for [d̠] reaches neither farther

than to the canine teeth nor more backwards than the first molars.

The contact and total pressure is greater for the retroflex [ɖ] than for dental [d] (which is articulated on the incisives and on the limit of the upper gums). The retroflex [ɖ] is retired back on the alveol^es and articulated with the ridge of the hollowed tongue. Ex Pl III 36 and Pl IV, n. 37-40.

Fig 5

The colored method indicates the real contact of the tongue in Fig 5, ex. dabba^h and proves that for [ɖ] ~~as~~ as for [t], the active part of the tongue is just the middle of the ridge that touches the post-alveolar region of the palate. The anterior part of the tongue is slightly concave on the upper side and the tension is less for d than for t as it shows the shape of the inner side of the contact. [dabba:] Fig 5.

In bhanda IX, 40 and panda IV, 39 both articulations n and d are retroflex.

In example adda, Pl. IV, n. 38, the contact of intervocalic d is very large indicating an energetic (doubled) articulation after a short stressed vowel. The same doubled articulation is to be seen in budda, Fig. 7.

(dh) > [t, d]

NOTE:

The orthographed aspirated voiced alveolar plosive dh does not exist in the pronunciation of our subject in the ^{aspirated} ~~voiced~~ form: the aspiration and the sonority of the initial dh is lost so that we have to do with an alveolar voiceless plosive t whose aspiration has left a certain influence on the mode of intonation of the neighbouring vowel. The articulation is much more executed by the upper part of the tongue and by its tip slightly bent but not particularly inverted as it is shown in Ex ta Pl III, n. 26 and in Fig 6.

t

Fig 6

15

The intervocalic d in ex. [ka.da] Pl. IV, 41, has a large contact and indicates an energetic pronunciation caused probably by a greater tension of the preceding vowel [a] that presents a special ~~xxxxxx~~ melody under the stress, for this d is in reality a dh in [ka.da] < [ka.dha] (written to-day ka.dha, ka.da or ka.da, ka.dha)

Fig. 7

After a short vowel a gemination takes place ex. [budda] < buddha, fig 7, that presents in β the normal and in γ a more stressed articulation. In this exaggerated pronunciation, the tongue is ~~strengthened~~ ^{tch} raised higher, and more bent, i.e. curled up and the articulation in these conditions becomes "retroflex" the contact in the front being performed by the lower part of the inversed tip ((fig 7, γ)). The same articulation is in final d - Ex. [mud.a] Pl. IV, 42, but weaker than in [budda] and a little more advanced.

To examine more the character of this t < dh, we can consult the trace on the dry tongue, Ex ta Fig 6- but always the articulation is performed with the tip of the tongue and the upper part of the blade as it was stated for the ordinary t (fig 3) or th (fig 4). If we try to distinguish by their palatograms the t (from original t) and the t < th < dh, we can hardly recognize a great difference: the t < dh seems to be a little weaker. And because our subject does not mix up them, as it seems, the reason could be, not in the point of articulation, but in the mode of breath, which we shall examine later, and there will be stated, if the initial t < dh is to be ranged to t and intervocalic d < dh to d (Ex. [ka.da] IV, 41 and [budda] fig. 7) and [mud.a] IV. 42.



The retroflex voiced alveolar nasal occurs only in medial intervocalic position (or in combination with other retroflex consonant) The examples Pl.IV, n.43- 46 show that the contact is made opposite the first molar teeth with the upper part of the tongue slightly concave in a spoonform. The contact with the gums on both sides of the molars is very small and smooth (sometimes is marked only one side on the palate, the other being stopped on molar teeth, which is evidently personal particularity of the subject as in *pano* Pl. IV, n.44 *pano* Pl. IV, 45; *na*, IV, 43. ~~44~~. The point of articulation is advanced as usually before anterior vowels, ex. [*pani*] (Pl. IV, n.46).

Fig 8
Bj

The trace on the tongue indicates that it is just the margin of the tongue that touches and surely there is more pression on the upper than on the lower side of the tongue. Ex. *pano* , fig 8, *β* and *ʒ*.



All palatograms of the vibrant voiced retroflex *r* indicate the Panjabi retroflex character i.e. the contact is executed in the prepalatal and alveolar region IV, 47-48, fig 79. The tongue, slightly concave at its front part, raises towards the palate, opposite the first molars, being retired a little back and is projected to the palate but without stopping. The tongue continues the movement sliding lightly over the alveoles and jumping down towards the edge of the low teeth, the over incisives are not

fig. 9

touched. The muscles of the tongue tip are relaxed and its edge has a circle-like form, as in fig. 10 β , not pointed as in fig 11 β , so that the gliding contact sweeps the palate in a large line from one side of the teeth to the other.

(Sometimes, the tip is narrower, i.e. more pointed, so that the contact does not reach the ridge of the teeth on the sides, but I have seen this form only in the beginning of the alphabetical syllable ra , V, 50. and never in the normal intervocalic position in real words. The characteristic vibrations of this retroflex glide sound come from the glotte, from the contracted isthmus of the throat, and their interference with the tone of the resonance cavity of the mouth like in the English and especially American intervocalic r . The contact reaches its greatest pressure in the middle, is weaker in the beginning (inner side) and at the end (outer side) which is indicated not only by the form of the trace, but also by the circumstance, that its edges dry more quickly. (Pl. IV, 46) . The raised tongue does not touch the palate on the sides, but only grazes by its edges the upper molars. The contact on the sides is rather exceptional (Pl. IV, n. 47) and occurs only in the beginning, like alphabetical sound ra . ~~1119~~ I suppose that is ^{the cause} why this sound has been sometimes approached to d , when the articulation is executed, starting from the slowly prepared position, when the tongue is not in continuous movement through all three phases of this consonant.

The trace on the tongue proves that even here -ex ma ~~ra~~ fig. 19 β , β it is the edge of the tongue and more the upper part of the tongue that sweeps the alveoles and executes the gliding contact.

॥॥
॥॥
॥॥

The voiced retroflex lateral is formed like r with the tongue, spoonlike bent upwards, and touching behind the alveoles rather high on the palate, opposite the first molars. The tip of the tongue is made thin (Fig 11 β and ʒ) and pointed; it strikes the roof of the palate and glides on the alveoles jumping down to the low teeth. The pression of the contact is a little stronger with the tip more stretched and more pointed than for r, so that it is performed only with the middle part; the sides are not at all touched , neither on the palate, nor on the molars.

fig 10

The trace on the tongue shows that the contact is performed just by the edge of the tip (Fig 10 and 11) . Only by the energetic initial articulation sometimes the lower part touches more and seems to be really "retroflex" ~~॥॥~~ ^{i.e.} inverted as in vala Fig. 11 , ʒ but this is not to be regarded as the most frequent case . Ex. laɪə (Pl. V, n. 55-56) permit to compare both articulations dental l and retroflex ɭ.

fig 11

᳚ (᳚)

NOTE:- There is no retroflex ᳚ in Panjabi words; in the saṣcrit words ᳚a (Pl. V-n. 57) pu᳚pa, (V, 58), the subject pronounces the ᳚ with the tongue spoonlike bent, and raised towards the roof of the palate rather back and high, this could advise that it differs from the other retroflex sounds which are more advanced , more alveolar. I have not found it in real

Punjabi words.

[j=y] - PALATAL.

The palatal voiced fricative has its contact along the sides of the molar teeth so that the frictional space is rather large and the friction is very weak, especially in the medial position (Ex. aya-Pl. VI, n.62- and maya, Pl. VI, n.63); in the beginning, it is more pressed (Ex. [jā], V-59-60) and chiefly before $\dot{\text{r}}$ [jī] Pl. VI, 61) so that the contact approaches to $\dot{\text{z}}$ (ž).

NOTE: In relaxed pronunciation the j nasalised [j̃] can serve as a substitute for p (Ex. aḷa·na Pl-VIII, n.87)

~ S ~

The voiceless alveolar sibilant [s] occurs ^{rarely} rather only in some words, ~~hardly~~ rarely in the pronunciation of our subject. In the marked example [sappa] (Pl. VI-n.64) that he pronounces also [sapp̄] the contact is very narrow along the upper teeth to the incisives and the friction space in front is wide.

[$\frac{\text{S}}{\text{S}}$]

The voiceless chuintante [ʃ] is articulated like the French [ʃ], with the tip of the tongue behind the low teeth, the jaws are very near to each other, the lips not rounded. The blade touches the gums only by the sides, along the molars up to the incisors-VI, 65- VI, 66. In the medial

position the articulation is a little retired (reaches only the eyeteeth) under the influence of neighbouring vowels. Ex [baʃa] (Pl VI, n. 67) .
 The example [ʃuka] (VI, 66) is pronounced with both syllables, the trace of k does not recover the trace of ʃ .

[ʒ̣ , ʒ̣̣]

NOTE: The voiced prepalatal fricative ʒ̣ occurs in the pronunciation of our subject, but not in real Panjabi words; it is a Persian sound which is heard in the language of town citizens, the corresponding Panjabi sound is dʒ. Ex ʒa, Pl. VI, n. 68.

[tʃ̣ , tʃ̣̣]

The voiceless prepalatal affricate tʃ̣ is formed by a large contract along the teeth like for t and ʃ̣ together . The explosion of t is executed only by the tip while the side contact rests as for ʃ̣, so that the explosion is made in the position of ʃ̣ . The detachment of the tongue is executed by the same movement so that the acoustic impression is that of a single explosive. The greatest pressure is in front of the contact and during the articulation, is replaced to the sides by retiring slightly the tongue from the position of dental t, or better alveolar, to the position of ʃ̣, for the contact reaches the upper incisors only in the initial [tʃ̣] [tʃ̣a (ru) VI, 69] or in a stressed syllable as in matʃ̣a (VI, 71) . In final position the occlusion is very narrow and retired backwards. (Ex batʃ̣ VI, n. 72)

[tʰ, ʧ]

The aspirated voiceless prepalatal affricate is articulated in the same manner as tʰ, ʧ, but generally the contact does not reach the incisives teeth, not even in the initial position (tʰapɔ Pl.VII,73; or tʰabaɔ Pl.VII,n.74)

In the intervocalic position the contact is thinner than in the final, though the [tʰ] is placed in [vatʰa] Pl VII,75 and in [patʰa] VII,76 in a stressed syllable. In the final mattʰo (VII,77) the greater contact must have a reason in a stronger articulation after the short accentuated vowel that doubles the following consonant as we have already seen in the Panjabi pronunciation, moreover the final aspiration is lost.

[dz, dẓ]

The voiced prepalatal affricate dz, has a similar articulation as [tʰ] but it is accompanied by the vibrations of vocal chords, and the contacts are less extended, the tongue pression being weaker.

The initial position (dzapɔ VII,78- dzamɔ VII,79, is more energetic with a larger contact than the intervocalic adza⁸⁰ VII, or final sã dẓ VII,81-

The final position, in which the articulation is relatively weaker in most indoeuropean languages, in the example [addẓɔ] Pl-VII, n.82, is much more energetic with a larger contact than in adza-VII,80, or sã dẓ VII-81. It is due to the mentioned phenomenon of doubled consonant after a stressed short vowel and we shall study it later with the kymograph.

[dzh, džh > tʃ, č]

The orthographic voiced aspirated prepalatal affricate does not exist in modern Panjabi in initial position, but is changed in voiceless prepalatal affricate whose aspiration is lost and seems only to be marked by a special timbre of the neighbouring vowel. The palatogram indicates by its form a greater pressure and a greater palatalisation than an ordinary [tʃ, č] but auditively the consonant tʃ, č and č, tʃ resulting from džh > čh are rather difficult to distinguish. Meanwhile, we distinguish both articulations by underlining tʃ, č < džh to distinguish it from the ordinary [tʃ, č]. The ordinary [tʃ, č] in the articulation of our subject is less pressed on the sides along the molars than the [č, tʃ] -Compare f.inst. VI 70- and VII,74.-

If we compare hindi or sanscrit džh (Pl VII,83) with tʃ -(VII,84) we see that the muscular action in the surd tʃ is stronger than in the sonant džh.

fig 12

In the medial position the džh has only lost its aspiration and is pronounced [dz] ,and shows a great palatalisation of d.Ex. madža, fig 12.

+ xim r

The palatalized (mouillé) n̄ is articulated as n̄ ,removed a little back and accompanied by a large contact of the tongue on the hard palate -Pl VIII,85 and 86. The muscles of the tongue are much looser in n̄

than in n. The contact never reaches the upper incisive teeth as in the ordinary dental n. This Panjabi sound is formed in the same way as in the slavic languages, the n mouillé [ñ] or as the anterior French n mouillé (gn). The separation of the tongue from the palate is executed on the whole contact at the same time, so that there is no complex sound n+j [n+y], but a single ñ sound. In Panjabi, as in French, it does not occur in the beginning nor at the end of the words. When the occlusion and the tension are relaxed in careless pronunciation, the sound ɲ can be changed into nasalized j : Ex. aja·(na) Pl. VIII, n. 87.

VELAR.

k

The voiceless velar plosive has its contact in the region of the last molars at the limit between the hard and the soft palate. Ex. Kambḍ VIII, 90. The articulation is advanced by the influence of the front vowels. Ex. kiambḍ VIII, 89, and retired before back vowels, Ex. kuppā (VIII, 91).

kh

The aspirated voiceless velar plosive has the initial articulation more pressed than the intervocalic one. Comp. khubna VIII, 93, akhḍ, VIII, 94, aiho VIII, 95. If we compare the unaspirated k with the aspirated kh, we see that the aspirated has a larger contact kh: khub (VIII, 92-93) The place of the articulation for kh is more advanced than for k.

g

The contact of the voiced velar plosive is formed in the region of the last molars and chiefly on the soft palate.

The initial g before a stressed vowel-in ex. gapo (VIII,96) is more advanced than in the intervocalic position in ex. vago (VIII,97). The intervocalic g after a long vowel is weaker than after a short vowel in the same position. Comp. vagond :: paggo (VIII,97nd at 96).

gh > k

The orthographic voiced aspirated velar plosive in reality does not exist, but is changed in Panjabi of to-day into the voiceless unaspirated k in the beginning of the word. Ex. kappo (IX-99) The aspirated voiced gh is pronounced by our subject quite differently (IX,103).

In the intervocalic position gh has no more kept its aspiration and is pronounced as g; the palatogram of g < gh, in vago (Waga-IX,100), bago (garden-IX,101) is the same as in vago (rein-VIII,97) . In ~~ex~~ bago (IX,102) the influence of i has advanced the articulation. The loss of aspiration is expressed in a special articulation of the preceding vowel, whose melody we shall examine in the breathline of the kymograph, our palatograms not being able to give some more indications about the possible differences .

) The voiced velar nasal plosive does not occur in the ~~begin~~

beginning. ^{of words} Our artificial palate though cut just at the beginning of the soft palate, shows that the mean articulation is performed just behind the last molars of the soft palate. The prolongation of the palate was tried, but its indications were not surer and were troublesome for the subject, that is why they are not ranged here. Ex. paṛṛ IX, 104, maṛṛ IX, 105, ṛa IX-106.

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In general conclusion, it can be stated that the articulations of Panjabi sounds (of our subject) are executed in a similar way as the majority of Indoeuropean languages. The differences are in aspirated and retroflex sounds.

It can be taken as proved that the Panjabi retroflex articulations, that we have especially examined here, are not executed with the tongue inverted or curled up, but only slightly bent, and raised towards the alveols as a rule. Their articulation is coronal, executed with the margin of the tongue whose blade is slightly bent in a spoonform. It becomes retroflex only ~~sometimes~~ exceptionally, in emphatic(stressed) pronunciation, when the articulation is executed with a ^{tch}strengthened tip of the tongue, touching high on the palate, very far from the alveols^e. But the ordinary pronunciation of the retroflex consenants is alveolar (Pl. IX-~~104~~^{n. 102, 103, 105}) or postalveolar (^{a-β}~~104~~) as to the palate and marginal (coronal) as to the tongue.