LX. Facts and observations relative to the science of phonetics

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To form the subphosphate of potash ($3\text{KO}, \text{PO}_5$), one-sixth of an equivalent of phosphoric acid, 7.43 grains, was mixed with half an equivalent of potash:—

Before mixture . . .	$63^{\circ}61$	$63^{\circ}67$	$63^{\circ}69$
After mixture . . .	$67^{\circ}87$	$67^{\circ}93$	$67^{\circ}99$
Rise of temperature .	$4^{\circ}26$	$4^{\circ}26$	$4^{\circ}30$

Twice the mean result, $4^{\circ}27$, is $8^{\circ}54$ F., which is the heat disengaged on neutralizing each of 3 equivalents of potash by a single equivalent of phosphoric acid.

The heat therefore disengaged in the gradual saturation of phosphoric acid by 3 equivalents of potash may be thus distributed:—

By first	equivalent of potash	. .	$10^{\circ}00$
... second		. .	$8^{\circ}08$
... third		. .	$7^{\circ}54$
<hr/>			
$25^{\circ}62 = 8.54 \times 3.$			

LX. *Facts and Observations relative to the Science of Phonetics.*

By Professor LATHAM. (No. III.)

IN two preceding Numbers the connection was indicated between the mutes and the liquids, on the one hand, and the mutes and the semivowels on the other. In respect to this latter connection, it was stated that the sounds of *p, b, f* and *v* formed a sequence with the sound of *w*; and that the same took place between the sounds allied to *k* and *g*, and the sound of the semivowel *y*. Hence the sequences

$$\begin{array}{c|c} p & b & f & v & | & w \\ k & g & \kappa & \gamma & | & y \end{array}$$

Beyond this, however, there is an undoubted sequence between the semivowels and the vowels. *W* is connected with the *oo* in *look*; *y* with the *ee* in *feet*. This is the fact that gives to the *semivowels* their name of *half-vowel*; the sequence having been universally recognised.

In this connection of the semivowels (*y* and *w*) with the vowels (*ee* and *oo*) on the one side, and with the mutes (*\gamma* and *v*) on the other, we find the connecting link between the vowels and the consonants generally. Hence we have the sequences

$$\begin{array}{c|c|c} p & b & f & v & | & w & | & u & (= oo \text{ in } look) \\ k & g & \kappa & \gamma & | & y & | & i & (= ee \text{ in } feet) \end{array}$$

This circumstance gives a prominent character to the vowels *i* and *u*, and also to the series of mutes wherein *v* and *g* occur. It does not, however, give the affinities and sequences of the vowels. This, however, we know; for without going further back than the researches of Professor Willis, as explained in

the Transactions of the Philosophical Society at Cambridge (vol. iii.), we get the order of the vowels as established on acoustic principles. The four sounds of the

1. *a*, as in *fate*, = *æ*,
2. *e*, as in *feet*, = *i*,
3. *oo*, as in *look*, = *o*,
4. *o*, as in *note*, = *u*,

are shown to be in sequence. Between, however, each of the vowels in question there are certain intermediate sounds. Thus the *é fermée* of the French (common in most tongues) is intermediate to 1 and 2.

The *ü* of the Germans = *u* French, = *y* Danish, is intermediate to 2 and 3.

The *o chiuso* of the Italians is intermediate to 3 and 4. Hence the full sequence is as follows:—

1. *a*, as in *fate*, = *æ*.
2. *é fermée*, French, = *æ'*.
3. *ee*, as in *feet*, = *i*.
4. The German *ü* = *ü*.
5. The *oo*, as in *look*, = *u*.
6. The *o chiuso* = *ó*.
7. The *o* in *note* = *o*.

This is all, in respect to the system of the vowels, that the author feels certain of. The further questions as to the places of the *a* in *father*, and of the *u* in *but*, are open to fuller investigation. Besides this, there also remains open to closer researches, the question as to whether the arrangement of the vowels is *linear* or *circular*, that is, whether the extreme sounds of the *o* (as in *note*) and of the *a* (as in *fate*) may not be in the same relation to each other as *æ'* and *i*, *i* and *ü*, &c., or at least as *æ* and *i*, *i* and *u*, *u* and *o* respectively.

Now assuming for the present a linear arrangement of the vowels beginning with the *a* in *fate*, and ending with the *o* in *note*; considering also that it is only with the consonants akin to *v* and *g* that a sequence with the vowels is recognised; omitting, moreover, the intermediate sounds of *æ'*, *ü* and *ó* for the sake of precision, we have for the articulations that have fallen within our inquiries the following arrangement, exhibiting a series of sequences rather than any symmetrical system:—

*	*	*	*	*	*	<i>æ</i> = <i>a</i> in <i>fate</i> .
<i>l</i>	<i>k</i>	<i>g</i>	<i>x</i>	<i>γ</i>	<i>y</i>	<i>i</i> = <i>ee</i> in <i>feet</i> .
<i>m</i>	<i>p</i>	<i>b</i>	<i>f</i>	<i>v</i>	<i>w</i>	<i>u</i> = <i>oo</i> in <i>look</i> .
*	*	*	*	*	*	<i>o</i> = <i>o</i> in <i>note</i> .
<i>n</i>	<i>t</i>	<i>d</i>	<i>þ</i>	<i>ð</i>	*	*
<i>r</i>	<i>s</i>	<i>z</i>	<i>σ</i>	<i>ζ</i>	*	*

or else,

<i>r</i>	<i>s</i>	<i>z</i>	<i>σ</i>	<i>ζ</i>	*	*
*	*	*	*	*	*	<i>æ</i>
<i>l</i>	<i>k</i>	<i>g</i>	<i>x</i>	<i>γ</i>	<i>y</i>	<i>i</i>
<i>m</i>	<i>p</i>	<i>b</i>	<i>f</i>	<i>v</i>	<i>w</i>	<i>u</i>
*	*	*	*	*	*	<i>o</i>
<i>n</i>	<i>t</i>	<i>d</i>	<i>þ</i>	<i>ð</i>	*	*

or else,

<i>n</i>	<i>t</i>	<i>d</i>	<i>þ</i>	<i>ð</i>	*	*
<i>r</i>	<i>s</i>	<i>z</i>	<i>σ</i>	<i>ζ</i>	*	*
*	*	*	*	*	*	<i>æ</i>
<i>l</i>	<i>k</i>	<i>g</i>	<i>x</i>	<i>γ</i>	<i>y</i>	<i>i</i>
<i>m</i>	<i>p</i>	<i>b</i>	<i>f</i>	<i>v</i>	<i>w</i>	<i>u</i>
*	*	*	*	*	*	<i>o</i>

These sequences read both ways, *i. e.* either horizontally or vertically. The vertical ones, however, are often indistinct, and got at rather by inference and analogy than by the direct testimony of the sounds themselves. Thus the connection between *p* and *b* is clearer than that between *m* and *n*, this latter being clearer than the affinity between *l* and *m*. The sequence of the vowel, expressed by the horizontal lines, is, however, very distinct.

Such is the amount of sequences which seem to the author sufficiently distinct to claim recognition as the groundwork of phonetic researches. The peculiar transition to the vowels on the part of the sounds of series *k* and *p*, the affinity with the consonants on the part of the vowels *i* and *u*, and certain peculiarities of the mutes *s* and *z*, combined with the rudimentary character of the present arrangement, indicate the probability that further researches will give a more general expression to the affinities in question.

LXI. *On the Gas Voltaic Battery.—Experiments made with a view of ascertaining the rationale of its action and its application to Eudiometry.* By W. R. GROVE, Esq., M.A., F.R.S., Professor of Experimental Philosophy in the London Institution.

(Continued from p. 354 and concluded.)

IT now occurred to me that as several of these gases (take as an instance nitrogen) were absolutely without effect in the gas battery, this would form a valuable instrument for the analysis of atmospheric air or other mixed gases. I therefore procured,

Experiment 24.—Two narrow cubic inch tubes of seven inches long, carefully graduated into 100 parts. These were

* For the power of these signs see Phil. Mag. for February 1841.