

**Physiology.** — “*Contributions to an experimental phonetic investigation of the Dutch language. I. The short o*”.<sup>1)</sup> By Miss L. KAISER. (Communicated by Prof. G. VAN RIJNBEEK).

(Communicated at the meeting of September 29, 1923).

When listening carefully to the pronunciation of the “o” in closed syllables in Dutch, we perceive that — apart from the influence which all sounds undergo from preceding and following vowels or consonants — two completely different ways of pronunciation can be distinguished<sup>2)</sup>.

One of these two pronunciations is heard in words like: kok, tot, hol; the other in words like pop, bot, vol, hond. At the suggestion of my former master Dr. PLOMP, I have tried to go further into this question.

I first tried to determine experimentally this difference, suggested by linguistic feeling and observed by simple hearing.

*Experimental phonetic analysis of the speech movements.*

Several methods used in experimental phonetics were consecutively applied in order to determine the essential movements and positions of the vocal organs during the pronouncing of  $\text{o}$  and  $\text{o}$ <sup>3)</sup>. In doing so I chiefly made use of one trial person, while the results were afterwards tested to those obtained with other speakers.

1. Observation and measuring of the mouth opening while pronouncing different sounds proved that in this respect a,  $\text{o}$ , oo,  $\text{o}$ , oe form a series in which the mouthopening gradually decreases, the height

<sup>1)</sup> From investigations made at the Physiol. Lab. of the Amsterdam university and at the Phonet. Lab. of the Czech university at Prague.

<sup>2)</sup> I am aware of the fact that so called educated speech varies considerably in different parts of this country. As far as I know facts mentioned here hold good for the pronunciation of Amsterdam and surroundings and probably not or only partially e. g. for that of the Hague and surroundings in which the  $\text{o}$ -sound seems to predominate.

<sup>3)</sup> The o of kok is represented by  $\text{o}$ , that of pop by  $\text{o}$ .

diminishing regularly, while the width also decreases but not so regularly. The latter, namely, shows a sudden decrease between  $\text{ø}$  and  $\text{oo}$ . In this series the height of the mouth opening was 16 mM., 12 mM., 8 mM., 6 mM., 4 mM. respectively, the width 36 mM., 31 mM., 16 mM., 14 mM., 7 mM. respectively (see fig. 1).

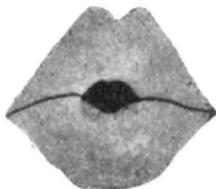
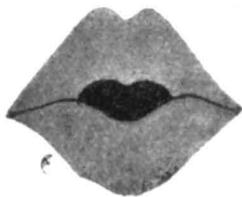
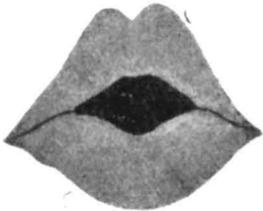


Fig. 1.

Closely connected with this are curves of the lipmovements made with the apparatus of VON WILCZEWSKI<sup>1)</sup>. This apparatus has been so construed as to have the curves indicate the natural size of the vertical lip-opening. Fig. 2 illustrates this. Fig. 3 shows a curve obtained with the same apparatus by pronouncing alternatively  $\text{døl}$  and  $\text{døl}$ . The difference is clear; the dimensions are about the same as those mentioned above.

Consequently, if we exclusively consider the shape of the mouth opening, we can imagine that  $\text{ø}$  is an  $\text{oo}$  that became more or less like an  $\text{a}$  while  $\text{ø}$  is an  $\text{oo}$  that has acquired some of the qualities of the  $\text{oe}$ .

2. By means of ZWAARDEMAKER's apparatus<sup>2)</sup> for registering speech movements, the putting of the upper lip, the movements of the lower jaw relative to the upper jaw, and the contraction of the muscles that form the bottom of the mouth, were recorded. Fig. 4 shows that also as regards jaw opening  $\text{a}$ ,  $\text{ø}$ ,  $\text{oo}$ ,  $\text{ø}$ , and  $\text{oe}$  form a descending series, while the pouting of the lips increases, (with this trial person there is less pouting of the lips for  $\text{ø}$  and  $\text{oe}$  than for  $\text{oo}$  in connection with the downward movement of the upper lip, during which the latter is somewhat flattened). The curve of the mouth bottom is not dealt with here because of its complexity. What interests us most in this curve is that it shows considerable and characteristic dif-

<sup>1)</sup> Vox. Heft 3/6, 1922.

<sup>2)</sup> Onderz. Physiol. Lab. te Utrecht. Ve reeks I 1899—1901 p. 76. Leerb. II p. 98.

ferences between the two o-sounds. These results harmonize quite well with those obtained by EYKMAN <sup>1)</sup> who, working with the same instrument, found an average jaw opening of 7,25 mM for a

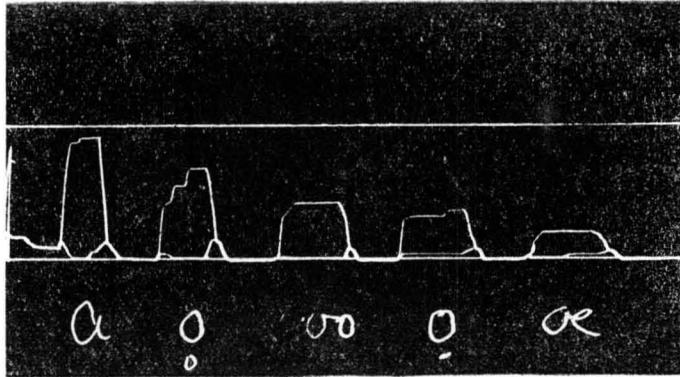


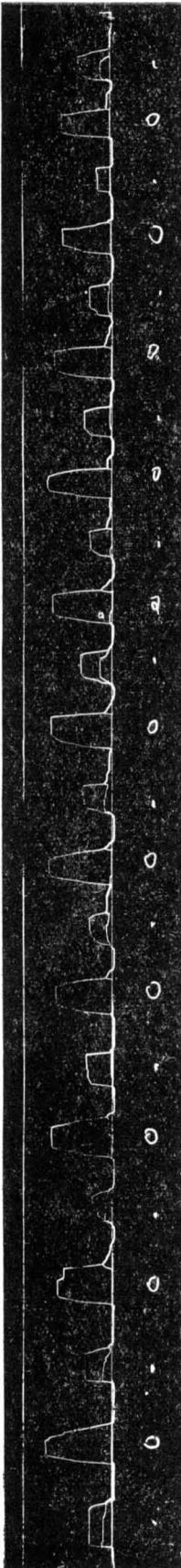
Fig. 2.

in "bat", 5,50 mM for o of "pot", 4,75 mM for oo of "boot", 4,50 mM for o of "bot" and 2,25 mM for oe of "boet".

Fig. 3.

Fig. 5 also shows curves of lip, jaw, and mouth bottom, but these curves are obtained in another way, viz. by means of a "mouth-funnel" that permits of registering the above mentioned movements at the same time. This instrument, constructed by me for another purpose, will be dealt with elsewhere. As it has no fixed support, it misses the exactness which characterizes ZWAARDEMAKER'S apparatus. Still it is very useful to give a provisional impression of something relative. It can be noticed in fig. 5 that in pronouncing "dorscht" there is less pouting of the lips and a larger jaw opening than for „dorst", while the curve of the mouth bottom is almost the same for both words. From the mouth-funnel curve it appears that the air current for o is stronger than for o, as is easily comprehensible. From the above, therefore, it becomes evident again that the two sounds differ considerably.

<sup>1)</sup> Onderz. Physiol. Lab. te Utrecht Ve reeks II 1899—1901 p. 202.



3. With the majority of speakers the hard palate is either hardly touched or not touched at all by the tongue in pronouncing oo, o, or o. Consequently the artificial palate cannot be of much use here. Yet I had the words "pop" and "bop" pronounced by two trial persons with whom a rather large part of the palate was touched. The results can be found in fig. 6. The difference between the two sounds is clear with both persons: the surface touched for o being smaller than for o, while it is a wellknown fact that for a the palate is not touched at all.

4. Finally the movement of the larynx was registered. It can be easily felt that the larynx assumes a somewhat different position in the two cases, viz. it is advanced more for o. However, I did not always succeed in recording this difference. I tried to do so with ZWAARDEMAKER'S method <sup>1)</sup>. The curves obtained, however, were too unlike in appearance but that definite conclusions could be drawn. Still it appeared from these curves that the larynx was retracted for o (as for a and oo), while it was advanced for o as for oe, though by no means to such a degree. Fig. 7 shows part of a curve in which the difference between o and o can be seen.

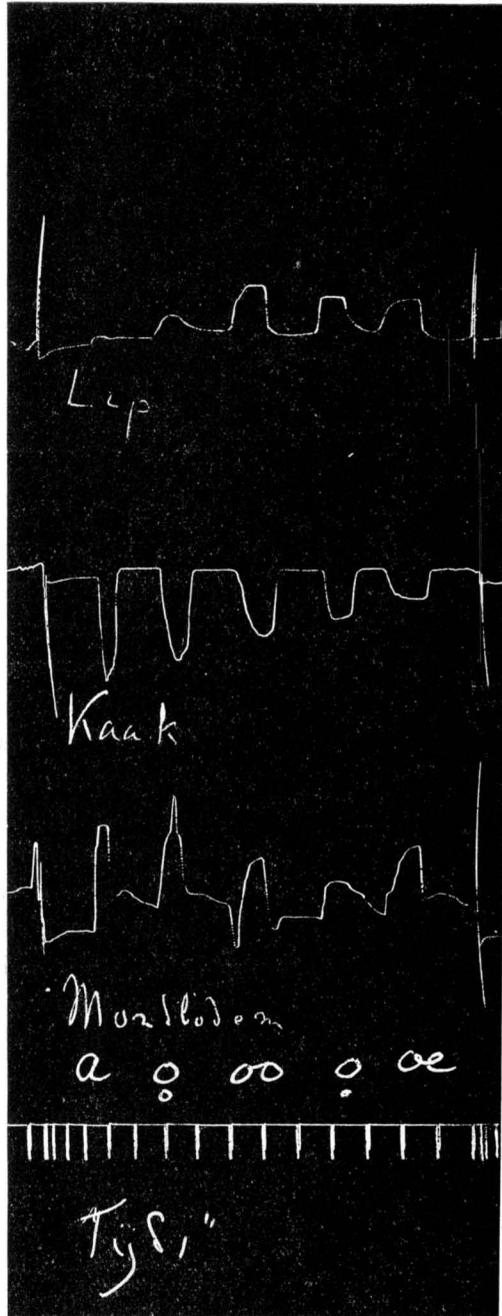


Fig. 4.

<sup>1)</sup> Leerboek der Physiologie II, p. 86.

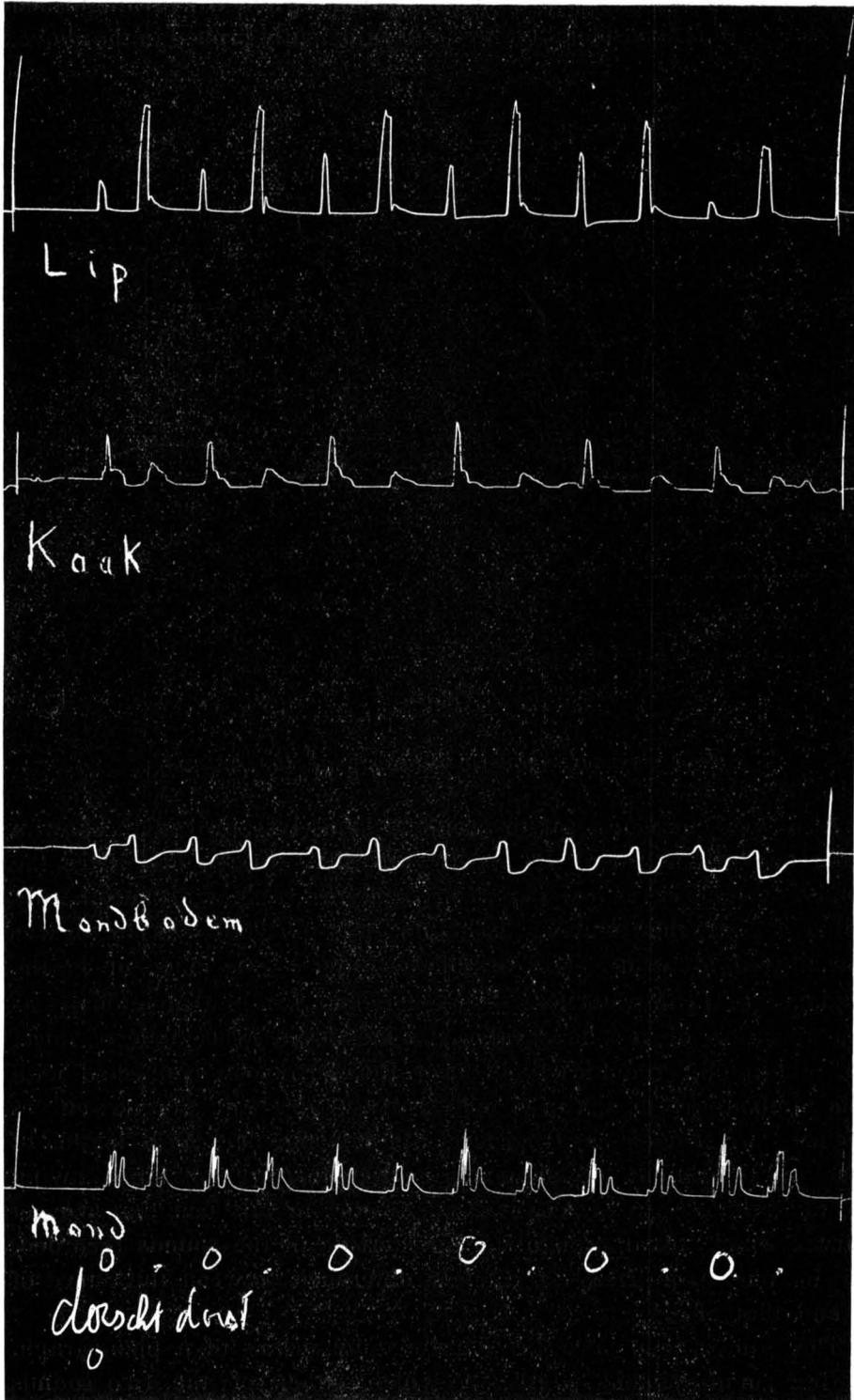


Fig. 5.

That the speech movements made to produce  $\text{p}$  and  $\text{p}'$  as distinguished by the ear differ considerably, has been sufficiently proved in the above.

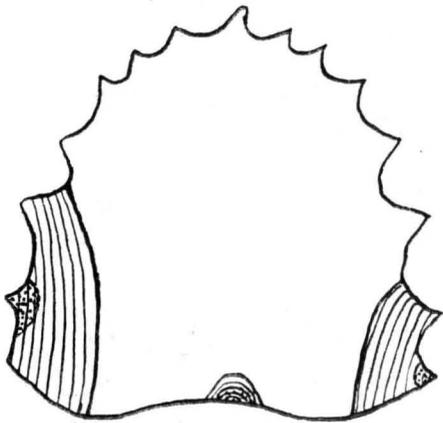


Fig. 6. Pp. v. d. S.

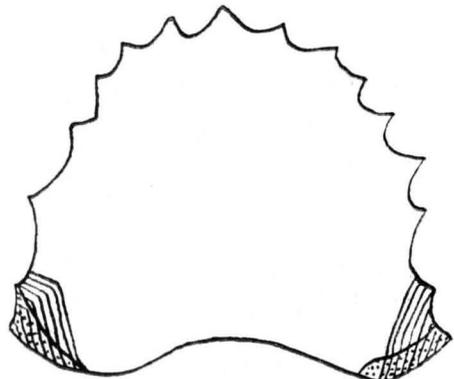


Fig. 6. Pp. R.

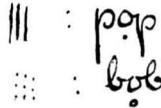


Fig. 6.

*Experimental phonetic analysis of the sounds.*

Also the characters of the sounds themselves proved to show a difference which could be easily recorded. In the first place the sounds can be easily registered on the kymographion. It need hardly be said that the tambour used for this purpose has to answer special requirements. This part of the inquiry was made under the guidance of Prof. CHLUMSKÝ. The tambour had the same shape as the recorder of a phonograph, the membrane was made of mica. An aluminium "mouthfunnel" after ROUSSELOT was connected with this tambour by means of a wide rubber tube. Fig. 8 shows curves of the two sounds as registered in this manner. As a matter of fact the vibrations of a membrane like this are not large, owing to its stiffness; it is however partly due to this fact that we get curves which are thoroughly characteristic of the sounds recorded. So in our case there is a clear difference between the curve of  $\text{p}$  and that of  $\text{p}'$ .

The sounds can also be registered by means of a phonograph. A few monosyllabic words in which either of the two sounds occur according to the meaning (e.g.  $\text{bop}$  and  $\text{bop}'$ ) as well as the

sounds pronounced separately were recorded by means of an Edison phonograph (old type).

The difference between the sounds as recorded by the phonograph can be made much more illustrative and easily measurable by

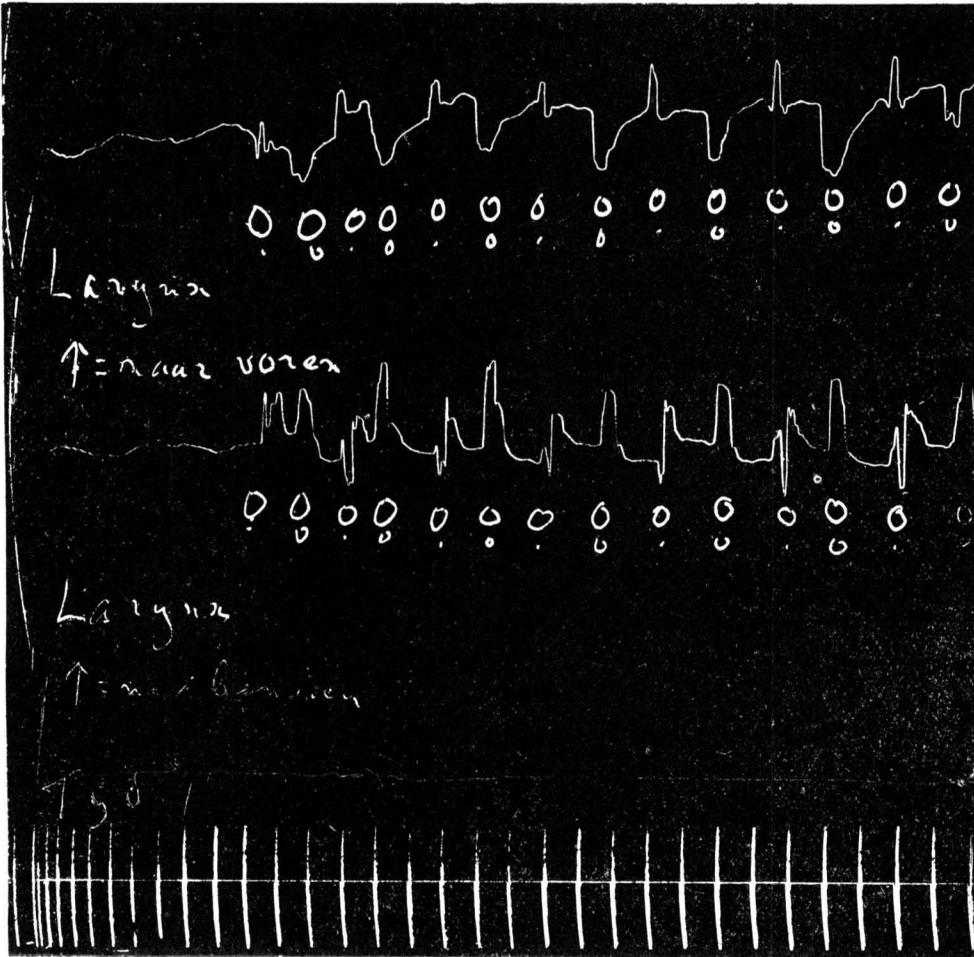


Fig. 7.

transforming the indentations of the wax cylinder into a curve on smoked paper. This is done by the apparatus constructed for this purpose by LIORÉ. A sapphire follows the groove of the phonographic cylinder; the movements made by the sapphire in doing so are transferred to a writing-lever, recording them on a rotating cylinder. As there is no such apparatus in Holland, as far as I know, also this part of the investigation was made at Prague under the guidance of Prof. CHLUMSKÝ. The words „bød” and „böt” were again recorded phonographically, making use of the apparatus of LIORÉ. By means

of the same instrument these curves were subsequently magnified 300 times and registered on a smoked cylinder. Fig. 9 shows part

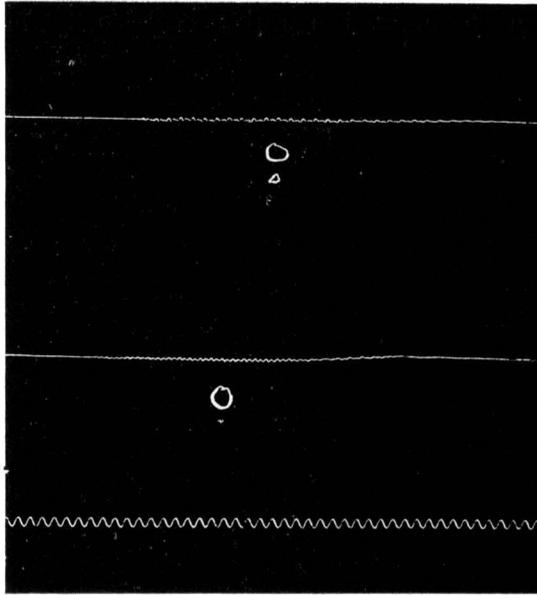


Fig. 8.

of these curves. The upper and lower curves represent the  $\text{o}$ -sound in "bot", pronounced in a low voice in the former and loud in the latter. The curve in the middle gives  $\text{o}$  sound in „bod” The difference between the two sounds is clearly revealed in this way and can be easily put into figures. The curve of  $\text{o}$  is much the same as that which characterizes the aa-sound.

After a considerable and constant difference has thus been ascertained, it may be desirable to get an idea of the circumstances in which  $\text{o}$  and  $\text{ö}$  occur in Dutch.

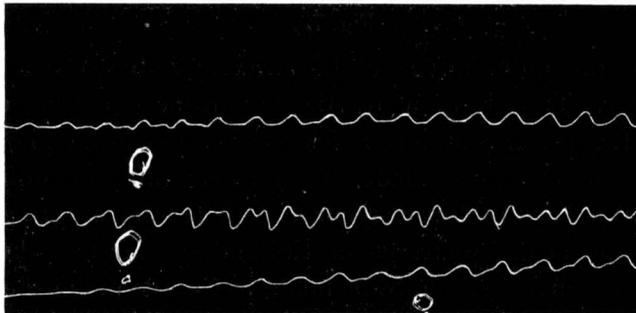


Fig. 9.

*Linguistic remarks.*

Every Dutch word of one syllable, containing o and also syllables with o, not occurring by themselves but with which influence from other syllables can be safely excluded (e.g. lom(mer)) were considered. Combinations of sounds that can be pronounced quite well, but are not found in the Dutch language, have been omitted.

As regards the influence by the several consonants, a few facts could be ascertained.

The most constant influence is that of following nasals. In this combination, namely, the  $\text{o}$ -sound occurs invariably. This can be easily comprehended, as the narrow mouth-opening and weak current of air passing through the mouth, promote the air current through the nose which follows.

Another influence is that of the lip-sounds; these promote the producing of the  $\text{o}$ -sound especially when preceding it. Also this becomes clear if we consider the narrowness of the mouth-opening. Guttural sounds like h, g, k, etc. are as a rule followed — and as far as they can be final, also preceded — by  $\text{o}$ . This also holds good, though in a less degree, for z, s, l, r, n and j; n of course only when preceding. D and t have no clearly manifested influence.

The r occupies a position of its own; its influence varies according to the way in which it is pronounced, which is different even with one and the same speaker at different times, its place of articulation varying between point of the tongue gums and root of the tongue-uvula. Taking this into consideration we can say that the advanced r promotes the  $\text{o}$ , the retracted r the  $\text{ö}$ -sound, both whether preceding or following the vowel.

From this it appears that the adjoining consonants either promote the  $\text{o}$  or the  $\text{ö}$ . It should be borne in mind, however, that the only absolute influence is that of nasals as following sounds. The other influences only work to a limited degree. The fact that the influence of several sounds appears to be inconstant proves that there is at least one factor more playing a part. This becomes evident from the fact that several words, have either  $\text{o}$  or  $\text{ö}$  according to their meaning, e.g.:

b $\text{o}$ t (noun = flounder, bone; adjective = blunt)	& b $\text{ö}$ d (noun of bieden = to bid)
d $\text{o}$ l (adjective = mad)	& d $\text{ö}$ l (noun, part of a rowing- boat = thowl)
d $\text{o}$ rst (noun = thirst)	& d $\text{ö}$ rst (from the verb dorsch = to thresh)

mōtje (dialect of moet-je=must you) & mōtje (noun, diminutive of mot  
= moth)  
pōrt (from the verb porren=to stir) & pōrt (noun from porto, oporto)  
tōbbe (noun = tub) & tōbben (verb = to worry)

It seems to me that the above may induce us to think of etymological influences. Words that have *o* in Dutch, usually occur in German with *u*, while those with *ō* either have *o*, *a*, or *au* in German. I do not venture to judge about the value of this phenomenon. Other cognate languages as well may give indications. It may be worthwhile to make an etymological inquiry in this connection.

If etymological influences are ascertained indeed, we can imagine that they be inconsistent to a certain extent with the other influences described above. The word "pols", for instance, may be mentioned in this connection, because the pronunciation is wavering. It appears to me that this word is pronounced "pōls" by more careful speakers, while the majority say "pōls". Judging by its etymology the former pronunciation would be the right one; the latter may be easier because of the *l* that follows.

*Summary.*

There are in Dutch two short *o*-sounds that can be clearly distinguished both acoustically and phonetically (perhaps also etymologically).

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