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BORIS RYBAK

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ANALOGIC VENTILATORY PHONETICS

B.Rybak

I.E.L.P.,Université de Paris III
F 75005 Paris

Phonation is a set of modulations of ventilation. So that there are two channels for : the nose and the mouth.It represents a kind of fluidic computer(Fig.1).

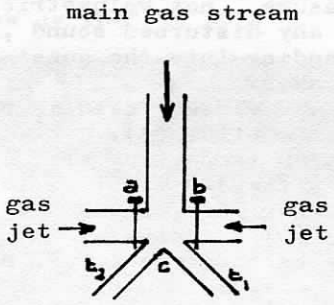

Fig.1.

When the sluice-gates a and b are both closed the main gas stream divides stochastically by two at c . When the sluice-gate a is open, b remaining closed, the main gas stream is turned aside through tube t_1, and conversely if b is open and a closed, it is then the tube t_2 which receives the totality of

the main gas stream. So that we have a versatile I-O device allowing operations according to binary unit systems. Speech is obviously a more complicated affair, but nasality and orality of phonemes belong to the fluidic principle I just spoke about.

The practice of speech analysis has to follow two princeps phenomena associate with very complex fluid mechanics of the articulate voice: 1) the air turbulences charcateristic of each phoneme ; 2) the homotopies of the deformable resonators which prohibite immediately any kind of oral mask since, if the labial resonators are blocked for instance, the sounds are disturbed .

Then , combining these theoretical considerations with the fast response ventilometer I devised (cf. these Proceedings concerned with the ventilomètre portatif), I developed a new phonetics - using the microphone only to square with the ventilatory signals - , phonetics which gives the analogic time course of any kind of articulate languages (the acronym is A.V.P.) (1). I call it also with French sigla P.A.R.L.(phonétique analogique rhino-laryngée).

It works with the nasal ventilometer I described in this School and, in addition, with an annulus adapted to the nasal cylinder of the ventilometer and supporting the electronic sensor. Consequently the set up is semi-quantitative , giving at the oral gate only μA - which is a measure , not volumetric - with the main advantage to avoid any disturbed sound , the flux of exhalated air expanding into the quasi-infinite space surrounding the speaker.

The apparatus was already used in pathology (2)(3)(4) and in ethno-linguistics (5).

The demonstration is dealing with a four channels "Tektronix 5103 N" ($\bar{t}$ = 500 ms/div.) to show :

1) at the superior part of the scope, the microphonic oscillograms (1 V / div.),

2) immediately below , the A.V.P. nasal (N)trace (generally 200 mV / div.)but in fig.3 N is the 3rd,

3) immediately below , the A.V.P. oral (B) trace (generally 200 mV / div.),

4) at the inferior part , the intensity (20 dB / V div.).

In addition I have adjoined in parallel a X-Y "Siemens" plotter with X = oral trace and Y = nasal trace. The "Lissajous" graphs given in figure 6 b are examples of what was done on the day of the A.S.I.; they were obtained simultaneously with the scope graphs; let us say that such curves permit to observe the variability of the pronounciation with great niceties and,

then,allow us to do studies for a new approach of the locutor recognition problem . The sentence pronounced here was : "J'ai pris une petite tasse de thé".

Technically, when the end of the sentence is reached, the A.V.P. set up is immediately removed from the head of the locutor to avoid a relaxation trace without meaning at the present time with the X-Y trace.

Figures 2 , 3 , 4 , 5 , 6 show the results obtained on the day of the A.S.I. demonstration (nasal sensor volume calibration gave 10 ml / div. of the scope).

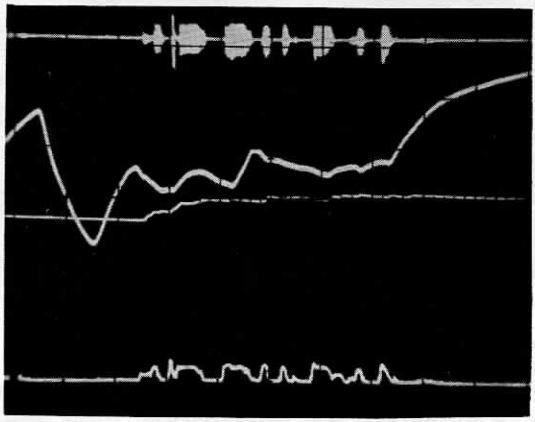

Fig.2 represents the traces for the sentence:"J'ai pris une petite tasse de thé" in DC ;

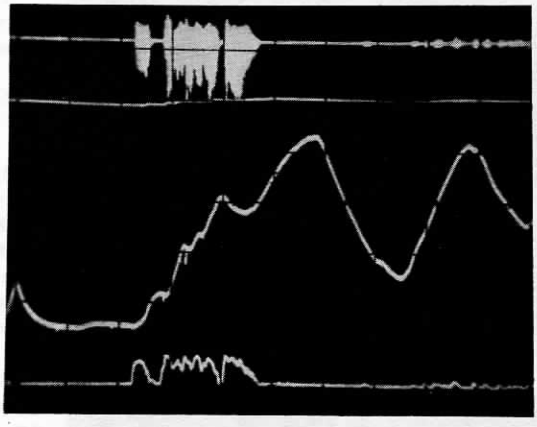

Fig.3 represents the traces for the syntagme :"Un pont dans la montagne" in DC;

Fig. 4 represents the traces for:"J'ai pris une petite tasse de thé" in AC (200 mV / div. for N , 50 mV / div. for B);

Fig.4.

Fig.5 represents the traces for : "J'ai pris une petite tasse de thé" in AC with N + B (combines the two air-pathways , i.e. what the locutor says and what the auditor is supposed to understand , at least to hear);

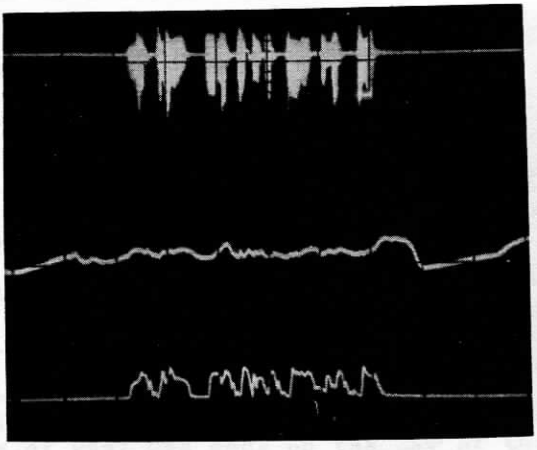

Fig.5.

Fig.6 a represents the scope traces for a slowly pronounced (still $\tilde{t}$ = 500 ms / div.) : "J'ai pris une petite tasse de thé" in DC and Fig. 6 b the parallel XY traces ,both at 500 ms / div. (notice the loops).

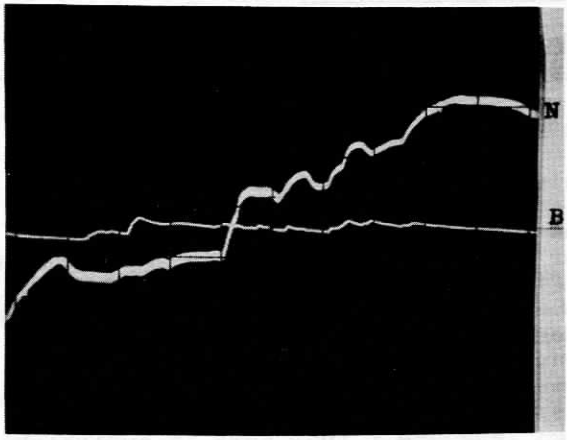

Fig. 6 a .

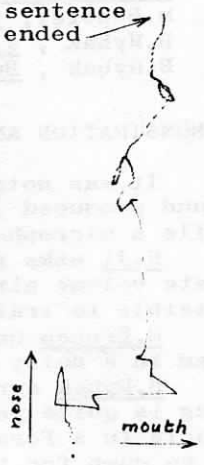

Fig.6 b .

Variability means that by iterating " identical " phonemes neither microphone nor A.V.P. gave the strictly superimposable traces for the same locutor , and consequently for different locutors. Then to found M or A.V.P. invariants one has to collect families of curves and calculated σ^2, χ^2, etc. ; each M or A.V.P. core should be considered as the seeked invariant.

RADIO-TRANSMISSION

The emitting system (90 x 65 x 25 mm ; weight = 135 g with battery 9 V (F 22) - 3 mA ; antenna : 8 cm) is a FM device (working at 100 MHz) driven by impulses of variable width; these impulses are obtained by comparing the signal of the amplifier with a periodic linear tooth ornament signal, permitting the transformation : tension V ⟶ interval Δ t. The measure is unaffected by amplitude alterations. The receptor realizes the inverse conversion (integration) . The apparatus is able to broadcast - for example when there is a change in breathing when the subject is stiff or moving - at 100 m , and permits then to do ambulatory A.V.P. + microphone controls .

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DEMONSTRATION AND DISCUSSION

It was notably shown that one can simulate (no sound produced) a talk using the A.V.P. technique , while a microphone is giving no signal .

S.Ji asks for precisions concerned with the steady state volume air flow. After assay , he asks if it is possible to train a dumb person with the A.V.P.technique.

M.Brocco underlines that this apparatus is useful even in a noisy environment .

B.Rybak agrees and answers to S.Ji that this training is quite possible - as well as the training of people in a foreign language (that case is equivalent to be dumb for this language): thanks to the fact that the A.V.P. traces are simpler than a microphone oscillogram, one asks the subject to try to superimpose his A.V.P. trace upon the A.V.P. monitor trace , and he succeeds.

J.D.Degos and T.Durali emphasize the rôle of A.V.P. technique in different pedagogies, as M.Jessel did.

During the demonstration of (A.V.P. + XY) records, B.Rybak drew the attention on the fact that the characteristic periods of the XY curve are the ascendant ones; N.H.Grönwall asks if there is a possible false or cross-tracing if one simulates in XY . B.Rybak says that he is nearly to say that humoristic fakers can always trace any XY , but the scope traces make the fun irrelevant .

It is a pleasure to thank Michel Morel , Bernard Gautheron and Philippe Dupuy for their technical assistance during the Session .

Cette Leçon a été prononcée le 11 juillet 1978 à 9h15 .